SCIENTIFIC AMERICAN

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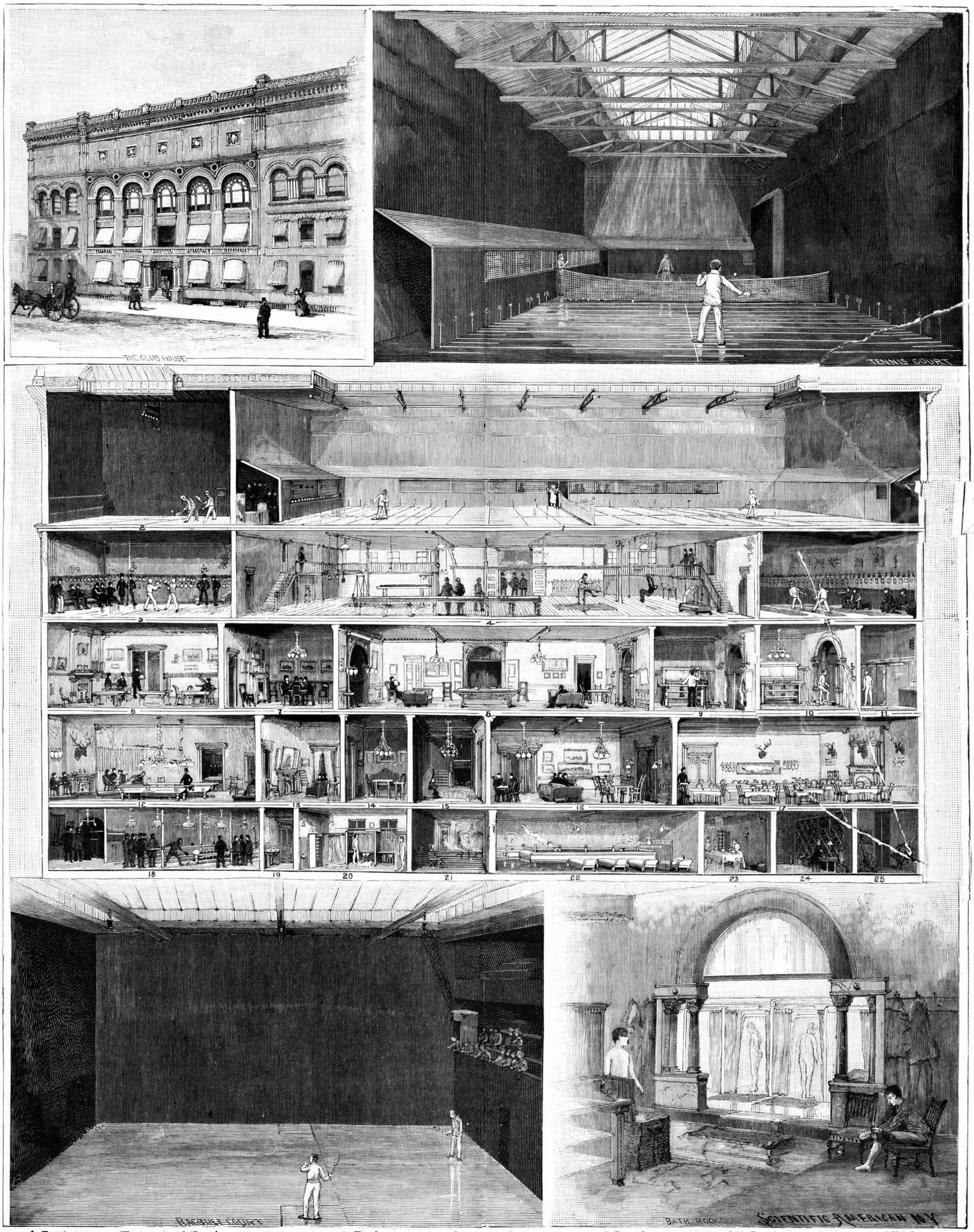

1. Tennis court. 2. Fives court. 3. Sparring room. 4. Gymnasium. 5. Fencing room. 6. Card room. 7. Ba kgammon room. 8. Lounging room. 9, 10, and 11. Dressing and bath rooms. 12. Billiard room. 13 and 14. Reading rooms. 15. Hall. 16. Sitting room. 17. Dining room. 18. Bowling alleys and shooting galleries. 19. Hall. 20, 21, 22. Turkish, Roman, and plunge baths. 23, 24, and 25. Store rooms, etc.

