SCIENTIFIC AMERICAN

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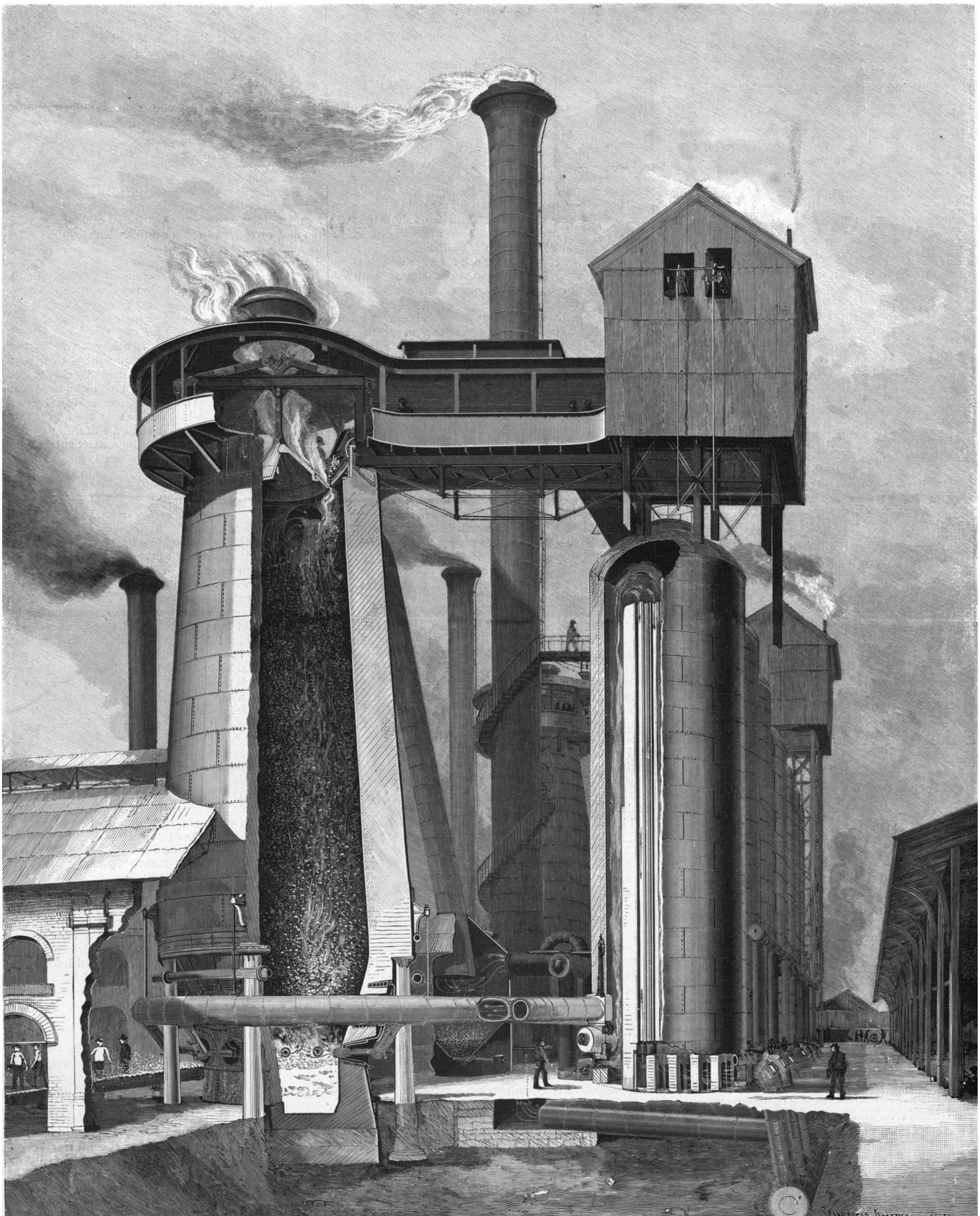

THE MANUFACTURE OF STEEL TUBING—BLAST FURNACES OF THE NATIONAL TUBE WORKS COMPANY, McKEESPORT, PA.—[See p. 264.]

Scientific American.

ESTABLISHED 1845

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(Illustrated articles are marked with an asterisk.)

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Scientific American Supplement

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THE LICENSING OF ENGINEERS.

Our attention has recently been called to a New York State law which seems to have been inspired less with a desire of serving the public and protecting its interests than for some less honest and less disinterested motive. We refer to a law enacted on May 22, 1897, establishing rules of qualifications for those having the care of boilers, steam generators or steam engines. Precaution should be taken to protect the public against accidents from negligence, ignorance or mismanagement; but the law in question can hardly commend itself to the unbiased mind, owing to the very narrow nature of certain of its features. The law is designed, not so much to enforce the employment of engineers for running elevators, boilers and engines in our large buildings, but it is designed to enforce the employment of a licensed engineer in small buildings, dwelling houses or apartment houses where steam heating apparatus is in use. To require a licensed engineer to take charge of apparatus of this kind is entirely unnecessary and oppressive. It is usual in such cases to have a fireman who is always in attendance and who is under the direct supervision of the janitor or the other manager of the building.

The particular features of this measure which show the animus which inspired the introduction of this bill are to be found in the qualifications governing the applicant for examination. In the first place, the applicant must be a citizen of the United States and over twenty-one years of age. The application must show that the applicant has been employed as a fireman, oiler or general assistant under a licensed engineer in some building in the city of New York for a period of not less than five years. It is evident from this provision that a thorough knowledge of steam engine practice is not what was sought after by the promoters of this bill. A thorough efficiency and a perfect familiarity with all the secrets and mysteries of steam engine practice are not sufficient to entitle the applicant to admission within the charmed circle, but he must "have been under the immediate supervision of a licensed engineer for a period of not less than five years," and, most wonderful of all, he must have been employed in the capacity of "fireman, oiler or general assistant in some *building located within the city of New York.*" We are unable to grasp why this extraordinary limitation should be considered as an essential equipment for an engineer, but it is evident that the society who introduced and fostered this interesting measure believed that this was surely a clever means for advancing their own interests. The engineer who, perhaps, has been driving a locomotive for thirty or forty years would not be allowed to take charge of any steam heating apparatus in any building in New York, without first taking up his residence there and undergoing an apprenticeship of several years.

This bill, like many others of its class, was passed by the Legislature without proper investigation into its merits or demerits. The bill was introduced to benefit a particular class; it manifestly had no other aim or object. The protection of the public against mischief is entirely of secondary importance. Like much legislation that we have to endure, this tends to make many suffer for the benefit of the few. The enforcement of this unjust and foolish law will throw out of employment many who have, for years, had charge of buildings and who were competent to manage the same as well as if they "had been an assistant under a licensed engineer for a period of five years in some building in New York."

It is to be hoped that this foolish law will be repealed. If it is not repealed, it is probable its validity will be tested, and it is more than possible that the act will be deemed unconstitutional.

The interested motives of the promoters of this bill may be noted from the fact that it was to take effect immediately, the intent evidently being to throw hundreds out of employment before they would be able to qualify themselves for passing the required examinations, or even filing their applications therefor.

PRISON ASSOCIATION OF NEW YORK EXHIBITION.

The recent exhibition of the Prison Association of New York was held with the idea of giving the public a more intelligent idea of the inner workings of our State prisons than it can glean from the daily press. The objects of the association are practical and humanitarian, and this was evident from the character of the exhibits, in which was very little of a merely sensational character. By far the greater part of it consisted of specimens of the handiwork of convicts in the prisons of New York State. A notable exhibit was that of a complete set of furniture for the warden's office, made by the prisoners at Sing Sing. It was made in oak, richly carved and polished, and the work would have done credit to any first-class factory. In the same room was an inlaid box made of nine thousand three hundred and fifty-six separate pieces of wood and a banjo made of six thousand and fifty-one pieces, both being the work of inmates of Auburn prison. The work done by students in one of the art classes was represented by some grille work which showed excellent taste and skill.

The clothing worn by the convicts is made on looms in the prison, and the various State institutions for the blind, the deaf and other unfortunates are also entirely supplied from this source. Here were shown specimens of the various suits, both for men and women, together with prison-made blankets, toweling, etc. The various prison schools and workshops at Sing Sing were represented by drawings, cabinet and joiner work, plaster cornice work, boots, shoes and a host of other articles of wear and household use.

The one truly sensational object in the exhibition was the chair used in electrocution at Sing Sing, in which thirteen people have already suffered death. Except for the heavy straps at the arms and legs, there was nothing to suggest its tragic purpose. The celebrated Bertillon system for the identification of criminals was shown and explained, and a typical case of photographs from the rogues' gallery formed part of the exhibit.

In a room devoted to the Elmira Reformatory a surprisingly large number of the arts was represented by specimens of steel engraving, zinc etching, bookbinding, printing, photography, etc., done by the boys in the various classes. Near by was a large board of drawings, mechanical and architectural, which had been made by prisoners who had received only six months' instruction.

In looking over the varied collection of articles, all the results of instruction in useful arts and sciences, one found it difficult to believe that it had come from within the inclosure of State prison walls. The exhibition testified to the great advance which has been made over the old methods in the treatment of convicts, and it is easy to see that, as far as the occupations of prison life are concerned, everything is done to improve the more debased and ignorant among the convicts and give them some reasonable hope of honest livelihood when their terms have expired.

The inmates of the State Penitentiary for the Eastern District of Pennsylvania were represented by a large model of that famous institution, made by themselves. This prison is conducted on the much discussed plan of solitary confinement adopted generations ago by that State. The prison is laid out so that the idea of solitary individual confinement shall be literally carried out. Formerly, from the time the convict entered the massive gate of the prison to the day on which he left it he never spoke to or looked upon the face of any man but his keeper. To secure this result the prison is built on a radial plan. The outer wall of the inclosure is 30 feet high and 640 feet square. In the center of the square is a tower 40 feet in diameter and two stories high, and from this radiate, like the spokes of a wheel, eleven long, low, one-storied structures. Each wing is built with two outer walls and a central dividing wall and covered with a low pitched roof, and it is divided by partition walls into a long double line of cells. Each cell opens out onto a little yard which is surrounded by high walls and is of about the same area as the cell. Light is obtained by a grated window in the roof. Formerly the convict ate, slept and worked in his cell and took exercise in his little yard, absolutely alone. The prisoner is received in the central tower, his pedigree is taken, and he is then taken to one of the cells, which he never leaves except for exercise. The idea of solitary confinement is not carried out so literally as it formerly was; but the convict does all his work in his cell and is never thrown in contact with the other convicts in workshops and classrooms.

Very different from this is the modern steel prison, with its modern provisions for light, heat and ventilation. The methods of this construction were shown by illustrations of the new wing of three hundred cells which is being built at one of the State penitentiaries.

A SEVENTY THOUSAND HORSE POWER CENTRAL STATION.

Work is progressing upon a building in New York City which will contain the largest aggregation of motive power ever gathered together in a single plant. Hitherto that distinction has belonged to the great ocean steamships, the largest power at present being in the engine rooms of the Campania and Lucania, of the Cunard line, each of which is credited with a maximum trial horse power of 33,000. In this connection it is interesting to note that the huge industrial establishments to be found in the textile and iron industries, with their miles of shafting, their vast power-driven machinery and their employes numbered by the thousand, do not call for one-half the motive power that is to be found snugly stowed away in the engine room of a St. Paul, a Lucania, or a Kaiser Wilhelm der Grosse.

The new power house is being built by the Metropolitan Street Railway Company of New York and it forms part of the scheme for introducing electric traction on the whole of the 218 miles of street railways owned or controlled by this company. At present there are three different systems at work: the cable, the underground trolley and the horse car. The mechanical power is supplied from four power houses: a cable power house on Houston Street and Broadway, another at Fiftieth Street, a third on East Twenty-sixth

Street, and an electrical power station at 146th Street. The first three of these furnish power for the Broadway and the Lexington Avenue cable roads, and the last furnishes current for the Lenox Avenue underground trolley.

Work is now well advanced on the 55 miles of horse car lines which are being equipped with the underground trolley, and for the present the necessary electrical power will be furnished from the 146th Street and East Twenty-sixth Street stations, the generating capacity of the former station being increased and a new electrical equipment being added at the East Twenty-sixth Street station.

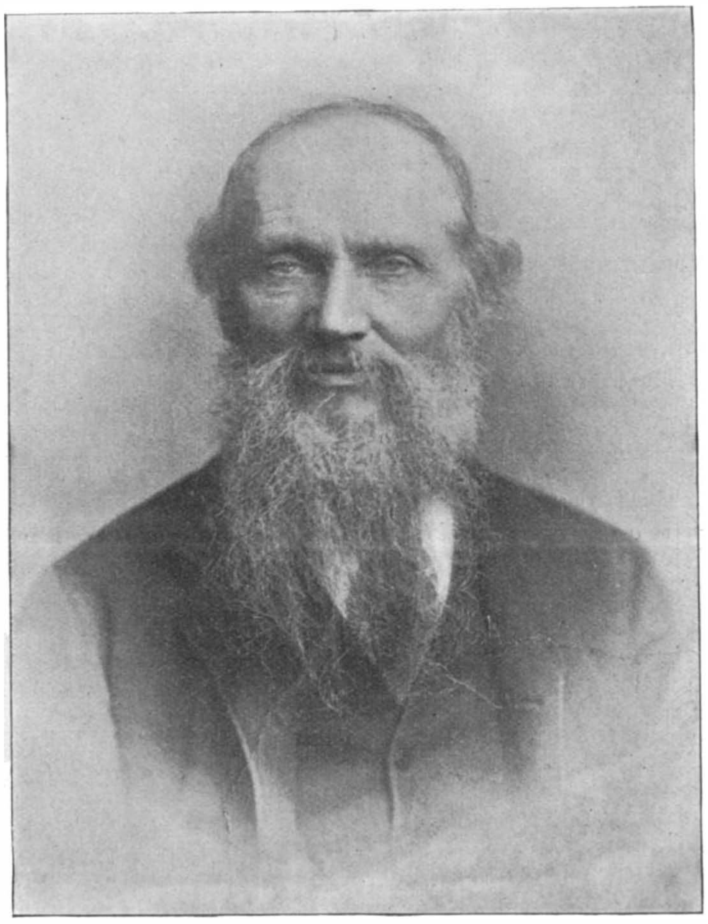
The many advantages to be gained by operating the whole of their vast system by one method of traction, and the uniformly good results which have been obtained on the experimental electric line on Lenox Avenue, have determined the company to make arrangements for equipping the whole 218 miles with the underground trolley. The advantages of economy to be gained by concentrating the power plant at one great central station are many and obvious, and it is this consideration that has led to the planning of the monumental power station which is now under construction near the East River between Ninety-fifth and Ninety-sixth Streets.

The economical distribution of current from one central station will be rendered possible by the use of a high potential in place of the 550 volt distribution which characterized the practice of a few years ago.

The building will cover a site measuring 201 feet by 270 feet. The foundation will consist of 8,000 piles, upon which will rest a five foot bed of concrete, which will extend over the whole area of the site. The building will be divided by a central wall into a boiler house and an engine room. The former will be four stories, and the latter two stories in height. The three lower stories of the boiler house will contain 87 water tube boilers, with a maximum capacity of 800 horse power each, and arrangements will be made for the use of forced draught. The upper third of the boiler house will be devoted to a set of huge storage bins, with a combined capacity of 9,000 tons of coal. The coal will be transferred from barges at the adjoining river dock to the bins by a system of elevators, and the ashes will be returned to the river scows by the same means.

In the adjoining engine room will be eleven cross compound condensing engines. They will be of the vertical type, and each will have a maximum capacity of 6,600 horse power. They will stand in two rows parallel with the dividing wall of the power house and each will be direct connected to a 3-phase alternating current generator. The current at 6,000 volts will be led to substations where static and rotary transformers will convert it to the 550 volt current used in the conduits.

We are informed by President Vreeland that the estimated time of construction is twelve months. The whole equipment will not, of course, be put in at once, but it will be set up contemporaneously with the demand created by the ultimate extension of the underground trolley to the Broadway and Lexington Avenue cable roads and to the various horse car lines owned or controlled by the company.



LORD KELVIN.

LORD KELVIN.

Among the distinguished scientists who attended the recent meeting of the British Association at Toronto, Canada, were Sir John Evans, Lord Lister and Lord Kelvin, each great in a different line of work. Lord Kelvin is particularly notable, owing to the fact that he has been a professor for over fifty years, and during this time he has witnessed the wonderful progress in physics and chemistry to which his personal contribution is so important.

Lord Kelvin, though of Scotch descent, was born in Belfast, in 1824, and was so precocious that he, then plain William Thomson, entered the College of the University of Glasgow at the age of twelve. From Glasgow William Thomson went to St. Peter's College, Cambridge, and in 1845 he graduated with highest honors and was elected a fellow of his college. Even before his Glasgow student days came to an end, William Thomson's original work in science was commenced, and his first mathematical papers, written before he entered Cambridge as an undergraduate, are all worthy of attention. From 1842 to 1845 he published important papers on heat, electricity and mathematics. In 1846 Thomson was elected professor of natural philosophy in the University of Glasgow, and thus at the early age of twenty-two he was appointed to the chair which he still holds. Many offers have been made him by the great English universities, but he has preferred to remain in his northern professorship, and his constancy is appreciated by the university which he adorns. The dynamical theory of heat early engaged the attention of Thomson, and he published important papers upon the subject in 1849, and in 1852 more than one joint paper was undertaken by the life-long friends Joule and Thomson. In 1855, Thompson published a paper on "Electro-dynamic Qualities of Metal," and it was while engaged in experimental work connected with this research that he began to make use of the assistance of his students; and this was the commencement of the physical laboratory of the University of Glasgow, which was, in fact, the first of physical laboratories. In 1855 and 1856 a new field opened itself to the genius of Thompson.