THE NEW YORK TENNIS AND RACQUET CLUB.—[See page 232.]

Scientific American.

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NEW YORK, SATURDAY, APRIL 15, 1893.

Contents.

(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 902.

For the Week Ending April 15, 1893.

Price 10 cents. For sale by all newsdealers.

ELECTRICITY AT THE GREAT EXPOSITION.

The extent to which electricity has been put into use for all purposes will be fully demonstrated at the World's Columbian Exposition. It should not by any means discourage inventors from further investigation in this direction. Instead, it should stimulate such investigation. The commercial and business world does not fully trust electric inventions, but is rapidly getting to do so, because of the rapid improvement of late in the quality and effciency of such apparatus.

Especially will it illustrate the latest practice in the utilization of electricity for lighting and power purposes.

In studying the many exhibits it is not probable that the average inventor, however keen his perceptions may be, can make radical improvements in the present method of producing electric light or power, and from a financial standpoint it is just as well that this is so, for the most money is almost invariably made by minor devices that are economic short cuts, so to speak, to accomplish a desired end. The department of electricity has probably been given more rein than any other department in the Exposition, on the basis that anything electrical should go in the Electricity building. Because of this apparent favoritism, classifications of exhibits in other buildings have not been observed, and while this breaking up of classifications has a demoralizing effect on the arrangement of exhibits, it has a redeeming feature in the fact that it concentrates all the applications of electricity in one place. An inventor who has in mind a certain principle which he wishes to demonstrate, and which he is endeavoring to study out, will thus have every advantage offered him in this building for observing the applications of electric energy, as demonstrated and as possible of demonstration, and he can readily tell whether this energy will be of service to him in perfecting his invention.

THE NAME OF ROBERT FULTON FOR A WAR STEAMER.

We elsewhere illustrate and describe a famous war ship, the Fulton the First, built in 1814. With her sides impenetrable by the artillery of those days, with her machinery and boilers in great part below the water line, and her paddle wheel in her center, she was in those days an almost invincible craft. It is on record that she excited the apprehensions of the British government, the most extraordinary qualities of destructiveness being attributed to her. As it happened, she never had a chance to figure in war, the treaty of Ghent and its results being communicated about the time of her completion.

She appears as the first steam man-of-war ever built. She is really the cornerstone of the navy of to-day, and in her Fulton may be said to hold an undisputed priority. It seems fitting that this country should in some way acknowledge his work. In the English navy, the names of ships are hereditary. After one ship has passed out of service, a second one, naturally of improved construction, will be built, and to her will be awarded the name of her predecessor. In this way, one after the other, a long and honorable lineage under the identical name may be established. After the destruction of the Fulton the First our navy made a second essay in the construction of a war steamer, and in 1837 and 1838 a ship was built, propelled by steam and fitted with sails, which was termed the Fulton the Second. She was provided with protective wooden bulwarks, beveled as far as possible to cause the enemy's shot to glance off. Although she made a trip to the West Indies and back, she was not designed nor suited for use in ocean work. The well known Charles H. Haswell was her chief engineer. Subsequently in 1851 this ship was rebuilt and was termed the Fulton the Third.

In our present steam navy Robert Fulton should receive due commemoration as its founder. His name should be given to our most advanced ship, and it should be understood that hereafter, as such ship would pass out of service or would fall from the first rank, the name should pass to the best ship in the navy.

THE NEW U. S. ARMY MAGAZINE RIFLE.

In December last we described the gun decided upon by a board of army officers, after unusually prolonged and severe tests, as the future service piece of the United States army. The gun selected is known as the Krag-Jorgensen, of Danish origin, but considerably changed to meet the trying tests that were made, and, by order of the department, work was commenced in November last, at the gun shop of the Springfield armory, to alter the old machinery and get ready new machinery necessary for the production of the new gun in large quantities. There was, however, such general disappointment at the selection of a gun of foreign pattern that Congress decided to grant another opportunity for competitive trials. The board of officers on magazine arms, by whom the examinations are made, consists of: Col. E. S. Otis, Lieut.-Col R. H. Hall, and Major H. B. Freeman, of the infantry; Lieut.-Col. J. P. Farley and Capt. S. E. Blunt, recorder, of the ordnance department; and Capt. G. S. Anderson, of the cavalry. The board is the same as in the former trials, except that Col. Otis, its president, has been added to it. The new series of tests has been going on since March 30, at the Springfield armory.

Among the guns entered for trial were the Spencer-Lee of 0·45 caliber, peculiar in that respect, and originally offered for test many years ago; the well-known Lee gun, adopted in foreign countries, but now offering a new 1893 model, 0·30 caliber, with a direct forward and backward bolt action; the Savage gun, 0·30 caliber, improved from last year; the Blake, 0·30 caliber, also improved from last year; four Durst rifles, two of the 0·30 and the others of 0·303 caliber, modified from last year; the Gillette, 0·30 caliber, presented by Lieut. Cassius E. Gillette, of the engineers, and containing parts of the Springfield rifle; the White, invented by Lieut. H. K. White, of the Marine Corps, which was slightly injured in a trial on April 1 and withdrawn for repairs; the Brooks, of Portland, Me.; two Russel-Livermore guns of 0·303 caliber, presented by Major W. R. Livermore, of the engineers, and a new 0·30 caliber Livermore gun, with his latest improvements; the Acton, from Aurora, Ill., and the Hampden, of Springfield.

In the trial of the improved Lee gun, on April 6, about 800 rounds were fired, the gun being improved over the gun of this inventor, which was tested by the board last year, and was then very successful upon all points except the dust test. The gun has a 10-shot clip, which can be used as rapidly as its old 5-clip, and the weight of the gun with the magazine loaded is less than nine pounds.

The Lee magazine gun has been for several years in use in the United States naval service, and was highly recommended by the United States Army Board in 1882. Its inventor is a Scotchman, for several years resident here, and there are many modifications of the Lee gun, including the Spencer-Lee, the Remington-Lee and the Lee-Speed, the recently adopted arm of the English army.

The Hampden gun, which made a splendid record before the board last year, has been materially improved, and much is expected of it in the present series of trials. This gun was shown in the SCIENTIFIC AMERICAN of December 29. It is the invention of Mr. T. B. Wilson, formerly a mechanic in the government shops at Springfield, and a member of the team of American marksmen who went abroad four years ago.

The short time which inventors have had to perfect their pieces and get ready an arm adapted to meet the severe tests prescribed by the board will operate to the disadvantage of competitors. Such arms as the government has called for cannot be studied out and constructed in a day. The reports must be in by July 1. Whatever may be the decision of the board, the activity of inventors in this special department has been stimulated by the competition, and any distinctively American arm which can be perfected within a short period and shown to have advantages over the arm selected will have a good chance for final adopton.

A Remarkable Meteor.

E. S. Martin, writing to *Astronomy*, says: December 9, 1892, about 9 o'clock P. M., a remarkable and magnificent meteor shot out from the constellation Andromeda and moved slowly and majestically toward the northeastern point of the horizon. When first seen here, it was about the size and color of an orange, but rapidly increased in brilliancy and size until, before it disappeared below the horizon, it was of the apparent size of the full moon and was surrounded by a mass of glowing vapor, which further increased its size to that of the head of a flour barrel. It soon became intensely brilliant, flashing at times a greenish blue light, throwing off sparks "fast and furiously," and left behind it a dense stream of vapor, 30° to 40° in length.

A gentleman who was at Jacksonville, N. C. (about 50 miles N. E. from Wilmington), and saw it gave me the same description of the meteor in every particular. To-day, I learned that the same meteor was observed at Washington, N. C. (about 125 miles N. by E. from this city). The writer says: "We saw the meteor which passed over, going in a northeastwardly direction. It did not seem to be very high and was going at a rapid rate. It was about the size of a man's head with a tail of some length, and small pieces were flying off and it was a beautiful sight."

It must have passed to sea about the neighborhood of Norfolk, Va., and probably fell into the ocean.