The problem of ocean telegraphy had presented itself to the world, and very soon he was practically called upon to solve it. When the cable was completed it was found that it required one minute to transmit one word over the cable. Thomson, experimenting with the reflection of the image of a candle thrown from his concave eyeglass on a sheet of white paper in a fairly lighted room, judged that the flame of a paraffine lamp reflected from a silvered mirror of one-tenth of that area would give an image bright enough for conveniently reading telegraphic signals. The mirror galvanometer was supplied for the 1858 cable. The directors of the Atlantic Company insisted that Thomson should go to sea with the expedition and also that he should take a patent for his instruments. To take out a patent was somewhat against his wishes, as he desired to give to the public the fruit of his labors, as he did with his sounding machine and his mariner's compass, but he found in each case that the only way to secure attention to inventions of importance was to patent them and work the patents. In 1867 the siphon recorder was invented and patented. On the successful completion of the Atlantic cable, in 1866, he received the honor of knighthood.

Sir William Thomson's other inventions can be only briefly referred to. They include electrical test instruments and the improved mariner's compass, to say nothing of the large number of minor inventions. Sir William Thomson succeeded Sir George Gabriel Stokes, Bart., as president of the Royal Society, in 1890, and was created first Lord Kelvin in 1892. The degree of LL.D. was conferred on him successively by the Universities of Dublin, Cambridge and Edinburgh, and that of D.C.L. by Oxford. He was a fellow of both the London and Edinburgh Royal Societies, and has been president of the British and other associations. He has also received various decorations from abroad. He is Grand Officer of the Legion of Honor, commander of the Order of Leopold, and has received the German Ordre pour le Merite. He is a member of a large number of foreign societies and has a multitude of medals conferred upon him for his eminent inventions and discoveries.

In 1876 Sir William Thomson was a judge at the Centennial Exhibition at Philadelphia, and in 1884 he visited America to attend the Montreal meeting of the British Association. On this occasion he delivered a course of lectures on "Molecular Dynamics," at Baltimore, to a class composed mainly of professors from different parts of the world, gathered together at the Johns Hopkins University.

During Lord Kelvin's present visit to the United States he traveled quite extensively and made a number of addresses. On September 23, accompanied by Lady Kelvin, Count di Brazza Savorgnan, Prof. Elihu Thomson and others, he visited the Schenectady works of the General Electric Company. The electric railway work most arrested his attention. He was particularly interested in the new "surface contact" electric road, of the type now being constructed for Monte Carlo. Another feature of railroad work shown was the handling of one of the cars equipped for the South Side Elevated, of Chicago, weighing 25 tons and carrying four 50 horse power motors underneath.

With these cars the rate of acceleration obtained is as much as 40 miles an hour in 15 seconds, giving a tremendous increase in quickness of service on elevated or suburban lines.

Lord Kelvin was much interested in the experiments which were shown him in high voltage currents. He carried a little green note book with him in which he jotted down formulæ, figures and autographs. It was easy to see in so much advance he was glad to recognize here, in America, the rapid fruition of ideas and suggestions which the slow pace of European advance would not have allowed him to test on this large and satisfying scale.

Coming away from the works, his indefatigability as an investigator was shown by his leaving a comfortable carriage to ride in a dusty trolley car equipped with magnetic brakes. Emergency stops were made along the road quite frequently, and Lord Kelvin hung over the open trap door of the car floor with an interest that might easily have resulted in his disappearance down it, but for the restraining hands of those who wished him to go back to Glasgow University safe and sound.

The recent awards to this country of important electric railway contracts for England and the Continent have awakened great interest among English electrical engineers, who see in these contracts a source of danger to the British electrical industry.

Lord Kelvin was asked by The Evening Post representative as to his views on this matter. He said: "I do not consider it out of the way or surprising that these orders should be placed here. England has not yet developed her electric railway work to as large an extent as you have, and hence is buying, as she always does, in the best market to save money. She has the engineering and manufacturing talent, but lacks the opportunity. Here you have towns of 10,000 population springing up in a year, and they naturally want the latest and best, making a good demand which renders easy production on a large scale and also stimulates the older communities near them. We have no such developments in England, and the areas of our towns are smaller, so that the necessity of city transportation is not so keenly felt as with you."

Asked as to the near outlook in England, Lord Kelvin said: "The predictions as to the resort in this country to electricity on steam roads in some parts of the country seem to me well founded. From my observation I do not expect, however, any change at present by our big railroad systems in England. They move slowly and with judgment, and things must be proved. I do believe that all our English tramways and all our city travel must soon become electrical. I do not see any alternative from that."

Archæological News.

F. Petrie, Honorary Secretary of the Victoria Institute, England, writes to the Rev. Alfred Putnam, D.D., President of the Danvers Historical Society, a letter in which he says: "It will interest you to hear that one of the Institute members writes home from upper Egypt to announce his discovery of a palace of Pharaoh of the sixth dynasty, with numerous valuable inscriptions. The wine jars of Pharaoh were found intact in a long cellar. All were hermetically sealed, but, on breaking the seals of one, the wine seemed petrified.

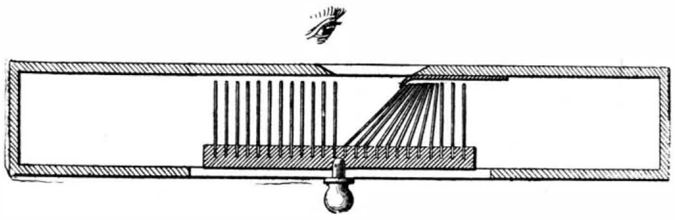
With the present year, the Archæological Institute of America will begin the uniform and regular publication of its papers, reports and other documents in a new periodical which will be styled the American Journal of Archæology, second series. The journal of the Archæological Institute of America will be conducted by an editorial board, the members of which will represent the several interests of the institute and the institutions in its care. The new journal will succeed the American Journal of Archæology, and the new periodical will be issued six times a year. It will include the archæological papers of the institute, the papers of the American School of Classical Studies at Athens; papers of the American School of Classical Studies in Rome; proceedings of the institute and other archæological societies; reports of the institute; summaries of archæological news, correspondence, notes and notices. The journal will be published in England and America by the Macmillan Company.

RECENT INVENTIONS.

We represent herewith some recently patented inventions which seem to have considerable interest.

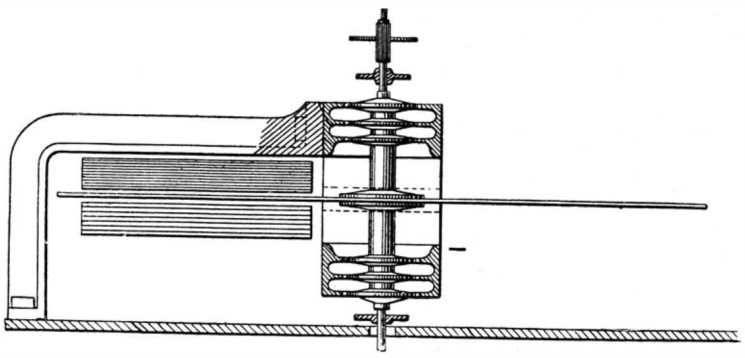
MUTOSCOPE.—One of the simplest forms of mutoscope is shown in the engraving. It is the invention of H. Casler, of Canastota, New York.

It is designed to show a series of pictures in rapid succession, so as to produce the motions of living objects. The mutoscope consists of a receptacle having an opening in its face and a sliding rack mounted therein; a series of picture cards carried by the rack, a handle for reciprocating the rack, and a finger for momentarily retarding the upper end of the passing card.



H. CASLER-MUTOSCOPE.

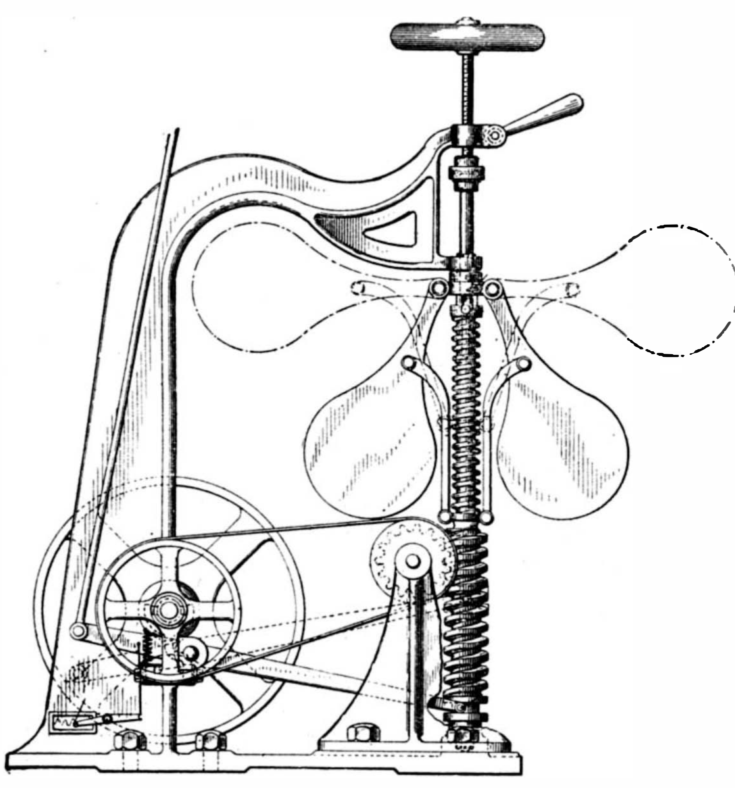
SUPPORTER FOR ROTATING SHAFTS.—A novel device for supporting rotating shafts has been patented by W. Stanley and F. Darlington, of Pittsfield, Mass.



W. STANLEY & F. DARLINGTON—MEANS FOR SUPPORTING ROTATING SHAFTS.

Although this device is intended chiefly for delicate instruments, such as electric meters, it may be applied to other machinery. The vertical shaft is provided with two series of collars, which are placed within magnetic pole pieces having interior rings or flanges closely surrounding but not touching the collars on the shaft. The magnets which are joined to the pole pieces are arranged to produce consequent poles. The shaft is guided by small journals at the upper and lower ends. In consequence of this construction the shaft is supported without friction or wear.

NON-CENTRIFUGAL GOVERNOR AND SPEED INDICATOR.—In the governor shown, the speed of the engine to be governed is transmitted through a gear wheel, revolving coincident with the motion of the engine, to a movable worm gear, the position of which is controlled by the tension of a spring and the resistance of revolving fans. The result of this combination is that a constant increased or decreased motion will not be transmitted instantly or necessarily at all to the fans, for the action of the gear wheel upon the worm is twofold. It may drive the worm at a speed depending upon the relation of the pitch of the worm to the teeth of the gear, or, if motion be suddenly increased, the teeth will not follow the spiral of the worm when driving the worm, but the worm will be suddenly raised one or more teeth, owing to the sudden increase in the speed of the driving mechanism. The raising of the worm does not, however, revolve it, but compresses the governing spring. It is this function which is utilized in determining the speed of the governed engine. Ultimately the increased speed of the engine, if not arrested by the governing mechanism, would communicate itself to the revolving fan. This would occur when the spring had resumed its normal tension; but this tendency of increase in the revolution under these conditions is counteracted in the fan itself, which is constructed so as to oppose an increasing resistance to any tendency to drive it faster or a decreased resistance to any tendency to drive it slowly.



J. F. RADERS—NON-CENTRIFUGAL GOVERNOR AND SPEED INDICATOR.

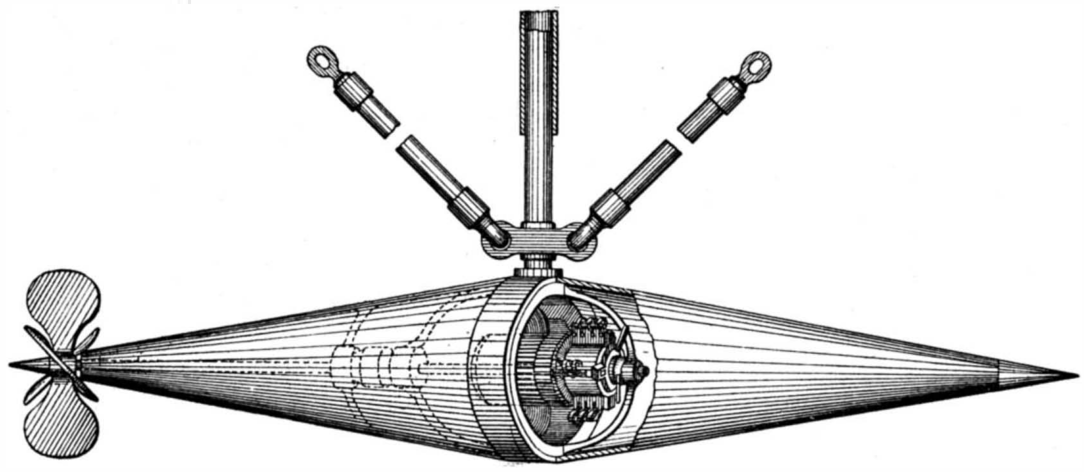
When the worm revolves faster than a predetermined rate, the increased speed of the engine will be taken up first by the raising of the worm and then by the increased resistance to rotation of the fans. The worm being connected to the throttle valve of the engine, the first result of an increased speed of the governor will be a coincident movement of the devices for controlling the flow of steam. The contrary result would be accomplished provided the fan were driven at a less velocity.

J. F. Raders, of Flushing, N. Y., is the inventor of this governor.

AUXILIARY PROPELLER.—The engraving shows a simple and apparently efficient device for propelling and steering a vessel in case the ordinary machinery becomes disabled or in case a sailing vessel requires auxiliary or alternative propelling or steering machinery.

The motor case has conical ends and is provided with a motor, either electric, steam or air, and a screw driven by the motor. The motor case has a hollow arm which prevents it from turning, and which contains the electric wires or the steam or air pipes connected with the motor. The braces serve to hold the case in the position of use.

It can readily be imagined that a device of this kind might prove a very useful adjunct to a steamship, large sailing vessel, or even a war vessel.



R. M. FRYER—AUXILIARY PROPELLING DEVICE.

R. M. Fryer, of Washington, D. C., is the inventor of this propeller.

HOSE NOZZLE.—The engraving shows an improved hose nozzle which may be made to throw a solid, round stream or a divergent, fan-shaped stream at will.

The nozzle body is a single casting, with a circular delivery and a flattened delivery, both extending in practically the same direction. A valve plug is fitted to the nozzle body, at the junction of the two deliveries, so that, by turning the plug in one direction or the other, the water may be directed so as to pass through the cylindrical or circular nozzle.

This device is the invention of J. Askins, of Redfield, N. J.

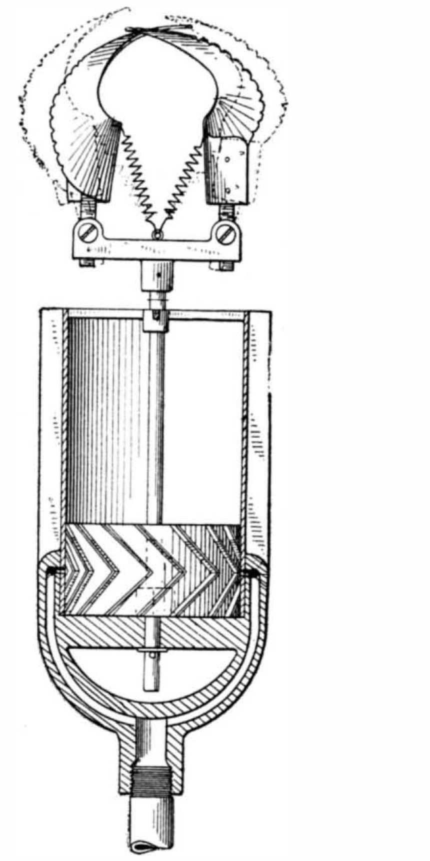
ROTARY FLUE CLEANER.—L. J. Jones, of East Norwalk, Conn., is the inventor of a rotary flue cleaner, designed to loosen soot, ashes and scale, and at the same time force them out of the flue.

The cleaner consists of a case provided with steam ports, a turbine wheel placed in the casing, mounted on a shaft and capable of revolving with great velocity, and a pair of scrapers pivoted to a cross arm on the shaft and arranged to be thrown outward into contact with the flue by centrifugal force. A tubular handle, attached to the casing, serves as a conduit for steam supplied to the turbine.

PERSONS in New York may now talk with Council Bluffs, connections just having been completed.

A Statue of Tubal Cain.