WE are indebted to Major David P. Heap, Corps of Engineers, U.S.A., for a copy of the "Annual Report of the Lighthouse Board" for the year 1892. There are almost one thousand lighthouses and beacon lights and thirty-two lightships. Over three thousand persons are employed to operate and maintain the various works and appliances used as aids to navigation. The total expenditures are about $2,500,000 per annum. Electrical lights are now being introduced in some places.

The question of insurance at the World's Columbian Exposition is one of great importance and magnitude and there is a rush for policies now. The Exposition management has carried insurance from the time that building operations were begun, and this insurance has been increased from time to time, as the work of construction has progressed. The rates have been the regular ones, varying from 75 cents on the Art Gallery and $1.25 on the contents of this building to $4 on the Dairy and Forestry buildings. The amount of insurance carried by the Exposition on buildings is over $5,000,000, and it is not probable that this amount will be increased much, if any. Outside of this insurance the Exposition will probably carry $1,000,000 or more on special exhibits that have been loaned with the distinct understanding that the Exposition be responsible for their safe keeping and return.

Every precaution possible to prevent fire has been taken. Most of the work in laying out the grounds, constructing the buildings, arranging the electric wiring, planning the power plant, etc., has been done in accordance with suggestions and recommendations made by the insurance underwriters. In a few instances the recommendations of the insurance companies have not been acted upon, such, for instance, as having each building at least one hundred and twenty five feet distant from any other building. In general, however, the wishes of the insurance companies have been recognized. A complete fire department has been established on the grounds, and has been increased from time to time as seemed necessary. The fire alarm system covers every section of the grounds, and alarm boxes are near together in the locations where fire would cause the most danger. Altogether there are some 150 alarm boxes within the Exposition grounds, and 13 in the Midway Plaisance. Hydrants are in great abundance both within the buildings and in the grounds. Thus, in the Manufactures and Liberal Arts building there are eighteen hydrants, ten in the Horticultural building, ten in the Palace of Mechanic Arts, eight in the Art Gallery, eight in the Transportation building, and two or more in all the other buildings. Each building, except the Art Gallery, has a standpipe rising to the roof, at intervals of one hundred and fifty feet. These standpipes have hose connections on the floor, in the gallery, and on the roof. The Manufactures and Liberal Arts building has over two hundred of these hose connections, and each of the other buildings has as many in proportion, so that every possible precaution against fire is taken. Each one of these reels is supplied with fifty feet of hose. There are forty hose carts stationed in the fire department buildings throughout the grounds, four of them being in Midway Plaisance. The fire department is fully manned. In addition the Columbian Guards are trained to do duty in this respect. The water supply for fire service is ample for all possible conditions. Four pumps in the Exposition grounds have a capacity of forty million gallons a day, and in addition, connection is had with the main city water service, so that no possible contingency shall arise where there will be a lack of water. The fire department is further supplied with several steam fire engines, a number of chemical engines, a truck company, over a thousand hand extinguishers, pails, and an abundant supply of hose. A fire boat designed for special service in the shallow waters of the lagoon and canals lies in the South canal, under steam at all times ready for service. This boat has a pumping capacity of four first-class fire engines.

The floors of four buildings are several feet above the ground, leaving a large area underneath. These buildings are the Manufactures and Liberal Arts building, Agricultural building, Electricity building, and the Palace of Mechanic Arts. In order to protect these buildings in case of possible fire under the floor, these great areas have been cut up into comparatively small compartments by means of partitions, thus greatly reducing the draught and the facilities for a fire to spread. In the floors are many entrance ways into these compartments, designed with special reference to the use of firemen.

Exhibitors make their own arrangements for insurance. Those who made these arrangements months ago were fortunate, as the market is now somewhat congested and rates are high. Three and one-half per cent is frequently paid, and instances are reported in which as high as six per cent has been paid, though as a general thing there is not much if any increase over the regular tariff rates. Some foreign exhibitors are carrying insurance which covers the exhibits in transit, during the holding of the Fair, and their return. There is no way of even estimating the amount of insurance that has already been placed and that will be placed, but it will run up into the millions.

The work of installing exhibits in the Mining building has progressed sufficiently to show that this exhibit will be particularly complete in mineralogy and metallurgy. The most conspicuous exhibit is in the center of the hall and is made by Germany. Strictly speaking, it is not a mining exhibit, as it comprises a complete variety of samples of T and angle iron, sections of pipes, which are placed one within the other, size for size, making quite a striking effect of the sectional side, also an elaborate display of tubes and samples of tube bending, together with a display of structural iron. There will be quite a display of mining machinery in the building, but practically all of the electrical mining machinery will be shown in the Electricity building, because of a recent rearrangement of the classification of exhibits. The display of building material, both stone and terra cotta, gives promise of being very complete, as also the display of coal. This department has been hampered for lack of space, as it could have utilized an annex with an area equal to the main building itself to good advantage. The underground exhibit in this building will comprise a tunnel three hundred feet long, which will be fitted up as a model mining tunnel, with conveying apparatus, hoists, etc.

There has been an appearance of more improvement in the past few days at the Exposition grounds than at any time since its inception. About ten thousand men are now employed in the various kinds of work, and in every department every man is used that can possibly be found place for. So far as the Exposition management is concerned, work does not lag in any respect, and every day gives reason to believe that the Exposition, so far as the management is concerned, will be as near a state of completion on May 1 as has been prophesied before in these columns. A large army of men is at work arranging the flower beds which were made last year. The roses and plants are found to have passed the winter successfully, the percentage of plants killed being very small. All parts of the grounds, except the main driveways, are being cleared up, and hollow places filled up, so that the work of finally preparing the grounds for the opening of the Exposition may be completed at very short notice. The weather guards that have been protecting the McMonnies fountain and much of the other statuary about the grounds and buildings have been removed, thus giving an appearance of a nearer approach to completion than the grounds had borne evidence of before. Staff workers are examining all the buildings, walls, and other places where staff is used, and are replacing broken pieces and renewing all injured places. At the same time that this work is going on, painters by the hundred are putting on finishing touches of paint. In short, an immense amount of vigor has been injected into all of the work going on.

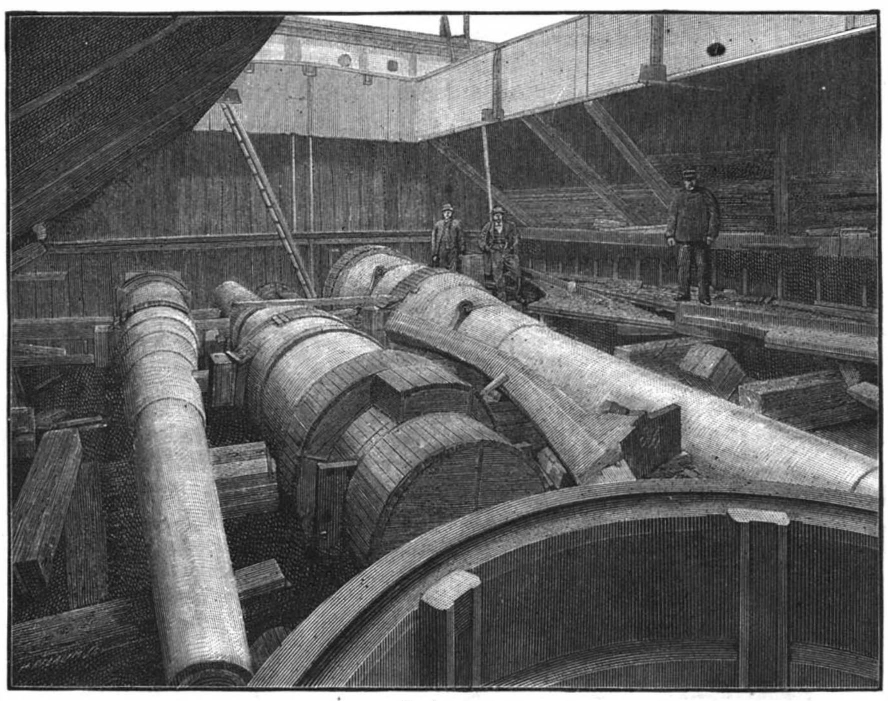
The greatest fear for some time has been that the great power plant in the Palace of Mechanic Arts would not be ready in time, and there is yet some danger that this fear may hold good, but if such is the case it will not be the fault of the Exposition management, but of the exhibitors. Practically all of the arc lighting plant is in the building and the dynamos are set, so that all that is necessary so far as they are concerned is to be belted to the engines. The incandescent lighting plant could, if necessary, be entirely completed, so far as the dynamos are concerned, by the 10th inst. If it is not completed by that time, it will be simply because of their not being rushed, but the installation will be completed in plenty of time for the opening exercises. The generators for the electric power are in place and several of them are in operation, so that it can be said that the entire electric equipment is already installed. At least half of the engines are on their bases and in a stage of completion varying from the placing of the foundation plate to others in full operation. The two thousand horse power quadruple expansion Allis engine, which is to be the center of the plant, is nearly installed. All the boilers in the main boiler house are installed and ready for operation, with the exception of four, and it will be but a few days before these are completed. Exhibitors, however, are rather backward in their work in this building. The foreign nations are somewhat ahead of American exhibitors, but unless there is a considerable amount of heavy apparatus to be handled, the entire exhibit should be in a very fair state of completion by May 1, if there are no unexpected delays.