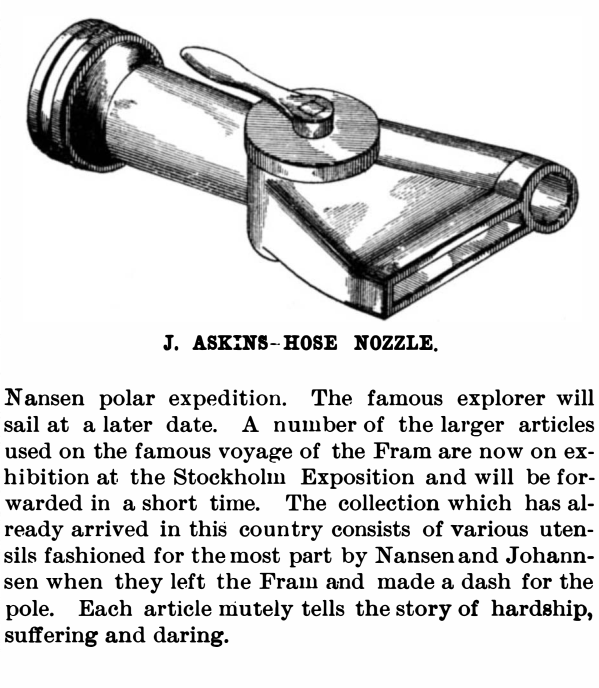
The iron and steel manufacturers of eastern Pennsylvania have decided to erect a statue to Tubal Cain, the original worker in metals, as their patron. They propose to honor his memory by erecting a statue on the Ohio River, at the junction of the Allegheny and Monongahela Rivers. The project has been taken up by the Engineers' Society of Western Pennsylvania and the Pittsburg Foundrymen's Association. It is proposed to build the pedestal of the statue of iron and steel, at a cost of about $200,000; upon this will rest a mammoth anvil, while a colossal bronze statue of Tubal Cain will stand in the attitude of swinging an enormous sledge hammer. The position of the statue will be such that nearly every visitor by river or rail will see it from a distance.



L. J. JONES-ROTARY FLUE CLEANER.

Nansen's Outfit Here.

The Thingvalla Line steamship Amerika, which recently arrived in New York from Christiania, Norway, brought the first consignment of relics from the recent Nansen polar expedition. The famous explorer will sail at a later date. A number of the larger articles used on the famous voyage of the Fram are now on exhibition at the Stockholm Exposition and will be forwarded in a short time. The collection which has already arrived in this country consists of various utensils fashioned for the most part by Nansen and Johannsen when they left the Fram and made a dash for the pole. Each article mutely tells the story of hardship, suffering and daring.



J. ASKINS-HOSE NOZZLE.

THE LARGEST AND FASTEST PADDLE STEAMER IN GREAT BRITAIN.

BY A. J. SINCLAIR.

We present two engravings—an exterior and an interior view—of the new steel paddle steamer "Empress Queen," which is the largest and fastest paddle steamer in Great Britain and which has just recently been completed by the Fairfield Shipbuilding and Engineering Company, Govan, near Glasgow, to the order of the Isle of Man Steam Packet Company, Limited, Douglas, Isle of Man, for their passenger and mail service between Liverpool and Douglas (a distance of 70 nautical miles). The first vessel owned by the Isle of Man Steam Packet Company, which have now a fleet of a dozen steamers—8 paddle and 4 twin screw steamers—was built in 1830. It was of 116 tons burden and 200 indicated horse power.

It was through the kind offices of Lord Henniker (Governor of the Isle of Man) that the Steam Packet Company secured the consent of Her Majesty Queen Victoria to have the ship called after her own name. The principal dimensions of the "Empress Queen" are: Length over all 375 feet, breadth of hull 42 feet, breadth over paddle boxes 83 feet 6 inches, and moulded depth is 25½ feet. She is constructed of steel throughout and is of 2,500 gross tons. The hull is divided into several watertight compartments by means of steel transverse bulkheads, which, besides reducing the risk of foundering to a minimum, materially augment the strength of the structure, forming valuable supports and ties between the decks and framing. The decks are four in number, and are termed "lower," "main," "spar," and "promenade." The dining saloon, on the lower deck, accommodates 124 first class passengers, and is the handsomest saloon of its kind of any Channel steamer afloat. Ample accommodation is provided for the number stated to dine at one time, and in addition to the long tables running along the full length of the room, there are several small tables at which parties can dine. The ceiling of the saloon is in white and gold. Forward of this are the pantry, scullery and plate-room.

The pantry is furnished with all the latest appliances, including steam, hot water boiler and steam carving tables.

Another good feature is the fact that there is a saloon galley connected with the saloon pantry, where everything may be sent down without carrying the edibles through the saloon, as in the older boats. The first class smoke-room is large and agreeably arranged, the framing being in oak, the paneling in teak, and the upholstering in dark green morocco, while white and gold are the prevailing colors of the ceiling. The main saloon, which we illustrate, is paneled in mahogany, inlaid with satinwood and ebony, while the ceiling is chastely decorated in white and gold. All the upholstering is done in the finest mouquette velvet, while the carpets are of the best Axminster, and form a beautiful contrast in shade with the cushions. The saloon is provided with couches, writing tables, etc., which go to make it as comfortable and complete as the most fastidious members of the traveling public could desire. To the right of the main saloon is the ladies' special saloon, which is unique in form and decoration, the latter being in satinwood, and set off in cozy alcoves by means of carved and arched columns in the same kind of wood. It is upholstered in an electric blue shade of velvet, with Axminster carpets to match. Leaving the main saloon, a descent is made by a handsome staircase to the second general saloon, which is fitted up with mahogany and satinwood panels, and upholstered in a light shade of mouquette velvet, with carpets to match.

MAIN SALOON, LOOKING FORWARD.

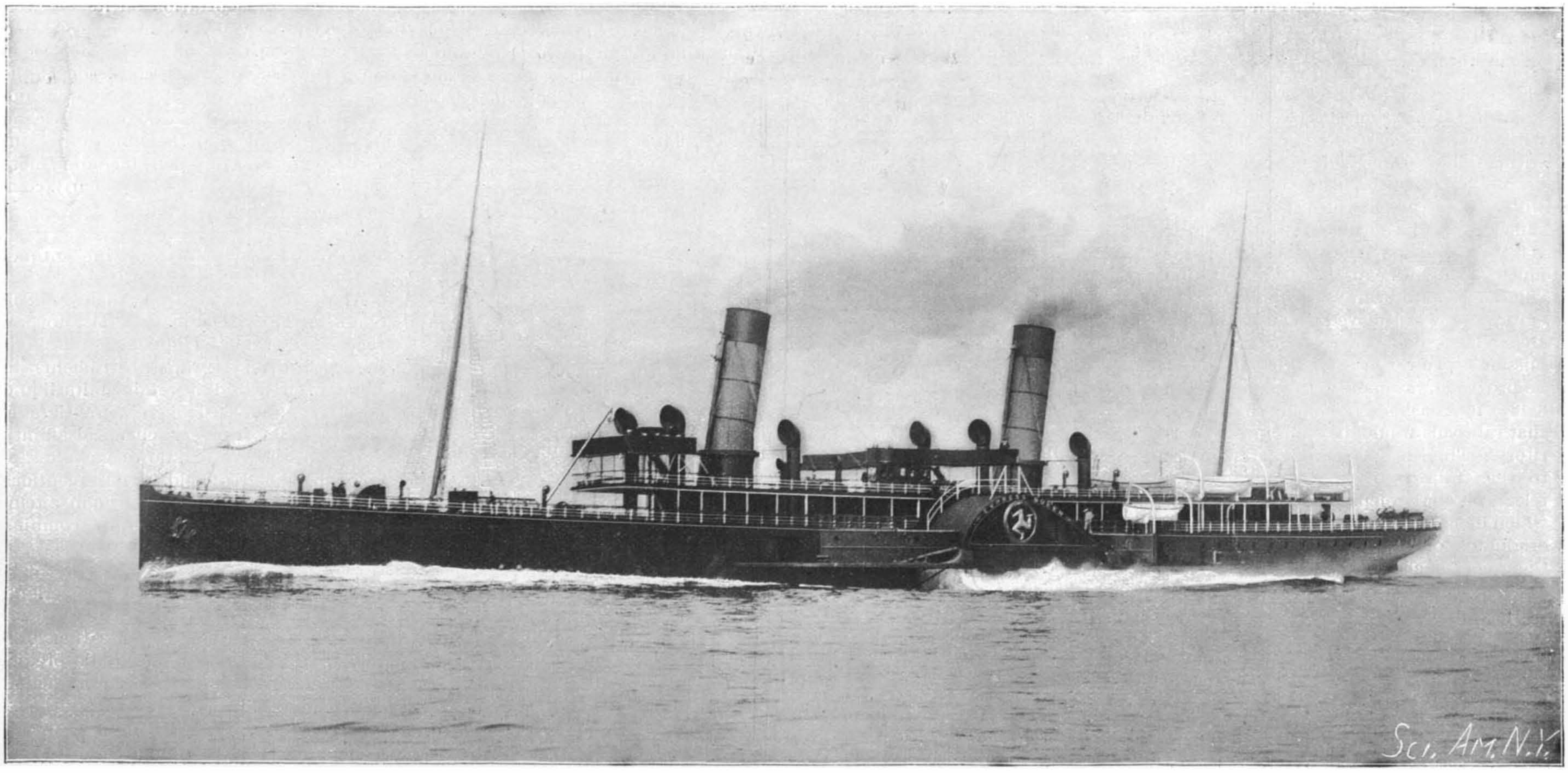
The forward part of the ship is allotted to the second class passengers. The dining saloon, forward of the machinery space on the lower deck, having bar and pantry adjoining, provides ample room for the second class passengers. On the same deck and forward of this, is a ladies' second class saloon, supplied with every up-to-date requisite.

On the main deck above is arranged a second class shelter, which contains a bar, buffet, mail and parcel rooms. The gentlemen's sanitary appointments are of the most modern system, and are provided for first and second passengers, abaft and forward of the sponsons respectively.

On the spar deck aft, in houses, are six handsome private cabins, fitted with berths, etc., and amidships on the same deck is a cloak room, and combined bar and smoking room, while all fore and aft all available space is utilized for sitting room, there being sparred seats sufficient to seat over 600 persons.

Above this is a very spacious promenade deck extending from the fore end of the boiler room aft to the end of the first class cabin, with buoyant seats running the entire length, excepting a small portion at the after end, which is appropriated for the stowage of boats, a feature which has received special attention, so as to allow of the immediate launching of the boats if necessary.

The bridges (36 feet above the water line) that surmount the promenade deck are placed one at the foremost extremity for navigating purposes, and the other between the funnels, and extending from sponson to



THE ISLE OF MAN STEAM PACKET STEAMER "EMPRESS QUEEN."

sponson, with captain's house under, for the better handling while docking and taking piers. From both of these bridges the bow and stern rudders are controlled by means of wheels connected with independent steam-steering gear placed below on the engine starting platform. A hand-screw steering apparatus is also placed in reserve aft in case of emergency. Docking and engine telegraphs are provided on each of the bridges.

The vessel was engined by the builders and the machinery consists of compound diagonal surface-condensing engines, the diameters of the cylinders being one 68 inches and two 92 inches in diameter, with a piston stroke of 84 inches. They are the largest and most powerful paddle-wheel engines yet built. Their nominal and indicated horse powers are respectively 1,290 and 10,000. When the ship was on her trials they worked up to close upon 12,000 horse power.

The three steam cylinders are placed side by side, and working on three cranks, the high-pressure cylinder being placed between the two low-pressure cylinders. The high-pressure cylinder is fitted with a piston valve and each of the low-pressure cylinders with flat slide valves, all controlled by the usual double eccentrics and link motion valve gear. The crank shaft is a ponderous piece of machinery. It is built, and, together with the paddle shafts, is forged of mild steel and bored hollow. The starting and reversing is effected by a large steam and hydraulic engine on the direct-acting principle.

The condenser is cylindrical, and placed athwartships between the cylinders and the supports for the shafting, and the condensing water is supplied by a circulating pump worked by an independent steam engine.

The paddle wheels are made of steel, and constructed on the feathering principle, with curved floats. The floats are each 18 feet in length. Steam is supplied to the engine by four double-ended boilers arranged in two compartments, one forward and one aft of the engine room. They are adapted to work with Messrs Howden's system of forced draught.

The vessel has two funnels and two pole masts, and presents a very handsome and majestic appearance. On July 8, the "Empress Queen" made four trial runs between the Cloch and Cumbrae Lights, when she averaged over 22 knots per hour, and, considering the stormy weather which prevailed on that day, the result was gratifying. The following Monday a six hours' sea trial was carried out on the Clyde with equal success, the average speed over the whole course out to sea being 22 knots. While on her trials on the Clyde the highest speed attained was fractionally less than 23 knots an hour.

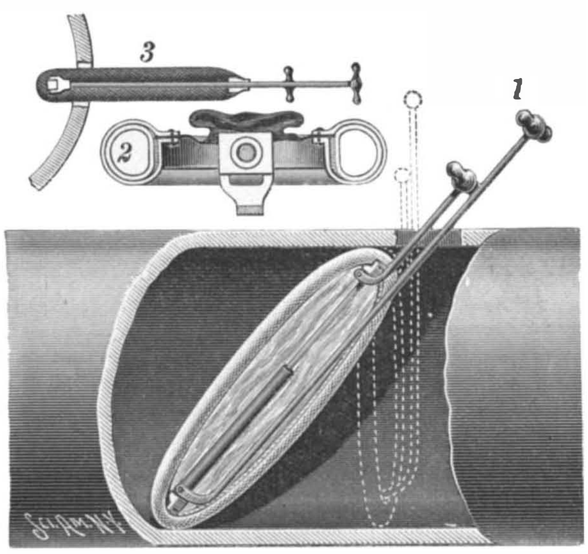
The "Empress Queen," which is licensed to carry 1,994 first and second class passengers by the Board of Trade, is now running to and from Liverpool and Douglas, which will be her regular station.

The Railroad in Alaska.

The building of a railroad through Chilkoot Pass will be undertaken by the Chilkoot Railroad and Transportation Company, of Tacoma. It will be 8 miles long and will connect Dyea at tidewater with the mouth of the Dyea Cañon. Transportation through this cañon and across the pass to Crater Lake will be effected by a system of tramways, the contract for which has been awarded to the Trenton, N. J., Iron Company, which agrees to have them in operation by June 15, 1898. The tramway will be of the Bleichert system. The first one will be 4 miles in length, reaching from the cañon to Sheep Camp, with a rise of 1,000 feet. A second tramway will extend from Sheep Camp to Summit, 3½ miles, with a rise of 2,500 feet, and thence to Crater Lake, with a fall of 500 feet. Iron supports will be put in every 100 feet. The tramway will have a capacity of 120 tons daily—sufficient for the outfits of 200 miners. It is to be hoped that the promoters of this much needed means of transportation will not encounter any serious legal difficulties. It was believed that the Interior Department had the power to grant permission to run over the public lands, but no provision was made in the act of March 3, 1875, for Alaska, as no one then thought that railroads would be run in the Territory. The same state of affairs applies to the tramways, the cable roads, the telegraph and telephone lines and other enterprises which demand passage over the public domains. The originators of the enterprises will be forced to apply to Congress for charters or for legislation that may enable the Interior Department to take charge of the matter. It is probable that Congress will act at once upon these applications, so that the railroads can be built before the spring season opens. The Interior Department has many applications for such franchises, but it can do nothing but refer them to Congress for action, and so notifies all those who applied. Out of the five passes over which routes could be constructed from the coast to the interior, three have been surveyed for this purpose.

A GAS MAIN STOPPER.

To temporarily stop a gas main and prevent the flow of gas therein, as is frequently necessary in making changes or repairs, the device shown in the accompanying illustration has been invented and patented by Patrick Goodman, 115th Street, East River (address in care of the Standard Gas Company), New York City. Fig. 1 shows the manner of using the device, a portion of the gas main being broken out, Fig. 2 represents a cross section and Fig. 3 illustrates the manner of inserting the device in a pipe. Two flat steel springs are made with eyes at their ends by which they are pivoted to two rods, one telescoping with the other, the springs being slightly curved outwardly, but being capable of compression. Outside of the springs is an elastic packing, which may be of rubber tubing, and outside of such pack-



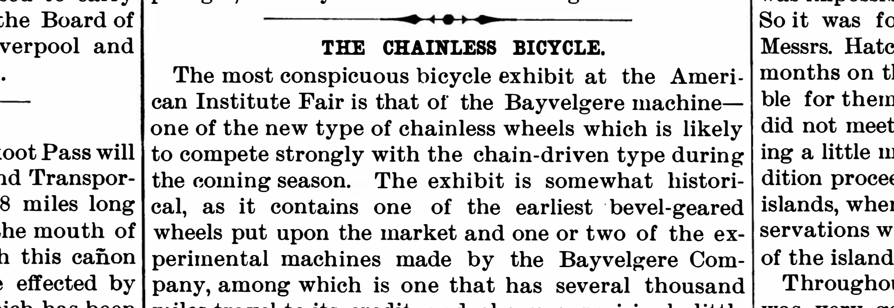
GOODMAN'S GAS MAIN STOPPER.

ing, and inclosing it with the springs, is a casing to which is attached a flexible diaphragm of cloth, leather or other suitable material, practically impervious to gas. Pivotally attached to the outer ends of the telescoping rods are outwardly extending handle bars, slightly curved near their pivotal points, and one handle bar being slightly longer than the other. The device, when first inserted in a hole in the side of a pipe or main, occupies an inclined position, as shown in full lines in Fig. 1, but, upon drawing upon the longer handle, the device assumes a vertical position, as indicated by the dotted lines, the springs being forced outward to form a ring which presses closely against the interior surface of the pipe, and, with the diaphragm, entirely shuts off the flow of gas.

THE CHAINLESS BICYCLE.

The most conspicuous bicycle exhibit at the American Institute Fair is that of the Bayvelgere machine—one of the new type of chainless wheels which is likely to compete strongly with the chain-driven type during the coming season. The exhibit is somewhat historical, as it contains one of the earliest bevel-geared wheels put upon the market and one or two of the experimental machines made by the Bayvelgere Company, among which is one that has several thousand miles travel to its credit and shows surprisingly little wear as the result of it.

The aim of the designer of this wheel has been to provide a construction which will maintain each pair of gears at all times in proper alignment and yet allow of considerable deflection in the connecting shaft. This has been accomplished by inclosing and supporting each pair of gears, both at the crank hanger and at the rear wheel, in a rigid casing, which is incapable of being sprung out of shape by any rough usage that may be put upon the bicycle. The power is transmitted from one set of gears to the other by means of a shaft formed with a knuckle joint at each end.



DRIVING GEAR OF THE BAYVELGERE CHAINLESS BICYCLE.

Every wheelman is well aware that, under the strain of hill climbing, when the maximum pressure is put upon the pedals, the rear forks are liable to spring somewhat out of line. This is due to the pull of the chain being applied only on one side of the wheel. In the chain-driven wheel this flexibility is of comparatively little consequence; but any such distortion on a bevel-geared wheel, provided with a rigid intermediate shaft, would cause the gears to bind and set up a considerable amount of friction. The flexible shaft shown in the accompanying engraving adjusts itself to this distortion or to any bending that may be produced by collision or other accident, and permits each pair of gears to work without binding, even though they be considerably out of line with each other.

The flexible shaft is provided with a four point knuckle joint at each end, the points consisting of steel balls which engage corresponding holes in the ends of the axles of the gears at the crank hanger and the rear hub. Each of the two gear wheels adjoining the intermediate shaft is formed in one with a short hollow axle, whose bearings are carried in a short threaded cylinder which is firmly screwed into the crank hanger or the housing of the rear gears, as the case may be. The two casings are connected by means of a tube with enlarged and threaded ends which just fills the space between the casings, and is held in place by means of threaded couplings. Wear of the intermediate gears is taken up by screwing the cylinders containing the ball races into the casings, and the ball bearings are adjusted by screwing up the cones on the outer ends of the short hollow shafts or axles.

The mechanism is entirely inclosed by the casings and connecting tube, and when it is filled with oil or other lubricant, it will run for months without attention. Taken altogether, it is a highly creditable piece of work, both in design and construction.

The Patagonian Expedition from Princeton University.

The Princeton Patagonian expedition which left in February, 1896, returned in August. It was under the auspices of Prof. W. B. Scott, of the department of geology. The object of the expedition was to collect vertebrate fossils from the tertiary deposits and the skins and skeletons of recent birds and mammals. The objective points, says Science, was the port of Gallegos, on the east coast of Southern Patagonia. From this point investigations were conducted along the coast from Sandy Point, in the Straits of Magellan, to Port Desire, on the north. In this region many interesting fossil forms were secured, and a nearly complete series of living birds, mammals and plants. After spending several months in the coast region, the expedition went into the interior, where many new glaciers and watercourses were discovered. Being an unexplored country, not only were new facts relating to the geography of the region discovered, but many plants and animals new to science were also collected, while the information obtained relating to geological phenomena was of the greatest value. Numerous volcanic cones hitherto unreported were discovered.

Owing to the difficulty of traveling in the interior, it was impossible to take any great supply of provisions. So it was found necessary to limit the expedition to Messrs. Hatcher and Peterson. They were absent five months on this trip, during which time it was impossible for them to receive or dispatch any mail and they did not meet with a single human being. After spending a little more than a year on the mainland, the expedition proceeded to Tierra del Fuego and the adjoining islands, where important collections were made and observations were taken of the geology and paleontology of the islands.

Throughout their work the Argentine government was very generous and courteous to the expedition, giving to its members transportation on its war vessels from Buenos Ayres to Gallegos and return, offering to place at its disposal a smaller vessel for use in researches among the islands. The collection is the most valuable of any formed from that region, including as it does a nearly complete series of mosses and flowering plants, 800 skins and skeletons of recent birds, eight tons of fossils, including more than 1,000 skulls and many nearly complete skeletons.

Further Experiments on the Liquefaction of Fluorine.

At the meeting of the Academy of Sciences at Paris, October 12, M. Moissan read a paper on the liquefaction of fluorine with Prof. Dewar's instruments in London. He said it retained its liquid form at minus 120 degrees Centigrade, whereas almost every chemical affinity of the most active of known gases disappears in such great cold. The exceptions are hydrogen and turpentine oil, which even in a temperature of minus 210 degrees Centigrade combine with fluorine and are incandescent.

SCIENCE announces the establishment in Switzerland of a weather bureau. It says: "A dispatch is sent each evening from Zurich giving the weather probabilities for the next twenty-four hours. The predictions are based on data received from the principal meteorological stations of Europe combined with experience of local conditions. The dispatch is further distributed by telephone to those communes prepared to subscribe ten francs [$2] per month for the service."

The American Institute Fair.

In the basement of the Madison Square Garden will be found an exhibit which will be recognized by visitors who were present at the Chicago World's Fair and became familiar with the celebrated display in the Department of Forestry. Reference is made to the lovely collection of American woods shown by Romeyn B. Hough, B.A., of Lowville, N. Y. It was a happy inspiration which led Mr. Hough to conceive the idea of preserving his specimens in the form of extremely thin and transparent sections or shavings, instead of in the form of the blocks or thick strips with which we are familiar. The most unique part of this exhibit is a set of albums, each page of which contains three specimens of one particular kind of wood. The sections measure about 2 inches by 4½ inches and they are cut from the tree in three different directions: transverse, radial and tangential. The wood is prepared by a process which in no way interferes with the natural colors and texture of the wood, and the specimens are cut in a special machine which produces sections varying from $\frac{1}{64}$ of an inch for transverse to $\frac{1}{250}$ of an inch for radial and tangential sections.

So fine is the work of the machine that sections of California white pine are shown which are only $\frac{1}{100}$ of an inch thick. These are of course transparent, and on holding up the hand to the light and looking at it through one of these sections a curious so-called X ray effect is produced, due to the refraction of the light in passing through the wood. In addition to the exquisite beauty of this work, the collection of volumes forms a complete treatise on the subject of American woods. The exhibit also includes preparations of woods for the stereopticon and the microscope, and a collection of wooden cross section cards for visiting or business purposes. The printing qualities of the wood, either for type or steel plate, appear to be excellent, and the grain and delicate tints of the woods give them a dainty and artistic effect.

The exhibit of the American Gas Furnace Company, of Elizabeth, N. J., comprises an oil gas machine placed in Machinery Hall, and in the Main Hall a large number of furnaces for hardening and annealing steel work, gas forges, brazing blowpipes, a furnace for automatic hardening, and an automatic tempering and coloring machine, in which the work is fed into a hopper and passes through a revolving spiral way, where it is constantly subjected to the action of sand or ground flint, heated to the proper degree, and finally leaves the furnace drawn to the desired temper-color.

The oil gas machine for converting naphtha into a fixed gas is automatic in its action, requiring no further attention than keeping the storage tanks filled. A 2 inch pipe is laid from the gas machine across the Garden to the floor above, and the mixture of atomized naphtha and dry air is so well combined that there is no evidence of condensation at any point. The gas is delivered to the furnaces at a pressure of 1 pound to the square inch. The lighting qualities of the gas are shown by means of a number of Welsbach lamps, to which it is fed through a pressure regulator, which reduces the gas pressure of 1 pound to the square inch required for the furnaces to 4 inches of water pressure. This is the first public exhibition made by this company, and its plant is certainly an interesting feature of the fair.

The Otto Gas Engine Company, of Philadelphia, show four of the justly celebrated Otto engines, the oldest type of gas engine to take a successful hold upon the public. Seven thousand of these engines are at work in England, and one of these shown at the fair is numbered 5,588, showing that over this number have been built in the United States. The exhibit comprises one 9 horse power horizontal engine, driving a 110 volt dynamo; a 25 horse power marine engine; a 36 horse power horizontal power engine and a 3½ horse power vertical engine.

The Harting Gas Engine Company call attention to the few parts of their machines, rendering them easy to operate by the unskilled hands of the amateur. The governing is done from the exhaust, and the claim of simplicity is certainly borne out by the appearance of the 2½, 1 and ¾ horse power engines exhibited.

Wietz & Weiss, of New York, show four gas engines, ranging from ½ to 8 horse power, which they claim will develop a horse power hour on 17 cubic feet of gas, and 1 horse power and 2 horse power kerosene engines, which are said to burn but 1 pint of oil per horse power per hour. A closed oil tank, carrying sufficient oil to run the kerosene engine ten hours, is attached to the cylinder above the crank chamber. The oil is forced into the cylinder through a small tube, and there it is vaporized and mixed with the proper quantity of air. To control the engine under varying load, the number of injections is regulated by a governor connected to an eccentric on the main shaft.

An exhibit worthy of special mention is that of the Clauson-Kaas Manufacturing Company, of New York. The stall is filled with a varied assortment of the very beautiful papier maché models which are made by this company, chiefly for use in the lecture room. The different departments include models of fruits, vegetables, botanical specimens, the anatomy of the human body and many other objects. The models are all hand painted, and the greatest care is taken to give them perfect shape and color. The imitation is carried to the point of weighting the objects, and the surface is made to give the correct sensations to the touch. This reproduction of the "feel" and weight in the case of fruits and vegetables is very deceptive, and it is difficult to realize that the weighted papier maché potato is not the garden-grown article. The most difficult and successful modeling is shown in the anatomical department, and the model of the human ear, in which each articulated detail is exactly reproduced, is a masterpiece of modeling. A curious display of models is that forming part of the mycological cabinet, which is the name given to the imitations of mushrooms and toadstools of all continents. The object of this cabinet is to propagate and enlarge people's knowledge of all edible and poisonous mushrooms and toadstools. It is considered that the surest way to teach the public what to gather and what to let alone is to teach them by means of these models and the description that goes with them. It may surprise the uninitiated to learn that the collection includes models of 119 specimens, of which 21 are poisonous, 14 suspicious, 24 not edible, the remainder —less than one-half of the total—being edible.

A modest stand, but one that should commend itself to every resident of the city that has the welfare of the dumb creation at heart, is that containing the Hallanan rubber horseshoe pads. The pads are made of rubber and canvas, backed with sole leather. They are made slightly larger than the horse's foot across the quarters, and form part of the shoe. The shoer fits the foot and pad with a three-quarter steel shoe of uniform thickness, and the space between the pad and the foot is filled with tar or oakum. The object of the pads is to place the weight of the horse evenly on the sole and frog and prevent the jar to the foot. It also tends to prevent slipping on smooth pavements or on ice-covered ground. It is used by the fire departments of New York and Brooklyn, where it is said to give good service and it has received the indorsement of several societies for the prevention of cruelty to animals.

One of the best pieces of mechanical construction in the Fair is an angular coupling or quarter turn countershaft, shown by T. R. Almond, of Brooklyn. It is intended to be used in place of the quarter turn belt or miter gears. At the point of intersection of the center lines of the two shafts, and at right angles to them, is a vertical shaft upon which is a stout sliding sleeve provided with two short horizontal arms placed 90 degrees apart. The arms terminate in steel balls which engage sockets on the extremities of two short rocking levers which are pivotally attached to the two countershafts. As the shafts are turned the sleeve on the vertical shaft has a rotating and sliding motion. The device, which is ingenious and well worked out, is said to develop less friction and show less wear than the more common methods of making quarter turn connections. The inventor was awarded the John Scott medal on the recommendation of the Franklin Institute.

A pair of electric dumbbells are shown by the W. and S. Electric Company, of Brooklyn. A small dry battery is suspended between the shoulders, and the wires are carried to the two dumbbells, where they connect with the wire wrapping of the handles. The strength of the current is regulated by a switch placed on the chest of the user.

The New York Trade School has contributed an exhibit of the excellent work turned out by its students, which calls for special mention. The question of trade schools and apprenticeship is a very live one just now, and if any one doubts the value of the instruction which is given in technical night schools, he should examine this exhibit. The work is shown on boards and comprises most of the departments. The work done by the class of 1896-97 in blacksmithing is exceedingly fine and much of it shows a finish which would do credit to a skilled journeyman. There are also exhibits of work in stone cutting, sheet metal work, steam fitting and plumbing.

The management have introduced some novel features in this year's exhibition, notably the food show and the exhibition of fruits and flowers. The latter is somewhat limited, but what there is of it is very choice, many of the exhibits coming from professional exhibitors, and from the gardens and conservatories of such exhibitors as Cornelius N. Bliss, William Rockefeller, J. Loeb and D. Wilson. The field is such a vast and attractive one that it should soon be possible for the annual exhibit of fruits and flowers to develop an independent existence. There is sufficient wealth and enthusiasm devoted to floriculture alone in and around Greater New York to fill the whole Garden with exhibits at an annual show.

A Remedy for Yellow Fever.

A special cable dispatch to the New York Sun, from Montevideo, on October 10, states that Dr. Sanarelli, the discoverer of the bacillus of yellow fever, announces that he has discovered a curative serum for that dread disease. He will shortly publish the results of his experiments.

Wealth of the Klondike.

The steamer City of Topeka arrived at Seattle, October 11, from Juneau, Alaska, bringing several miners from the Klondike regions and $300,000 in gold. Among the passengers was John F. Maloney, of Juneau, who came out from Dawson City with the Galvin party. He stated that the previous accounts of the wealth of the Klondike were overestimated. He also stated that one claim would produce $1,000,000, and that over $2,000,000 would come out of the Klondike region this fall. Patrick Galvin, who is recognized as one of the bonanza kings of the Klondike and who has been engaged in mining for three years, said: "There are 461 claims which have been operated sufficiently to prove their richness. There are 280 claims staked out, but not developed. Taking these claims and figuring out their cubic contents and making a conservative estimate, I do not see why the output from these claims alone should fall short of $50,000,000."

In a letter from Lake Lindermann a newspaper writer says that there is chaos on the Dyea trail. Thousands of people are struggling hopelessly on with damaged outfits and thousands with no outfits, clothes, food, or shelter are beating back against the storm, trying to reach Dyea. For eleven days the storm has raged, the wind blowing a gale and the rain falling in torrents. To the 800 or 900 people cooped up between the mountain lakes, high above the timber line, the past has been a nightmare. Baking powder is held at $5 per pound; horseshoe nails being 25 cents each. One man at Crater Lake went back over the trail and gathered up 500 nails from the hoofs of dead horses and sold the lot to one man for $65. A stick of dry wood the size of a man's arm sold readily for $4, and green wood sold at the rate of $1,000 a cord.

Libraries and Our New Supplement Catalogue.

It is gratifying to note that our new SUPPLEMENT Catalogue has been eagerly received by the large libraries of the country and has been placed on their shelves as a valuable work of reference. Many of the librarians have been so favorably impressed with the catalogue that they have wished additional copies for various departments of their libraries.

The librarian of the Wabash College Library says it is "An elaborate and most excellent index catalogue." The librarian of the Carnegie Library, of Pittsburg, says: "This little volume will get so much use in our library that we should like another copy, if you could spare one." The librarian of the Public Library, Peoria, Ill., says: "We shall find it of great value in reference work." The librarian of the Cornell College Library, Mount Vernon, Ia., says: "It will be of much help to us in using our back volumes of the SCIENTIFIC AMERICAN SUPPLEMENT."

Copies have been filed in the libraries in different departments of the United States government. This catalogue is a valuable reference index to a whole scientific and technical literature, much of which has not yet been published in book form. We are still able to supply a limited number of cloth-bound copies, which are mailed for twenty-five cents. Copies of the paper cover edition mailed free to any address in the world.

Explosion of Acetylene Gas.

While experimenting with acetylene gas in his machine shop in Rochester, New York, on October 4, Valentine Long, his brother, Frank Long, and Jacob Fassott, an employe, were injured by an explosion of the tank used in making the experiment. Valentine Long's skull is fractured over his right eye and he lost the sight of both his eyes. It is said at the city hospital that he will probably die. The other two men are not seriously injured. The tank was a strange-looking affair, about two and a half feet in diameter and made of galvanized iron, with bands of iron running along the sides to give it strength. It was placed in Long's shop a few days ago by an acetylene company recently formed in Rochester, in which Mr. Long was interested. At the time of the accident Valentine Long was preparing to make a pattern for a new valve that is used on the tank. A lighted gas jet that stood about three feet above the tank is supposed to have ignited the acetylene and caused the explosion. Fassott had a narrow escape from instant death. A piece of the iron from the tank grazed his body, cutting off the buttons from his trousers and making a rent across the bosom of his shirt.

The Steamer Cymric Launched.

The new White Star Line steamer Cymric was launched at the yards of Harland & Wolff, Belfast, on October 12. The Cymric is a freight and passenger steamer of 12,000 tons and is considerably longer than the Georgic, which is the largest of the White Star freight steamers now in the New York service. It is stated that the White Star Line has contracted for over 100,000 tons of new steamer property. The Oceanic was to have been launched in January, 1898, but, owing to the strike in the engineering trade in Great Britain, it is possible it may not be launched until May or June.

A NOVEL HAND CAMERA.

The remarkable progress that has been made within the past few years in the construction of hand cameras, whereby their cheapness, lightness, compactness, simplicity and accuracy are some of the predominant points, is well exemplified in the camera called the Adlake, which is the subject of our illustrations.

The well known box form of camera is adopted, and comprises at the front all of the important essentials for good work; as, for example, a lens easily removable for cleaning, a set of diaphragms quickly adjusted, a very simple yet rapid shutter, easily released, positive in its movement and quickly adjustable for time or instantaneous exposures. There are also the usual two finders for taking the picture in a vertical or horizontal position. On the rear is a space for holding twelve remarkably compact and simply constructed metal plate holders, plainly observable in Fig. 1 and in detail in Fig. 2. Each plate is exposed separately, withdrawn from the box and transferred to the rear of the series until all, or as many as desired, are exposed, each holder having stamped on it a separate number.