So far as the work on the Exposition buildings is concerned, it can be said that it is done, except in the case of the four buildings upon which the work of construction began about March 1. These are the Children's building, the Public Comfort building, Festival Hall and the office building for the treasury department. This last named building, the foundation of which was not laid until the 1st of March or after, is about completed so far as the exterior is concerned. All the staging and weather guards have been removed from the Administration building, both exterior and interior, and as the gilding of the dome is nearly completed and the staff workers have repaired the few pieces of broken staff on the exterior, the structure shows the grandeur of its conception.

Admission tickets to the Exposition were put on sale in Chicago and other parts of the country April 1. Each ticket is good for one admission at any time during the holding of the Exposition. The tickets are printed on very heavy, fine quality paper, like bond paper in composition, and are of great strength and durability. The tickets are 2¼ by 4½ inches in size and are of four designs. Vignettes of Columbus, Washington, Lincoln and a fully feathered American Indian are used, thus representing the four important periods of the history of America. Every possible precaution has been taken to so make these tickets that they shall be impossible of counterfeiting, and it will be impossible to use them a second time, because as a ticket is dropped into the automatic turnstile at the gates to the Exposition grounds it is cut in such a way as to disfigure it beyond redemption.

Last week attention was called in these columns to the untruthful reports that had been circulated regarding extortions that the Exposition management had permitted to be planned by the allowing of concessions for all sorts of purposes. These stories have become so numerous that the Exposition management has at last taken notice of them, and in a letter to the public President Higinbotham explains the whole matter of the concessions, showing, as was shown in these columns, that there will be no extortion at all, but that the comfort of the visitor will be provided for in every respect free of charge, while at the same time visitors who are willing to pay a moderate sum for special attentions can be accommodated.

The Exposition authorities are making every effort to prevent the smoke nuisance, which has always been one of the disagreeable features of Chicago, making itself conspicuous at the Exposition grounds. The temporary steam plant that has been used in the grounds has used soft coal and a good deal of black smoke has been emitted, but now that the buildings are being given their final coating of paint, and that the "White City" may be such in fact as well as in name, the smoking chimneys are being stopped. Crude petroleum is the only fuel that will be used in the Exposition grounds, and the many hotels adjoining the grounds have been given formal notice to use either smoke-consuming devices or fuel that makes no black smoke. This rule is to be rigorously enforced,



THE KRUPP GUNS FOR THE COLUMBIAN EXPOSITION.—[See p. 228.]

and the freedom from smoke will add greatly to the attractiveness of the Exposition and to the comfort of the visitors.

Fifty or more small pavilions are being constructed throughout the World's Fair grounds, convenient to all the promenades and main arteries of travel, for purposes of dispensing soda water, confectionery, and other things. These buildings are constructed under the concessions granted for this purpose.

The arrangements for a corps of guides to do duty during the holding of the Exposition have been completed, and the guides will be appointed at once, in order that they may be properly trained and educated for the work they are to undertake. There will be about 250 of these guides; probably 25 of them will be women. The guides will wear a uniform, and will be systematically organized and officered. Headquarters will be established at different points in the grounds, at which visitors can make arrangements for guides.

Preparations are decidedly evident on every side in Chicago for cleaning up and preparing for the reception of visitors to the Exposition. Railroads are repairing their tracks, renewing and fixing their rolling stock, and painting and otherwise improving the facilities of their stations. The hotels for weeks have been undergoing a thorough renovation, and everywhere similar preparations have been going on. Now the city authorities have begun work in earnest to clean up the streets and alleyways. An army of men, with scores of teams, has been put to work in all parts of the city, and there is every prospect that Chicago will be cleaner on the 1st of May than it has been for years, if ever before in its history. This thorough cleaning up is a matter of considerable importance to intending visitors to the Exposition, because of the increased healthfulness of the city that will result.

Arrangements have been fully perfected for publishing a daily paper at the Exposition grounds. It will be an eight page paper, issued each morning, five pages being made up each from a stereotype of the first page of the five morning papers published in Chicago; the other three pages will contain official notices, programmes, and other important matter regarding the Exposition. The paper will be called the *Daily Columbian.*

An electric transfer table has been installed in the annex of the Agricultural building for the special purpose of installing larger exhibits, such as passenger cars, locomotives and rolling stock of all kinds. The table runs on seven tracks and is of sufficient capacity to accommodate cars eighty feet long and any weight up to about 200,000 pounds. The tracks on which it runs are two feet below the grade of the tracks on which exhibits are shunted, and below the spur tracks in the grounds, but the table itself is on a level with the tracks. This table is operated by a twenty-five horse power electric motor which is placed in the cab in the center. This motor is wired for five hundred volts, and takes current from two trolleys of bare wire placed in boxes near the two rails in the center. The motor can also be attached to a revolving drum, by means of which cars or engines can be hauled on to or off the transfer table by the use of a steel cable. This transfer table was manufactured by the Industrial Works, Bay City, Michigan, the same company that manufactured the locomotive cranes used in most of the other buildings in handling exhibits.

THE KRUPP EXHIBITS.

The steamship Lonquiel lately arrived at Baltimore, loaded with the Krupp exhibits for the World's Columbian Exposition. Our engraving shows three Krupp guns in the hold of the Lonquiel as they came over. The longest gun is one near which the men are. These are Captain Williamson, of the Lonquiel, Mr. Stone, boss rigger, who has charge of the lifting, and Mr. Henry, one of Krupp's men.

Besides the guns seen there are two smaller ones. The piece of steel seen in the foreground is a portion of a ram.

The largest gun is 120 tons weight, 18 feet circumference at the breech, 46 feet long, 22½ inches diameter of muzzle outside measure and 17½ inches diameter of bore.