The construction of the plate holder and mode of operation will be observed in Fig. 2. Two vertical grooves in the box on each side hold a metal plate holder frame having a small recess cut out in each side, as will be noticed by a black space in the upper part of Fig. 2. The thin metal plate holder, just thick enough to hold one glass plate, provided with a hinge side, the latter having on its upper edge and outer corners light wire clamping or locking springs, is pushed down in the metal plate holder frame just described. Just in front of the frame are two skeleton fingers, having at their upper ends curved portions which fit into the black recess shown in the plate holder frame, and are attached to the axis of a revolving shaft at the bottom, at the end of which is also a push crank projecting through the box, the knob being seen in Fig. 1, on the side. To make an exposure the finger frame is turned into a vertical position until it fits snugly into the plate holder frame. The plate holder is then inserted, which brings the corner projecting clamping wires into the curved ends of the finger frame. The cover of the box is shut, then the knob on the outside is pushed down. This carries forward the finger frame downward in the arc of a circle which takes with it the door of the plate holder, leaving the latter in a horizontal position on the bottom of the camera. After the exposure is made the knob is pushed up tightly, which closes the door of the holder, it being secured by the three wire clamping springs. The cover of the camera is opened, the plate holder removed and another plate inserted. The plate holder is made with a thin rabbet edge, in which the edge of the plate holder door, or side, fits and excludes all light.

Referring to the mechanism of the shutter, Fig. 3, it will be noticed that the shutter is of the ordinary oscillating fan-shaped type, having an elongated aperture, working on a pivot from one side to the other in opposite directions, and that a very small movement just below its axis produces rapid movement above. To this portion is attached a link secured to the lower end of a long swinging vertical arm, or lever, pivoted at the top, seen on the left. A rapid movement of this lever near its fulcrum will give an extremely rapid motion to the shutter. Behind this lever will be seen the pivoted black operating swinging lever, on the end of which is secured the operating oscillating spring, having one end attached to the long vertical lever not far from the fulcrum.

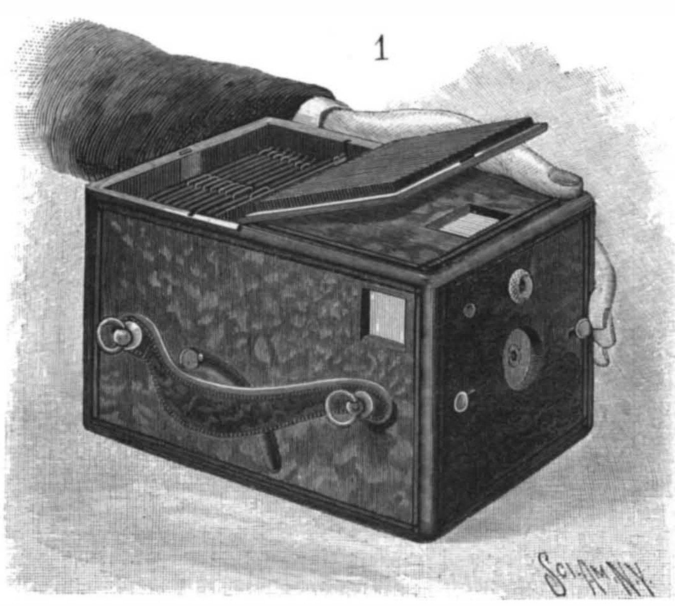
When the operating lever is pushed in one direction by the knob on the outside the spring is partly rotated until its center is above the attached end, causing the shutter lever to be suddenly pushed in the opposite direction, giving a corresponding rapid movement to the shutter. Pushing the operating lever in the opposite direction makes the spring carry the long lever to the other side. In this way a slight side pressure on the push button quickly operates the shutter without a jar or difficulty. A second pivoted lever (shown at the right, Fig. 3) pivoted at the bottom, to the axis of which is a flat spring, has a horizontal arm projecting from its center which engages with a like short arm projecting from the shutter proper. It may be called a time lever. When the button on the outside is pushed toward the lens, the arm on the lever engages the arm on the shutter and stops its movement, leaving the aperture open for time exposures. When pushed away from the lens, the lever releases the shutter and allows the latter to close.

Above the shutter and working just behind the lens will be observed a star-shaped diaphragm plate turning around its center and having three different apertures. On the surface of the plate are slight indents, which engage in the end of the horizontal flat locking springs. The diaphragm plate is attached on the front to a rotating ring surrounding the finder lens, and is thus rotated from the outside to whatever working aperture is desired.

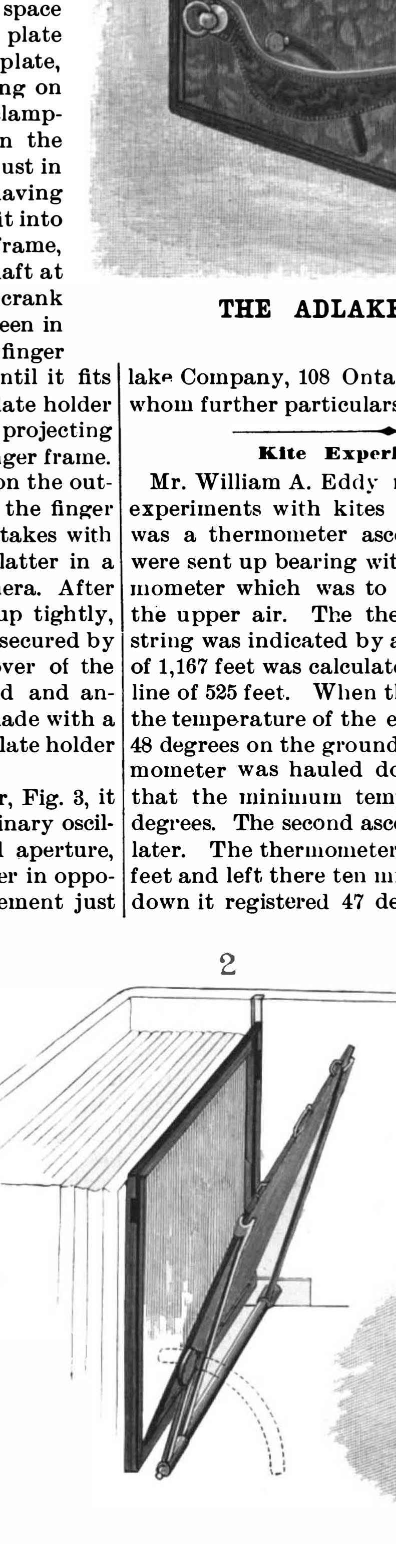
Convenient strap rings are attached to the handle of the camera for carrying it over the shoulder or on a bicycle. Pictures we have seen made with it are clear cut and distinct, showing that its cheapness is no bar to the production of good work.

Its simplicity and certainty of working are its salient features, while at the same time its strength of structure is such as to permit of rough handling without detriment.

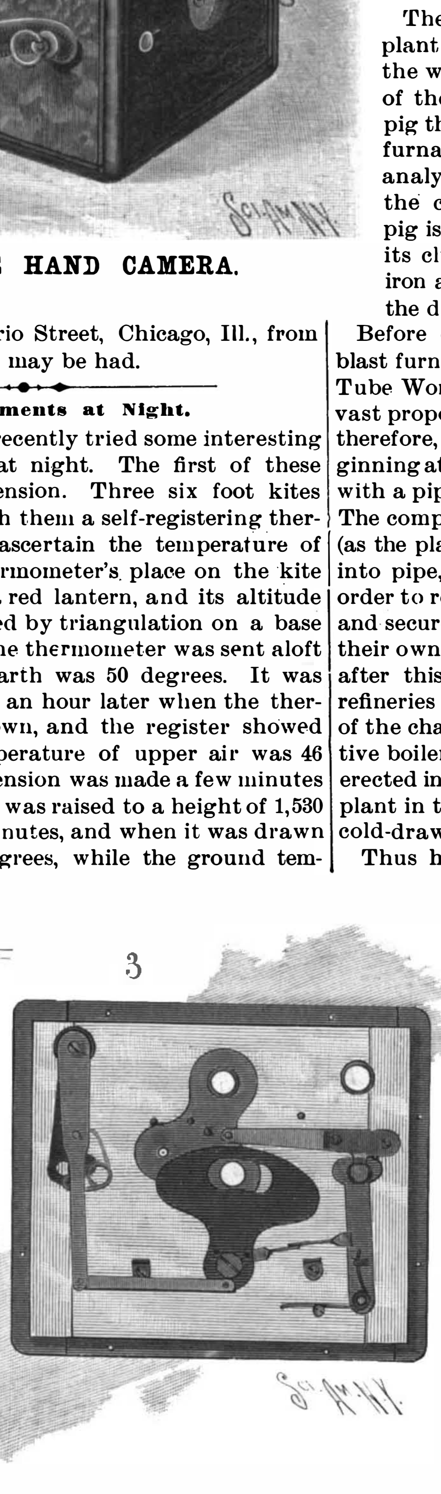
The camera is manufactured by the Adams & Westlake Company, 108 Ontario Street, Chicago, Ill., from whom further particulars may be had.



THE ADLAKE HAND CAMERA.



THE PLATE HOLDER DEVICE.



THE SHUTTER.

Kite Experiments at Night.

Mr. William A. Eddy recently tried some interesting experiments with kites at night. The first of these was a thermometer ascension. Three six foot kites were sent up bearing with them a self-registering thermometer which was to ascertain the temperature of the upper air. The thermometer's place on the kite string was indicated by a red lantern, and its altitude of 1,167 feet was calculated by triangulation on a base line of 525 feet. When the thermometer was sent aloft the temperature of the earth was 50 degrees. It was 48 degrees on the ground an hour later when the thermometer was hauled down, and the register showed that the minimum temperature of upper air was 46 degrees. The second ascension was made a few minutes later. The thermometer was raised to a height of 1,530 feet and left there ten minutes, and when it was drawn down it registered 47 degrees, while the ground temperature was 44 degrees. The minimum temperature registered in the highest strata was 43 degrees. Mr. Eddy and his associates next raised a triangular reflector, 24 by 5 inches, covered with silver paper, to watch its operation in the light of a full moon and see what it would do with the rays. One of Mr. Eddy's associates went to a point a quarter of a mile distant, and from there could plainly see the reflector, although at first it was difficult to distinguish it from the stars.

A COMPANY has been organized at Seattle, Washington, to develop the coal and oil fields recently discovered in Alaska, some 350 miles west of Juneau. Thirty thousand feet of piping has been ordered for this purpose from the Pittsburg district.

THE STEEL PIPE AND TUBE INDUSTRY.

I.—THE MANUFACTURE OF THE PIG IRON.

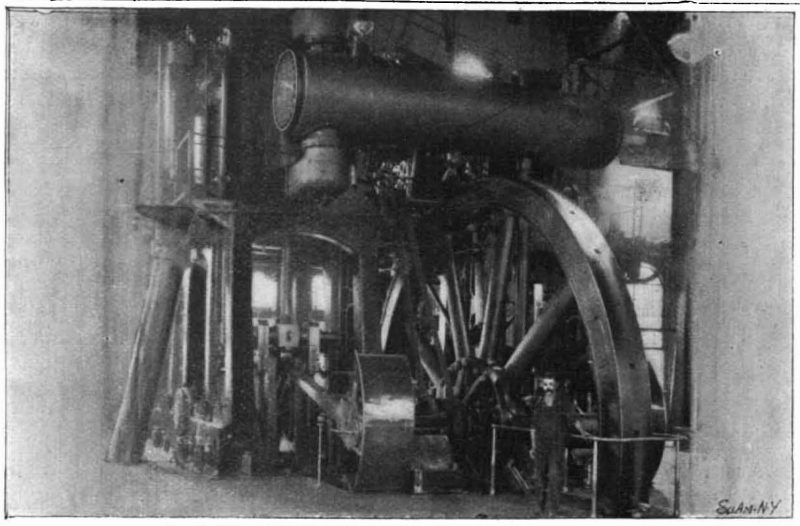
The manufacture of pipe and tubing is one of those branches of the iron industry that have been slow to discard puddled iron in favor of Bessemer steel as the raw material of manufacture. This reluctance to use the new material has been due to the difficulty in producing lap and butt welded steel pipe that would be as strong at the weld as in the body of the pipe, and it is undeniable that the earlier attempts were marked by repeated failure. The obvious advantages of strength and smaller cost in the use of steel were so great, however, as to stimulate the manufacturers to an earnest study of the problem, and of late years it has been so completely solved that welded steel pipe and tubing can now be made, and is made, that shows a larger percentage of strength at the weld than at any other point. It has been found that to procure a perfectly reliable weld a special grade of steel must be used, and that the chemical composition of the pig iron itself must be made the subject of careful study. Under the old system the manufacturers of steel tubing were apt to purchase their raw material in the shape of pig iron with very little, if any, regard to its composition; whereas it is now the practice of the best manufacturers to exercise the greatest care in the selection and mixture of the pig before it is melted down for treatment in the converters.

The National Tube Works Company, whose plant is the largest and most representative in the world, attach much importance to this branch of the manufacture, and they make every ton of pig that goes to their steel plant in their own blast furnaces. Every lot of pig that is cast is carefully analyzed and its composition recorded, and when the cupolas at the steel plant are charged the pig is selected from various casts with reference to its chemical composition, so that the molten cast iron as it is poured into the converters shall have the desired chemical proportions.

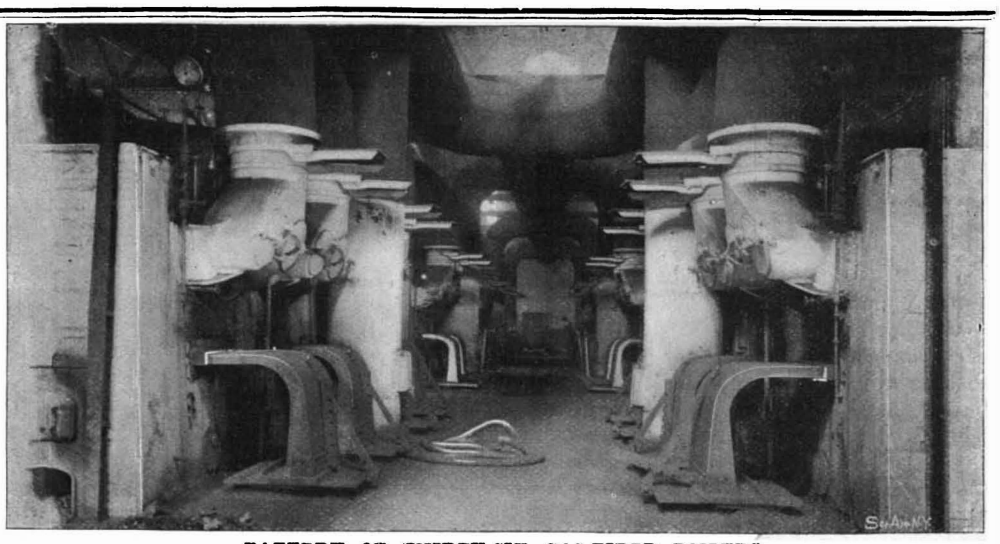
Before entering into a detailed description of the blast furnaces, it may be mentioned that the National Tube Works Company, whose plant has grown to such vast proportions, was formed in Boston in 1865, and is, therefore, thirty-two years old. It made a modest beginning at its present location, McKeesport, Pa., in 1872, with a pipe mill which employed two hundred men. The company at that time merely rolled the "skelp" (as the plates from which the pipe is made are called) into pipe, buying the skelp in the open market. In order to render themselves independent of the market and secure a more reliable material, they built in 1879 their own puddling furnaces and rolling mills. Shortly after this a forge was added, together with Swedish refineries and "knobbling" fires for the manufacture of the charcoal iron, of which the company's locomotive boiler tubes are made. The present steel plant was erected in 1893, and there is at present an entirely new plant in the course of erection for the manufacture of cold-drawn seamless tubing.

Thus has been built up the present vast establishment, which can claim to be not only the largest tube works in the world, but also one of the largest steel works of any kind in this country. Those of our readers who have never had an opportunity to visit a works of this magnitude can form some idea of its size from the following statistics: The combined steel plant and rolling mills cover an area of 90 acres and give steady employment to an army of 7,000 men. The raw material brought into the works and consumed every day averages 1,000 tons of ore, 1,500 tons of coal, 700 tons of coke and 300 tons of limestone, not to mention other material in lesser quantities. For the intershipment of material within the works there are 12½ miles of standard gage track and one mile of narrow gage. The rolling stock of this system of railroads consists of 350 cars and 11 locomotives, the latter varying in size from the smallest of their kind up to machines of 75 tons weight. The total output of tubular goods for the year is 200,000 tons.

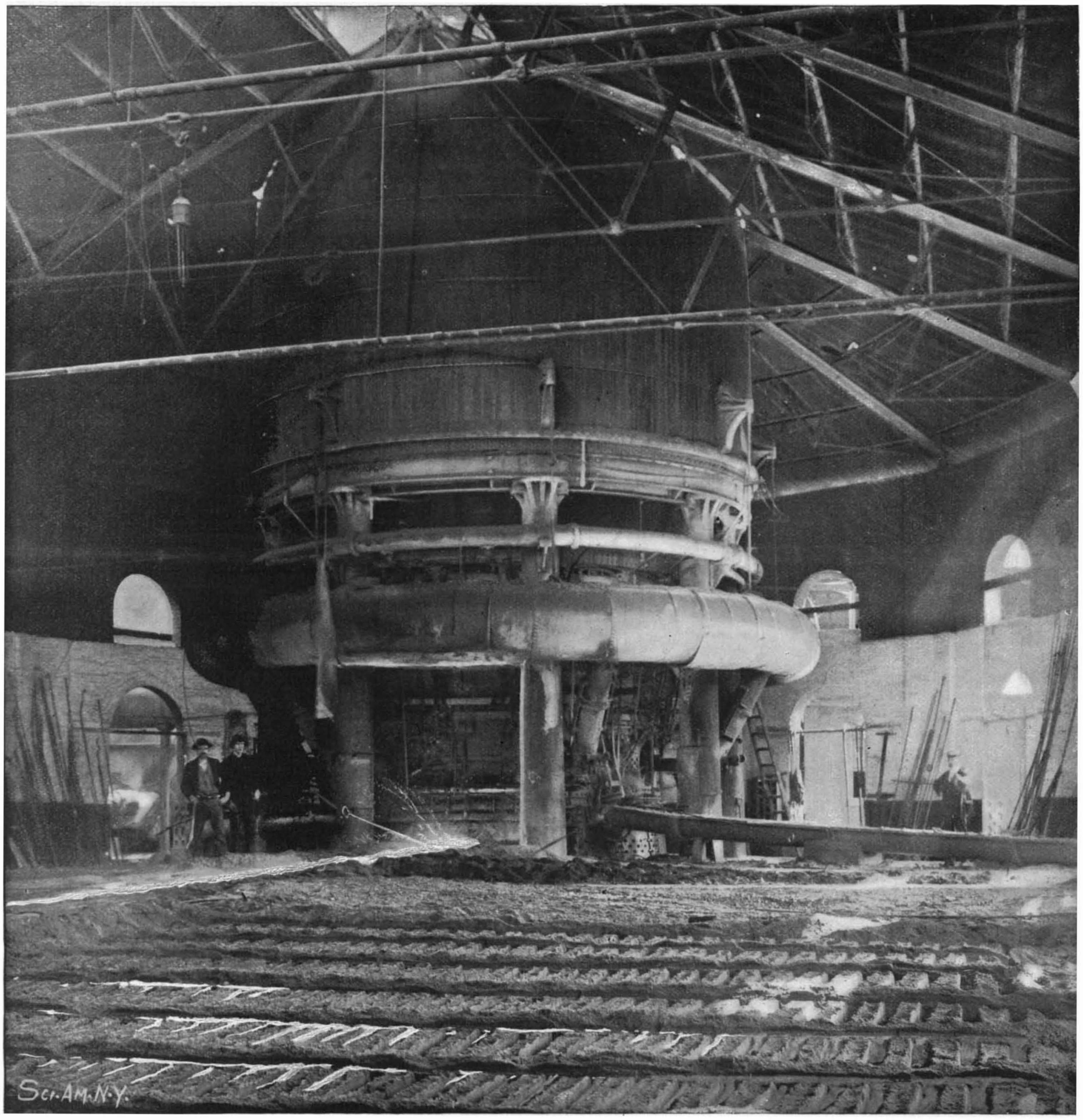
The raw material—coke, limestone and iron ore—is brought into the works on cars and run up onto raised trestles, from which it is dumped into long rows of bins. From these it is drawn off, as will be explained later, for charging the blast furnaces. The plant contains two blast furnaces, known as the Monongahela furnaces, of the latest type, with a capacity of about 700 tons per 24 hours. These furnaces, with the elevators for raising the ore, coke, etc., to the charging platform, the hot blast stoves and the foundry in which the pig iron is cast, are shown on the front page engraving. Each furnace consists of a massive cylindrical structure of brick and steel 80 feet in height and of varying diameter. At its mouth it has an internal diameter of 16 feet, and it increases in the first 60 feet of its depth to a diameter of 20 feet, the taper being



A 1,450 HORSE POWER BLOWING ENGINE.

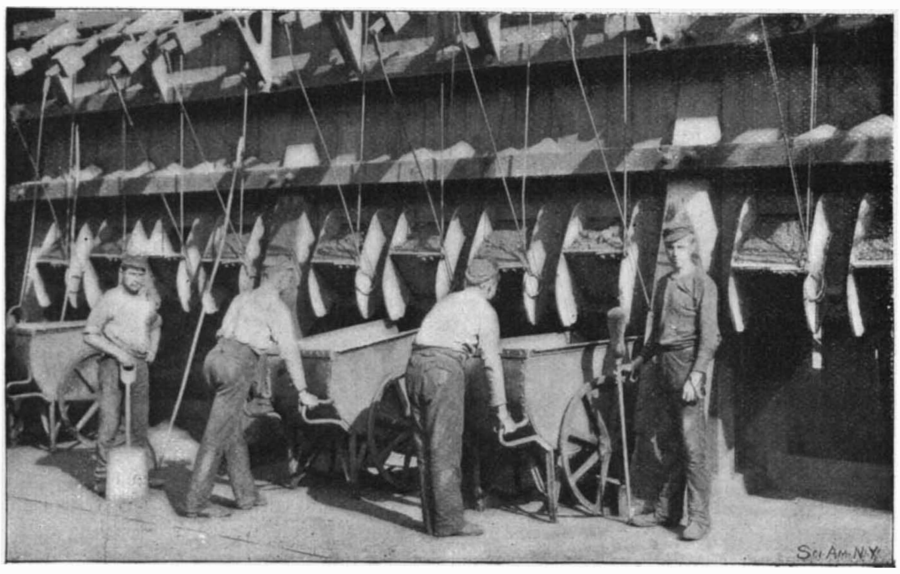


BATTERY OF THIRTY-SIX GAS-FIRED BOILERS.



THE BASE OF A FURNACE 80 FEET HIGH—CASTING THE METAL.

REMOVING PIG IRON FROM THE SAND.



LOADING ORE AT THE BINS FOR THE FURNACES.

MANUFACTURE OF STEEL TUBING—THE BLAST FURNACE PLANT.

given to allow of an easy descent of the material. The walls are 3 feet in thickness, and the greater part of their weight is carried upon a circular row of massive cast iron columns, which bear against heavy steel girders placed beneath an offset formed in the wall at this point. From here to the level of the blast tuyeres the furnace tapers to a diameter of 12 feet, and this diameter is maintained to the bottom of the furnace, 8 feet below the tuyeres. The massive walls are built of brick, with an outer casing of sheet iron and an inner lining of firebrick. It will thus be seen that a modern blast furnace presents the appearance of sections of two hollow truncated cones, placed base to base and terminating in a cylindrical chamber or basin. The upper portion is known as the "shaft" or "body," the lower portion as the "boshes," and below this is the "hearth" or "crucible," in which the molten cast iron collects. The boshes, it will be seen, lie just above the tuyeres, and as the material which they contain is exposed to the fierce blast of the furnace, the walls at this point are provided with hollow bronze castings built into the brickwork, through which a stream of cold water is constantly circulated. These extend completely around the boshes and penetrate the wall to within a few inches of its inner surface. At the bottom of the boshes the wall is pierced by seven tuyeres through which the hot blast is introduced.

In the earlier blast furnaces the hot gases were allowed to escape at the mouth of the furnace, from which great masses of flame issued continuously and gave that weird and brilliant night effect for which the iron manufacturing districts were formerly noted. This was, of course, an extremely wasteful practice, thousands of dollars' worth of fuel being recklessly burnt away to no purpose. To-day the mouth of every furnace is closed by a massive cast iron cup and cone arrangement, which is only opened when a fresh charge is to be lowered into the furnace. The cup is a massive casting, which rests upon the inner edge of the wall and extends down into the furnace mouth. The cone is suspended within the cup, its lower edge being of larger diameter than the cup, so that when it is drawn up it completely closes the opening.

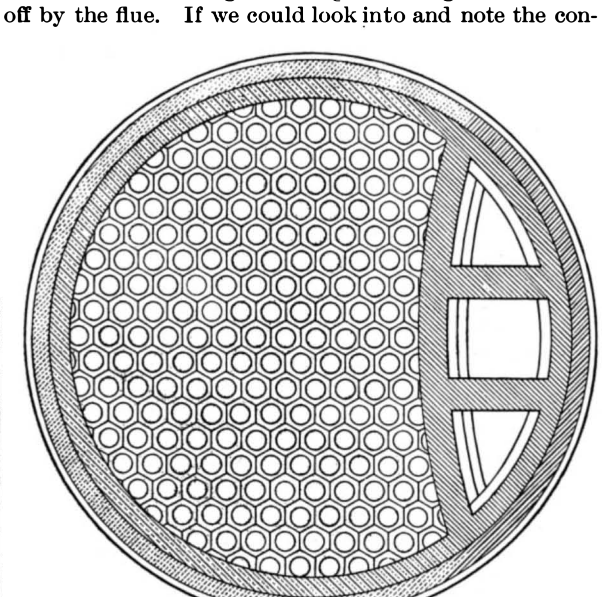
On one side of the furnace, just below the hopper, is a flue opening, through which the gases escape down a large riveted steel pipe to a dust collector, where the cinders and all solid particles remain and are taken out from time to time through a chute at the bottom. The gases are then utilized for two different purposes. Part of them is led to the Cowper hot blast stoves, where it heats the blast on its way from the blowers to the furnace, and part is conducted to the batteries of boilers, shown in Fig. 2, where it is utilized in raising steam for the blowing engines.

The Cowper stoves, of which there are seven, stand in a line opposite the furnaces. Each stove is a cylindrical wrought iron tower 20 feet in diameter and 79 feet 6 inches in height. It is closed by a dome-shaped roof, and the whole interior is lined with fire brick. On the side next the furnaces is a large vertical flue into which the furnace gases pass by a valve at the bottom. The body of the stove is taken up by a mass of fire brick pierced with innumerable small, vertical flues, extending from top to bottom and open at each end. The hot gases are ignited on entering the base of the large flue by admitting air through a valve, and the hot products pass up the main flue and down through the mass of fire brick, finally escaping to the large steel chimney, which stands between the furnaces. When the interior of the stove has been heated to a proper temperature, the gases are shut off and turned into the next stove. The cold blast from the blowers is now turned on at the bottom of the stove and passes up through the brickwork, from which it absorbs the heat, finally passing down the main flue, from which it is led to the circular blast main which surrounds the furnace just above the tuyeres. By the time it leaves the stoves the air is heated to from 1,300° to 1,400° Fahrenheit, the difference between this and the cold blast representing heat saved from the gases and restored to the furnaces.

The gases that are not used in the hot blast stoves are carried in large riveted pipes to the boiler house, of which we give an interior view, Fig. 2. Down each side of the room are arranged sixteen two-flue boilers, each of which is 54 inches diameter and 30 feet long. There are also four 250 horse power double deck water tube boilers in two batteries, making thirty-six boilers in all. All of these are fired with the furnace waste gas, which is distributed by the large pipes which extend through the boiler house near the roof From the main pipe it is led down beneath the foot plates, and there controlled by valves which admit it to the burners, which will be noticed curving over from the floor to the furnace front. Here the air necessary for combustion is admitted, and the gases are burnt in the fire box. The supply of gas is controlled by means of a rack and lever, which serves to slide the burner to and from the furnace and increase or reduce the opening by which the gas enters it.

After passing down through the long line of boilers one is prepared to find an imposing display of motive machinery in the engine house—and it is indeed a truly impressive sight that meets the eye. The blowing engines, one of which is shown in Fig. 1, are all gathered under one roof, and together they aggregate a total of nearly 5,000 horse power. On one side of the room is a group of five Allis-Corliss condensing blowing engines with 42 inch steam cylinders, 84 inch air cylinders, and a common stroke of 5 feet. Each engine develops 700 horse power, and each is provided with its own condensing pump. There is also a very handsome compound condensing blowing engine, of which we give an illustration, with a 40 inch high pressure and 76 inch low pressure cylinder, and two air cylinders 76 inches in diameter, the stroke being 5 feet. This engine develops 1,434 indicated horse power, and with the other engines brings the total up to close upon 5,000 horse power.

The 2,000 tons of limestone, coke and ore which are consumed daily by the furnaces are brought into the works by the train load. The cars are run up onto trestles, from which their contents are dumped into long rows of bins. Our illustration, Fig. 5, shows the chutes at the bottom of the ore bins, which latter are ranged down the long shed which is seen to the left in the front page engraving. The "burden," as the mixture of ore, limestone and coke with which the furnace is charged is called, is made up according to the grade of iron which it is desired to produce. It is taken from the bins in iron trucks in the proper portions, and wheeled to the large elevators shown in the engraving, which lift it in the trucks to the charging platform at the mouth of the furnace. Here it is dumped into the hopper, and as soon as the latter is filled, the cone is lowered, permitting the charge to fall into the furnace. The furnace is kept constantly filled with burden, and when it is once started it is kept burning continuously, the solids descending and the gases rising to be carried off by the flue. If we could look into and note the condition of the contents, we should find at the top a layer several feet thick of raw materials, the temperature of which was about 500°. Below this would be a few feet in which the ore was somewhat reduced by carbon. In the next layer, at a temperature of 1,000°, the limestone would be found decomposed into lime and carbonic acid. Below this would be a wider belt at from 1,500 to 1,700 degrees temperature, where the iron, now reduced from the ore, would be taking up the carbon to form cast iron. A little lower down oxides, such as silica and phosphoric acid, are reduced, the silicon and phosphorus combining with the iron. Within the boshes the iron is completely melted, as is also the slag which results from the combination of the fluid with the various impurities. The molten mass finally collects in the hearth, the slag being on the top, and the heavier iron at the bottom. The slag is drawn off through an opening at the top of the hearth, and the cast iron is tapped through a narrow slit near the bottom. The illustration No. 3 is taken from the interior of the foundry in which the pigs are cast. In the foreground is seen the base of one of the great furnaces The large circular pipe which surrounds it is the hot blast main, from which the seven smaller pipes lead to the tuyeres below. On one side is seen the trough through which the slag is drawn off, and on the other side the molten iron is being drawn off, through the tap hole. The cast takes place six times a day, and the total output of the two furnaces is about 700 tons per day. The sand is prepared by forming parallel lines of moulds which connect with the central channel down which the molten iron flows. The tap hole is opened by breaking away the clay with which it is closed, and the metal flows at a white heat down to the end of the main channel, where it spreads right and left into the moulds. The filling commences at the extreme end and finishes at the furnace.



TRANSVERSE SECTION THROUGH COWPER HOT BLAST STOVE.

When the cast has cooled off sufficiently to be handled, the pigs are broken loose and laid across each other in a position convenient for handling by the man who carries the heavy pair of tongs. (See Fig. 4.) They are then lifted, one at a time, by a gang of powerful and well-muscled men, who carry them through the open archway at the side of the foundry and load them into cars on which they are hauled to the steel-making department.

We reserve the description of this department for a later issue.

M. de Morgan's Last Discovery in Egypt.

We may give a fuller account of discoveries which we mentioned briefly a few weeks since, says The Independent, made in the Nile Valley by M. de Morgan, Director-General of Antiquities of the Egyptian government. The most important of these discoveries is an extensive tomb which appears to be the most ancient yet unearthed in Egypt. M. de Morgan began his investigations in that portion of the Nile Valley formed by the bend in the Nile between Thebes and Abydos, where he brought to light many of the oldest records belonging to early Egyptian history that have yet been found.

The first notable discoveries were a number of ancient flint arrowheads, and other implements in the shape of indented flint blades, which had probably been used as saws and sickles. All of these evidently belonged to a period considerably antedating the time of the fourth dynasty. It is thought that the sickles date from even the first dynasty, for the reason that wheat is believed by historians to have grown wild in Egypt at that time, and that these implements were evidently used for harvesting this wild cereal. M. de Morgan also found evidences that these ancient people had a religion of their own, which he believes to have been a sort of fetichism, as he can in no other way explain the curious images, the slate figures of fishes, birds and turtles which he dug up. He says:

"These figurines must have belonged either to the first dynasty or to a race and period preceding it, as I have found them only in these autochthon places."

He adds that in no other tomb of the ancient empire that has been discovered have any fragments of this kind been found.

Continuing his study of the ground, M. de Morgan made his way along the valley until he reached a point near Negada, where an extraordinary mound attracted his attention. Excavations were begun at the base of the mound, and revealed the existence of a huge quadrangular-shaped tomb, which the explorers believed to be intact. One of the solid sides of the tomb was pierced, and an opening made the size of a large doorway. On entering the tomb it was found that various galleries extended at different angles, and long passageways with rows of carved columns descended into subterranean chambers. From top to bottom the walls were covered with hieroglyphic inscriptions and with figures of men and animals cut deeply into the surfaces. Warriors in bass-relief, different from anything seen in other tombs, and images of children, kneeling as if in fear, appeared here and there on the sides of the passageway.

The main gallery led into a series of twenty-one rooms, each containing many objects, such as pieces of furniture of different designs, fragments of bronze statues and a quantity of broken vases. In the center of each room were placed sarcophagi, containing the mummified remains of the dead. The vases were cut out of alabaster, rock crystal, quartz and a substance resembling obsidian, and were carved with peculiar designs. A large central room contained a single sarcophagus, resting upon a pedestal of solid rock. Around it, crudely carved in ivory, were forms of fishes and dogs; and near the feet were the remains of what appeared to be a mammoth lion, made of countless pieces of ivory put together. At the head of the sarcophagus and facing it was a life size statue of a man, carved in wood. The sides of the room were covered with inscriptions of a period so remote that interpretation was impossible. The explorers opened the sarcophagus, and found an inner mummy case, covered with hieroglyphics. The sarcophagus was then closed and sealed, and prepared for removal to the museum at Gizeh, where the body will be carefully unwrapped. The sarcophagi in the other rooms, all of which were supposed to contain the bodies of royal persons, were also removed to the museum, where they will be opened. In all the rooms, M. de Morgan found large urns tightly closed and having on top what is known as a "banner name," or the seal of the king—a conclusive proof of the great antiquity of the tomb. These, as well as all the fragments and other loose objects, were carried to the museum.

The ceilings of the passageways and rooms were lined with what appeared to be sun-dried bricks of coarse workmanship, while the pavements of the floors were of granite. In many places the walls were in such a crumbled condition that large portions of the inscriptions had become obliterated. The royal names upon the sarcophagi consisted of a few signs; and, instead of being written in cartouches, were inscribed in a square similar to the "banner name" on the vases. The seals on the vases in the king's chamber were made from a cylinder, and not from a scarab, according to the Egyptian fashion, as found in other royal tombs. Everything bore evidences of the most remote age.

Correspondence.

A Needed Patent Office Reform.

To the Editor of the SCIENTIFIC AMERICAN :

In your valued issue of the second instant you present an article on the "Proposed Amendments to Our Patent Laws."

In addition to the propositions of the National Association of Manufacturers of America, I desire to call your attention to an inconsistency in the present working of the Patent Office which forms a sufficient grievance for another amendment.

The injustice (and it is nothing less) to which I refer is the unnecessary time and delay consumed in getting an application for a patent through the Patent Office.

With a surplus of $300,000 accumulated during the past year, and a total surplus to its credit of more than $5,000,000, it would seem there is no excuse for submitting inventors to such long delays as is now the case in the examination of applications ; especially, on the ground that the office is overworked, or that the force of examiners is insufficient to cope with the vast amount of business pouring into that office each day.

If more examiners are necessary to the proper dispatch of business, there is nothing to prevent the doubling or trebling of the present force, in the light of the resources at hand.

The writer has a number of applications for patents now before the Patent Office, and when he is told respecting one set of papers that this particular application "will come up for examination in about four months from the date of filing," it seems an absurd proposition for a government institution to make, which exists for and is backed and supported by an army of inventors, whose fees have enabled the office to pile up an unheard of surplus over and above its expenses.

Four months before one's application can reach an official examination ! This is almost an insult to the inventive age, and certainly leads to the conclusion that there is large room for a grand reformation along this line, and that it is high time some action were taken looking to the correction of this evil and a betterment of this branch of our patent service.

In patent practice the great desideratum is the utmost dispatch consistent with absolute accuracy, and there is no reason why the United States Patent Office should not be so skillfully equipped as to be able to pass on each and every application in at least two weeks after the date of filing thereof.

To compel an inventor to wait four months or more, before he can know what the outcome of his application is to be, serves to tie his hands, and prevent him from marketing what might prove a valuable invention, and at the same time keeps out of his possession funds which are absolutely necessary to his work and welfare.

Were every inventor a manufacturer, then the time consumed in passing upon these applications would not so materially affect him, for he could manufacture his invention with the usual "Patent applied for" stamped thereon, and patiently wait the pleasure of the Patent Office ; but when, as is now the case, inventors are dependent upon manufacturers, it is impossible to dispose of a patent which the Patent Office has not as yet granted ; and as money is what the inventor needs, he is unjustly compelled to wait until the insufficient force of the Patent Office reaches and passes upon his application.

Unless some reform is inaugurated to correct this grievance, what is to be expected of the future, when the accumulation of applications at this date has put the examiners four months or more behind in their work ? How does the office expect to cope with inventive expansion, if they find themselves handicapped with work at this stage ? And why is that $5,000,000 surplus lying idle, when it might be expended in supporting an increased force of examiners, and thus facilitate the work of examination ?

If the National Association of Manufacturers of America are seeking amendments to the patent laws of this country, they would do well to incorporate the above in their repertoire, and thus bring about a badly needed reform. WILLIAM E. HEATH.

Baltimore, October 9, 1897.

Electrical Show—Madison Square Garden Selected for the Second Exhibition.

Another electrical show has been planned for New York. Indications are it will be larger than the first, and for that reason the management lately signed a lease for Madison Square Garden for the month of May, 1898.

The exhibition company was incorporated in Albany last week. The officers are : C. O. Baker, Jr., president; F. W. Roebling, vice president ; George F. Porter, secretary and treasurer, who, with L. F. Requa, C. H. Lieb, H. H. Harrison and J. W. Godfrey, compose the board of directors. Mr. M. Nathan, the general superintendent of the last show, will have the management of this.

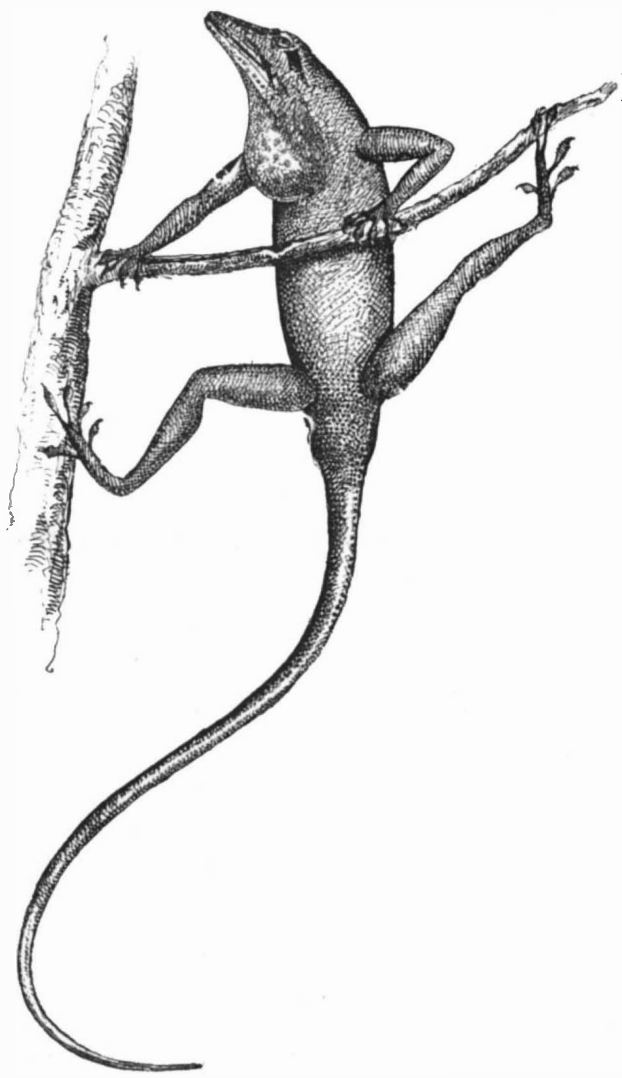
The new electrical inventions and improvements developed since the last show, and the interest and cooperation of many manufacturers already assured, will count for much toward making this a more complete demonstration of all the applications of electricity and its branches than was possible in the first exhibition in 1896.

THE COLOR CHANGES IN LIZARDS.

BY C. F. HOLDER, PASADENA, CAL.

The chameleon of eastern countries has attained a world-wide reputation for its wonderful faculty of changing color. In America we have a lizard, shown in the accompanying illustration, which is, if not so remarkable, one of the most interesting of this group of animals. Anolis principalis is best and most familiarly known in Florida and some of the Southern States, where it darts about among the vines and other vegetation, mimicking the dark green verdure and presenting a really wonderful illustration of this singular phase of nature.

At one time I possessed several specimens of the anolis, and endeavored, with poor success, to introduce these little animals into Southern California, hoping that they would adapt themselves to the conditions which prevail here, but my lizards simply became pets and apparently preferred the house, where they were provided with flies and other delicacies. These little creatures were about five inches in length, of a general dark green hue shading to gray, assimilating the various objects upon which they rested slowly but



AMERICAN CHAMELEON (ANOLIS PRINCIPALIS).

very decidedly. I arranged several little corrals, one with a white base, another with a gray, another with a green, and changed the occupants about. In ten or fifteen minutes they very materially would adapt themselves to the new tint, though they never became white, the change then being merely a fading out of all lines, leaving the body a faint gray. At night they became a beautiful green, which may be considered their normal color. The changes made in confinement I am confident were not so rapid as those when the lizards were in their native Florida, where moisture and hot days and nights gave them the exact temperature necessary for their best display.

There is something mysterious and even uncanny in watching the change of color. When placed upon a green twig the little creature would immediately draw itself out, extend its front and hind legs at full length and become to all intents a part of the twig or branch, so that it was difficult to distinguish it. Meanwhile the mysterious blush of green was deepening and stealing over its back and sides, making the resemblance still more striking. The natural assumption of one who had given the subject no especial attention might be that the anolis had glanced around, and perceiving that it was presenting a contrast not favorable to its personal safety, had assumed a color more protective. In other words, that there was some intelligent act associated with the change. When the little creature was blindfolded it assumed the same tint as at night, and did not change when placed upon the most striking colors, showing that the eye was the involuntary medium by which the different tints were obtained. The act of adaptation is perfectly involuntary, or made without the knowledge of the animal, being the effect which certain colors have upon the pigment cells of the animal. At least this is the generally accepted explanation, and the experiments which have been made with blind animals seem to show beyond question that the eye is the medium.

These peculiar changes, which are so well known in fishes and reptiles, can be understood by glancing at the pigment cells of a frog. The skin is seen to consist of two portions, the cutis and epidermis, the latter apparently being made up of cells. The cutis has large cavities among the nerves, which are commonly filled with pigment and are very sensitive, contracting and expanding in a remakable way. The pigment cells are called chromatophores, and vary in color in different animals and in the parts of each animal, and may be red, brown, green, yellow, black or various shades. The color of the chromatophores appears to change during contraction or expansion and constitutes a most complicated and delicate study. Thus, in a little fish (Gobius Ruthensparri), Heincke, the German naturalist, while watching its yellow pigment cells, saw them gradually expand and become black.

These cells are distributed all over the body with more or less regularity, and upon their contraction and expansion depends the prevailing color of the animal. Thus, if the pigment cells or chromatophores expand, the prevailing color will become black and the very light spots in the animal dull. On the other hand, if they contract, a reverse effect obtains. Exactly how these wonderful changes in all animals which adapt themselves to their environment are produced is not known, but it is assumed that certain colors through the medium of the optic nerve produce contraction or expansion, and the result is a protective tint or one which assimilates that upon which the animal is resting. The eye receives the stimulus or impression, which passes from the optic nerve to the sympathetic nerve, so reaching the various series of chromatophores. Thus, when a flounder is taken from the sandy bottom and placed on a black bottom, it at once grows darker ; in other words, the color of the bottom has in the manner described caused a relaxation of the chromatophores, and the brown and orange colored ones have turned black or dark, thus aiding in the protection of the animal—a protection at once remarkable and interesting. Among the flounders this is very marked. In the octopus I have produced almost instant changes, waves of color being seen to pass over the animal. This is especially noticeable in the little squid cranchia, while the larger squids are marvelous illustrations of this faculty. The dolphin, so common in the Atlantic, is well known for its wonderful changes, not necessarily protective.

The little Florida anolis is easily domesticated, and two specimens kept by me became interesting pets, crawling about without the slightest fear ; seeking the snug shelter of the binding of a book in cool weather, coming out to bask in the hot sunshine, showing themselves to be perfect thermometers.

It is doubtful if the anolis would thrive in Southern California as the nights are often very cool. All through the winter here all the reptiles enter what is known as a winter sleep or partial hibernation. At half past four, or as soon as the direct rays of the sun begin to be missed, the lizards leave the rock heaps where they have been sunning themselves, and crawl into the crevices and into holes in the ground, stretch out their limbs to the rear, stiffen, and enter what is apparently complete hibernation ; but, as the sun rises the following day, they are warmed into life again and renew all their activity.

Automatic Coupler Law.

The Chicago and Alton Railroad and other roads recently filed petitions with the Interstate Commerce Commission asking for extension of time within which their cars, under the act of March 2, 1893, are required to be equipped with the automatic couplers and power or train brakes, the time fixed by the act being January 1, 1898. The commission has made an order fixing the hearing of such petitions for Wednesday, December 1.

The commission has also ordered that any railroad filing application for extension shall also make, on or before November 20, 1897, a statement under oath of the number of freight cars owned and the number of freight cars which will be equipped with automatic couplers and the number which will be equipped with power or train brakes by December 1, 1897, and the number of freight cars which have been equipped with automatic couplers and the number which have been equipped with power or train brakes each calendar year since the act went into effect.

Airship Crosses to France.

Cablegrams from France state that the balloon of Charles Pollock, who started from Eastbourne, England, October 12, across the Channel, descended safely near Domart, fourteen miles northwest of Amiens.

The Effect of Great Cold on Animalcules, Worms, Insects and Other Animals.

BY JAMES WEIR, JR., M.D.

That certain animalcules, worms, insects and other animals can and do experience no appreciable harm when subjected to extremely low degrees of temperature, the following experiments and observations would, unquestionably, indicate.

Until, comparatively speaking, a few years ago, freezing was considered to be absolutely fatal to all forms of animal and vegetable life. So universal was this belief that contaminated and filthy water was thought, by both scientist and layman, to be rendered potable after it had been subjected to great cold. Some ten or fifteen years ago, however, several severe epidemics of typhoid fever were traced directly to the use of ice which had been taken from ponds into which there flowed surface drainage. This observation occasioned an entirely new opinion to be formed.

In 1889, I subjected various cultivations of the specific germs of tuberculosis, typhoid fever, cholera and anthrax, by artificial means, to degrees of temperature far below any degree of cold that ever occurs naturally. These colonies were in bouillon, agar agar, and other culture media and were, therefore, easily studied. When the media containing germ colonies were gradually thawed out and then submitted to microscopic examination, no appreciable change in the various microbes was to be observed. When minute portions of these colonies were transferred to fresh culture media, the germs immediately began to increase and multiply, thus showing that they had not been killed or even injured by the intense cold to which they had been subjected. It is claimed that the germs of yellow fever and kindred diseases are destroyed by cold. If this is true (and I have no reason to think that it is not), this fact goes far toward demonstrating the truthfulness of a proposition which I have long advocated, namely, that there are two kinds of microbes—the animal and the vegetable. It has long been known that intense cold is fatal to many organisms known to be vegetable, while, on the other hand, none of the microscopic animalcules are killed by the process of freezing alone.

Infusorians appear to be uninjured by great cold, even when it lasts for weeks at a time. An experiment, and one easily performed, will demonstrate to any one the truthfulness of this assertion.

Let the observer satisfy himself that the pond or ditch from which he wishes to take the ice necessary for this experiment contains the infusorian, say the "slipper animalcule" (Paramœcium); this he can do in October or November. Then, in the depths of winter, when the ice is thick on the ditch, after a hard and long-continued freeze, let him take a small piece of the ice (a portion containing confervoid growths will be necessary, as this particular infusorian seeks shelter thereon), gradually thaw it out, and then place a drop of the water or a bit of conferva beneath the object glass of his microscope. He will soon discover paramœcia full of life, and absolutely unaffected by their sojourn in their ice envelope.

Vorticellæ or "bell animalcules," so called from their bell-like shape, draw in their cilia and shrink upon or coil their stalks just before the water becomes congealed. This interesting performance can easily be observed if a colony of these animalcules is watched on the stage of a microscope. This observation, to be successful, must be carried out in a room whose temperature is about 18° F. A fragment of duckweed, alga, or any pond weed known to be inhabited by vorticellæ should be placed in a drop of water beneath the object glass. The stage and glass slide will rapidly become cold. Finally, the drop of water will freeze, but, just before congelation takes place, the vorticellæ will draw in their cilia, coil their stalks and sink to rest on the weed. If the slide be carried into a warm room and the drop gradually melted, the little creatures will soon begin to erect themselves on their stalks and to move their cilia in the act of feeding. A certain rhythmical pulsing of the umbrella (nectocalyx) of a medusa or jelly fish can be noticed as the creature swims in the water. This pulsing varies in frequency according to circumstances. When medusæ are placed in water whose temperature is being gradually lowered, at first this rhythmical motion will be accelerated. I have seen the nectocalyx under such circumstances pulsate so rapidly that its movements could hardly be counted. Gradually, however, as the water neared the freezing point, this pulsing would become slower and slower and finally cease. This inactivity would disappear, however, as soon as the temperature of the water became higher. Semper asserts that long-continued freezing is fatal to all infusory animalcules. Now this statement is misleading and indefinite, from the fact that he does not fix a time limit. I am certain that several days' freezing is not fatal to the infusorians which I had under observation. I have also found live infusorians in the sediment of ice water, the ice from which it was derived having been harvested several months previous to the time of examination. These forms were not adventitious, but were true fresh water infusorians (Paramœcium). The contractile vesicle (the infusory heart) of this little animal gradually slows its "pulse" as the temperature is lowered, and finally ceases all motion. Yet the creature is not dead, for, if judiciously thawed out, it will resume all of its functions. Rhizopods, rotifers and other animalcules likewise stand freezing with perfect impunity. In fact, all cold-blooded water animals appear to be indifferent to the lethal effects of extreme cold.

Last winter, while carrying on these investigations, I observed a very curious thing. I was examining a giant water beetle which was frozen in a lump of ice. I noticed, just below the head of this insect, an uncongealed drop of water; in this clear drop, not unlike kindred drops sometimes found in quartz crystals, I observed a little animal swimming freely about. I could not make out its genus through the intervening ice; so fractured the lump in order to obtain the animalcule. Unfortunately, it was lost and I cannot describe it. Had this creature an inherent quality which kept the water in its immediate vicinity in a fluid state, thus affording it safe domicile during winter, or was the drop due to some law of crystallization? The little mite seemed to be perfectly at home, no matter what gave rise to its miniature lake.

Some of the higher water animals, such as fishes and frogs, can endure great cold without harm. Not long since, I saw a carp (C. carpio) in the very center of a cube of ice. This fish resumed all the functions of life as soon as the ice melted and set it free. It is claimed by explorers that the waters of the North Polar seas are remarkably destitute of the lowest forms of life; indeed, of all forms. Yet that they are absolutely without life has not been shown, for even in the ice cold waters of the extreme North Arctic Ocean microscopic animalcules, to a limited extent, defy the benumbing and otherwise fatal touch of the Frost King!

Turbellarians, nematoids or thread worms undergo freezing without appreciable harm. Little worms will frequently be found in ice taken from ponds, lakes, etc. This has given rise to the idea that ice "breeds worms." These little creatures are simply nematoids which have become frozen in the ice and which have been liberated by liquefaction.

The common earth worm (L. terrestris) may be frozen stiff without experiencing any harm whatever. Several earth worms were taken by me from a vermicularium and placed in a jar containing earth. This was done early in autumn, so that the creatures might become accustomed to their surroundings by the time winter set in. Every now and then decaying vegetable substances, such as leaves, rotten wood, etc., were sprinkled over the surface of the earth in the jar; water was also occasionally sprayed in. Thus, the worms had an abundance of food and water. The jar was set out in the open air, though a roof of boards was placed above it to keep off the snow and rain. It was subjected to all the cold of a severe winter. On one occasion the thermometer registered —10° F. in the center of the jar for ten or twelve hours. As soon as the milder weather of spring set in, the worms began to move about, some of them laying eggs, thus showing that they had not been hurt by a temperature many degrees below freezing point. Again, several worms were taken from a vermicularium and surrounded by an envelope of dampened earth an inch in thickness; they were then exposed to a temperature of —10° F. for ten hours. When examined, they were found to be almost rigid; indeed, some were quite so, breaking in the fingers when they were bent. Yet these worms (that is, the unbroken ones), when gradually thawed out, showed no sign of injury.

Last autumn I saw a bumblebee take up her winter quarters beneath the bark of a locust tree. The fragment of bark under which she crept was slightly resilient, so that she was partly supported in her place by its elasticity. She was fully exposed on all sides, save her shoulders and part of her back, to the air; the piece of bark made a very efficient roof which kept off the snow and rain. During a cold wave, when the thermometer registered —6° F., I lifted the bark and removed the insect with forceps. I would not touch her with my fingers. I was afraid that their warmth might produce local temperature changes on her body, thereby inciting frost bite. She was, to all appearances, frozen through and through. Here was this insect (covered only with her own velvet robe), surrounded by an atmosphere whose temperature was a half dozen degrees below zero. The very tree on which she rested was being riven and split asunder by the intense cold. Was she alive, or did I hold in my forceps only a frozen, inanimate lump of gauzy wings, legs, body, intestines, etc.? This question was answered later on; in fact, on the fourth day of April, when she awoke from her long winter sleep and resumed her place in the economy of animated nature. I happened to be near when she awoke and came out on the bark. She carefully smoothed down her velvety body covering of black and yellow and essayed a short flight. She then flew to a pot of water and drank a long, deep draught. Finally, she flew about the lawn as if in search of something. And so she was. She was looking for a suitable spot in which to establish a nest. This she eventually selected near a rose bush and soon disappeared beneath the turf.

The common toad (B. lentiginosus), at the approach of winter, burrows an inch or two into the ground and, surrounded by the roots of grasses, weeds, or herbs, goes into its winter sleep. Last November I saw one take shelter beneath a tussock of couch grass (T. repens), boring its way beneath and between the tough roots by a rooting motion of its head. Its fore legs or "arms" and its fingerlike claws were also used to great advantage, as well as its muscular hind legs in excavating and shaping its winter "dugout." At one time during the winter the soil was frozen solid to the depth of four inches. During this cold spell, I carefully dug up the tussock of grass and, upon examination, found the toad stiff and, seemingly, frozen through and through. I replaced both grass and toad, packing the frozen earth about the roots as well as I could under the circumstances. On the 18th of March I again dug up the toad. It was, to a certain extent, torpid, but, otherwise, was entirely uninjured by the great cold through which it had passed.

A friend, on one occasion, was blasting out stumps on his plantation, when a large mass or ball of snakes of various kinds was unearthed and exposed to view, all of which, seemingly, were without life. It was very cold, in fact, some 8° or 10° below zero. This gentleman placed a thermometer in the center of the ball of snakes and found that it registered 5° below zero. He carried home a large black snake (Bascanion constrictor) and a small copperhead (Ancistrodon contortrix). The snakes were gradually warmed and soon gave such unmistakable evidence of returning animation that they were summarily dealt with. Now, an interesting question intervenes. These two species are, generally, very bitter enemies. Do they lay aside personal animosity at the approach of winter and seek one another for mutual protection, or do their natures change at or about the time of the inception of hibernation?

We have seen that animals may be frozen through and through and yet suffer no harm. Where, then, dwells the vital principle in these creatures—in what organ or organs? Reduced to a frozen mass, they yet hold within themselves the elements of life which only need the awakening touch of heat to be set in operation. Of what character is that mainspring, which, although, for the time being, completely locked as it is in the hard grasp of the Ice King, is, nevertheless, through the influence of warmth, set free, and at once resumes its power and puts in motion the phenomena of life?

When we come to examine the higher animals, we find that some of them are able to endure very great cold. In fact, it has been demonstrated that the internal temperature of some of these animals, during winter, approximates that of the external atmosphere. In the case of the zizel (Spermophilus citillus) Horvarth declares that he detected a temperature of 2° C. Says Semper: "The zizel, when lying in its winter sleep, always has the same, or nearly the same, degree of warmth as the surrounding air. In one case the temperature was 2° above zero, and a thermometer showed that its internal temperature was exactly the same; in another experiment the animal was sleeping in a room, at about 9° to 10°, for several days, and its internal temperature was 8·4°." Thus it will be seen that in this animal we have the wonderful phenomenon of a warm-blooded creature changing to a cold-blooded creature in winter, "since its temperature corresponds with that of the surrounding atmosphere." Most of the warm-blooded hibernating animals, however, keep up their internal heat by the oxidation of their fat; thus, the bear, the opossum and the raccoon, which on entering the winter sleep are remarkably fat, but which, when they awake in the spring, are thin and lean. Some rodents, however, show comparatively speaking very low temperatures; for instance, the ground hog, in which, on several occasions, I have detected a temperature as low as 60° F.

A Trolley Ride One Hundred and Twenty-four Miles Long.

The network of trolleys with which New England is now covered makes it possible for any one to ride for 124 miles on trolley roads. This is probably the longest trolley line in the world. Of course the trip would have to be made in a number of cars. From the residence of Mr. Henry H. Rogers, vice president of the Standard Oil Company, at Fort Phœnix, in Fairhaven, to Nashua, New Hampshire, the route is as follows: New Bedford, Fall River, Taunton, Bridgewater, Brockton, Braintree, Quincy, Boston, Malden, Melrose, Wakefield, Reading, Wilmington, Billerica, Lowell and Dracus, to Nashua.

PENMARCH lighthouse, on the Brittany coast, with its 10,000,000 candle power electric light, 180 feet above sea level and visible sixty miles away, is a monument to Marshal Davoust, Duke of Auerstadt, his daughter having given the French government $60,000 for the purpose.

RECENTLY PATENTED INVENTIONS.

Engineering.

POWER DEVICE FOR PUMPING WELLS.—Joseph J. Kwis, Findlay, Ohio. According to the novel construction provided by this invention, a practically direct connection can be made between the engine or other motor used and the mechanism employed for operating the surface rods in oil pumping machinery, the motion being so communicated through the driving wheel as to prevent any twisting strain whatever on the shafts. The device is compact, durable and inexpensive, and may, if necessary, be secured to a single timber, dispensing with a built-up foundation.

Mechanical.

PIPE WRENCH.—Edward B. Charlet, Kewanee, Ill. The stock of this wrench has a slightly curved, toothed forward end, and in an opening in the rear of the curved toothed portion is pivoted a hook-shaped jaw, having teeth to operate in conjunction with teeth on the stock. In a notch in the stock is held the rear end of a spring whose forward end bears against the back of the hook-shaped jaw, to throw it into engagement with a pipe or other article to be gripped, a sleeve holding the spring in position, and the tension of the spring being increased by slipping the sleeve forward.

Agricultural.

CULTIVATOR.—George McDougall, Cedar Junction, Kansas. For the cultivation especially of listed corn, this cultivator is made with parallel runners connected by arches, above which is the driver's seat, the rear end of each runner being inclined inwardly and carrying upon a spindle a cultivator disk. By means of levers which extend up within convenient reach of the driver the cultivator disks may be brought to any desired angle to the row of corn under cultivation, and locked in such position, causing the dirt to be heaped up to a greater or less extent around the roots. Arms extend outwardly from the runners to smooth the ridges between rows.

DISK PULVERIZER. — David Harper, Scott County (Post Office, Neelyville, Morgan County), Ill. Upon a pair of axles supporting a main frame, according to this invention, is mounted a front and a rear series of rotating disks or pulverizers, the series on each axle being adapted to be moved to an adjusted position in unison, and the series on one axle being held for movement independently of the series on the opposing axle, by means of operating levers which extend up through the platform in convenient reach of the driver. All of the disks on the rear shaft may, if desired, be set crosswise to the right or left, and held to such position by pawl and rack devices on the lever, the cultivator being designed to leave the ground in proper condition for the harrow after the first cut.

Miscellaneous.

MECHANICAL CALCULATOR. — Robert Duncan, Knoxville, Tenn. This is a device more especially designed to facilitate computing the charge to be made for a guest at a hotel, without mental figuring, and it may also be used for ascertaining amounts due workmen, or, with slight changes, for computing interest, etc. It comprises a casing in which are mounted a calendar and cost price disk and a rotary rate disk. Four separate divisions of the day are noted for computing the cost from the time of entry to the departure of a guest, the clerk then simply moving the disks to correspond thereto, and finding in a properly marked division the total sum due, indicating the amount of the bill.

TALLY SHEET. — Herbert L. Baker, White Castle, La. For books having tally sheets used by lumbermen this invention provides an improved sheet arranged to permit of readily writing the tally marks in the proper spaces, and to indicate at a glance the total number of feet in any number of pieces of lumber. The sheet has a head line of figures to show the number of pieces tallied on each line, a column of figures to show the amount of each piece tallied, and spaces for receiving the tally marks, whereby the lumberman can conveniently keep tally on the sheet at the proper place and at the same time instantly read the total amount in feet.

SECTION LINER FOR PARALLEL RULES.—John C. Richardson, Middlesborough, Ky. An attachment enabling the user of a parallel ruler to conveniently and rapidly draw with the ruler sectional lines equally spaced apart forms the subject of a patent issued to this inventor. An arm slidably and adjustably held on one member of the ruler has its other end projecting over the other member, the projecting end being provided with a foot adapted to engage a stop pin on the member over which the free end of the arm projects.

MUSICAL INSTRUMENT. — Benjamin McLaughlin, Boston, Mass. This invention is for an improvement in instruments of the banjo, guitar, mandolin and violin type, whereby may be obtained a tone of greater volume and purer quality, while also affording convenient means for raising and lowering the pitch of the instrument after the strings have been tuned. It consists principally in the employment of a resonator, located in the body of the instrument, its upper surface being adapted to engage the bridge, and it being engaged by an adjusting screw, whereby the resonator may be moved to and from the bridge to increase or decrease the resonant qualities of the instrument, and raise or lower the key or pitch, without necessitating the manipulation of the keys. The invention also provides a novel arrangement of the bridge.

FRAMING FOR FURNITURE.—John C. Horn, Chicago, Ill. In the construction of such articles as desks, bureaus, chiffoniers, etc., this invention provides for their framing by means of corner posts having dovetail slots, longitudinal bars and locking bars having tenons on their ends, etc., in such manner that the furniture may be put together without using glued joints for holding the parts, and so that it may be shipped in knock-down form without liability to marring the finish, and readily put together without any special skill. The construction is such that all the work of preparing the parts may be done by machinery, thus making such furniture comparatively inexpensive, while it is of less weight than ordinary furniture.

KNIFE GUARD.—Frank W. Waite and William D. Broadwell, Petersburg, Va. This is a device adapted to be applied on the cutting edge of a knife and held there by spring tongues, to limit the depth of cut, thus adapting a portion of the blade to the especial purpose of removing the rind or skin from fruits or vegetables and absolutely preventing this portion of the blade from cutting into the article being prepared, although leaving the greater portion of the blade available for slicing, cutting, etc. The device is simple and inexpensive and readily applied or removed from the blade.

CURRYCOMB AND BRUSH.—Martin V. B. Griffey, Moscow, Ky. This is a combination implement adapted to be used separately or together, the brush being hinged to the comb and adapted to be folded back thereon with its back toward the back of the comb, or to be turned down to have the same face with the comb, there being means for fastening the brush in either of these positions. It is evident that when the comb and brush are fastened in line with one another the horse is both combed and brushed by each single stroke. Springs connect the currycomb with the handle frame, and its teeth thus become somewhat yielding, as are the bristles of the brush.

CARRIAGE CALL.—John A. Kunkel, New York City. The noise and confusion usually attendant upon the calling of carriages when theaters are out or the opera is over, or after a numerously attended reception, often amount to a very serious annoyance, and to obviate this difficulty is the object of this invention. In a casing with guideways are placed multiple series of transparent plates, each carrying a numeral, and means are provided whereby, on simply pulling a cord, the attendant may elevate any desired numeral designation so that it may be seen by everyone in the vicinity, the range of the device covering any designation from 1 to 999, and thus taking in the number of any carriage it may be desired to call.

BALE BAND TIGHTENER. — John L. Duval, Houston, Texas. To permit the operator to conveniently place the bands in position and fasten the ends together after the bale is pressed, this invention provides for the use of platens, each having grooves or recesses for the bands, while spring-pressed bars extend between the grooves or recesses and beyond the face of the platen, serving as guides for the bands and a support for the bale before it is compressed, the bars receding into recesses in the platen when pressure is brought to bear on the latter.

NON-REFILLABLE BOTTLE. Louis J. A. Fernandes, New York City. This bottle is made entirely of glass, and has a valve, so arranged that the contents of the bottle may be poured out, but the bottle cannot be again refilled for use as an original package. Within the neck is a valve cage, and an upper extension of the neck, in which the cork is placed, is fitted on and held in position by a suitable cement, after the bottle is filled. A spring presses the valve to closed position when the bottle is held upright or in horizontal position, but, when the bottle is tipped farther over, the spring yields to allow the valve to open and the liquid to flow out.

DISTILLING APPARATUS.—Jose Gallegos, Antigua, Guatemala. This invention provides means whereby the pressure within the apparatus will be kept practically constant, by connection with an expansion chamber whose capacity is regulated by a counterweight, thus preventing any excessive pressure that might burst the apparatus. Any loss of vapors of the substance under distillation is also most effectively provided against.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co. for 10 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS, ETC.

ELECTRIC SMELTING AND REFINING. By Dr. W. Borchers and Walter G. McMillan. Philadelphia: J. B. Lippincott Company. Pp. 415. Price $6 50.

The "Elektro-Metallurgie" of Dr. Borchers has been for quite a period a leading authority upon the subject with German engineers, and this volume is a new edition of this work, translated and with additions by Mr. McMillan, lecturer on metallurgy in Mason College, Birmingham. The author has had twelve years' practical work in chemical and metallurgical industries, and treats of all those metals in whose extraction and working the electric current has found any application, excluding, however, electrolytic analysis and electroplating. To each chapter is also added a short survey of the purely metallurgical methods of treating the metals, so that the reader may compare such processes with the electrometallurgical processes. All of the descriptions are brought down to include the most recent developments in the art, enough being stated under each of the various metals, separately, to give a good general idea of the present industrial position of that branch of the subject.

MODES OF MOTION; OR, MECHANICAL CONCEPTIONS OF PHYSICAL PHENOMENA. By A. E. Dolbear. Boston. Pp. 119. Price 75 cents.

The professor of physics at Tufts College endeavors, in this little volume, to make it clear how one kind of energy is converted into another kind, and the conditions needed for transforming it. Electrical and magnetic phenomena are presented as depending upon simple mechanical conditions, and a chapter is given to luminous ether.

Business and Personal.

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

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7221) W. A. P. asks: 1. What is water hammer and its causes? A. Water hammer in pipes is caused by the surging of the water in partially filled steam or water pipes. In steam or return pipes in heating apparatus air or steam may be lodged in places along horizontal pipes, separating portions of water, which, by the natural condition of moving water, produces wave motion and impact upon the inner surface of the pipe. In water pipes the presence of air in horizontal pipes produces the same action as in heating pipes. The absence of air in the water pipes of a house near the bibbs causes water ram by the sudden closing of a bibb, due to the arrest of the momentum in the long column of water in motion. The air chambers in plumbing work act as a cushion. 2. How can the true water level in a boiler be told when it is foaming, and what is the best thing to do when you find that the boiler is foaming? A. The water level may be judged from the mean of the water surge in the water gage. If gage cocks only are used, the approximate water level may be judged from the manner of opening the gage cocks. By slightly opening the gage cocks one after the other, you may obtain clear steam from the upper gage, a drizzle of water and steam from the middle gage and more solid water from the lower gage, when the mean height is between the middle and lower gage, with variations suitable to high or low water. A boiler may foam from excessive use of steam or from foul water, want of cleaning, etc. An engineer should always be able to judge whether the boiler is too small for its work or whether dirty water and want of cleaning is the cause of foaming.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

OCTOBER 12, 1897,

AND EACH BEARING THAT DATE.

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

Acids and making same, compound of gamma-oxypiperidin-carbo, G. Merling ... 591,483
Adjustable wrench, E. P. Drew ... 591,743
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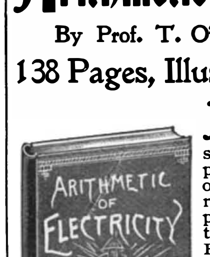

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