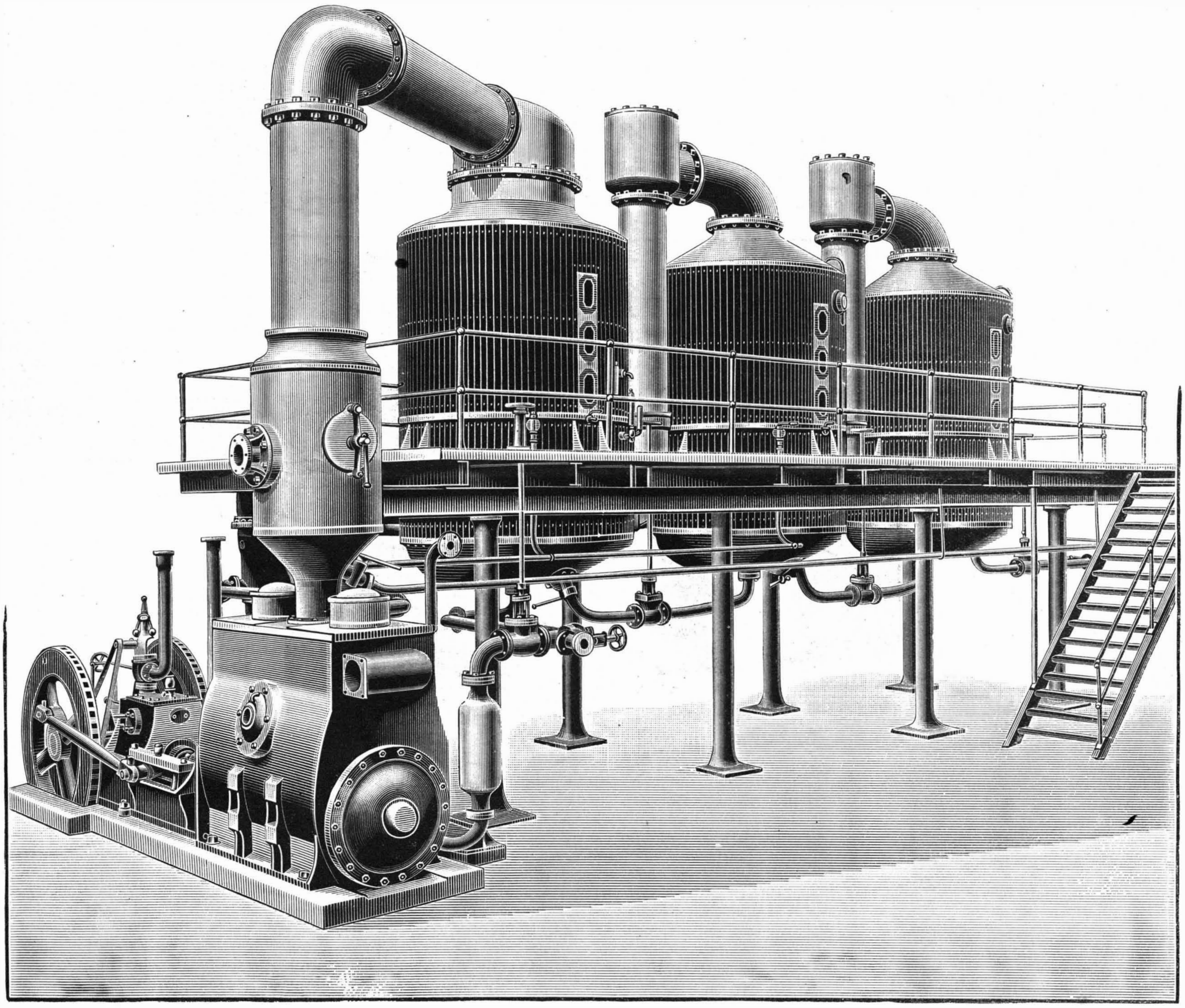
The middle gun in picture weighs 62 tons; the other in the foreground, 43½ tons; the smaller ones, 32 and 14 tons each.

There are besides these in the vessel one shaft, 22 tons, 83 feet long, 17 inches diameter; one gear wheel, 23 tons, 10 feet diameter, 14 inches thick; two armor plates, 16 tons each, 16 inches thick; two 27 tons each, 20 inches thick, and one 65 tons, 22 inches thick. A special railway truck of great strength for the carriage of the great 120 ton gun to Chicago will be illustrated probably in our next.

IMPROVED TRIPLE EFFECT EVAPORATOR.

We illustrate a triple effect evaporator, by Mr. Harvey, a member of the well known firm of McOnie, Harvey & Co., of Scotland Street Works, Glasgow, and given in a recent number of the *Engineer*, London. The general arrangement is very clearly shown in our engraving, the vacuum pump seen on the left being of extra large size. For those of our readers who are not versed in sugar machinery, it will be enough to say that the sirup is boiled *in vacuo*, and therefore at a temperature so low that all chance of charring or discoloring the sirup is avoided. The steam produced in the first "calandria" or vacuum pan is used to heat the second calandria, and that produced in the second heats the third.

The advantages claimed for Harvey's patent evaporating apparatus are complete and rapid circulation of the juice, combined with proper distribution of the steam in the most effective manner for the heating of the juice, by the proper proportion of the various vapor pipes connecting the vessels, also in the form and position of the vapor inlets to the calandrias. The condensed water outlets from the calandrias are made very large, and are connected to patent water and vapor receivers. There is a special arrangement of pipes and cocks connected to the main condenser, by means of which gases of any density lodging in any part of the calandrias are immediately drawn off, the accumulation of such gases being one of the sources of interruption to the free distribution and circulation of the vapor or steam in the calandrias. The usual back pressure or exhaust steam of 3 lb. to 5 lb. per square inch is ample to work the apparatus, which is automatic in its action, and owing to its extreme simplicity and moderate price has given, we understand, great satisfaction to sugar planters in various parts of the East and West Indies, reducing the cost of labor and effecting a very great saving in fuel, so that in some cases no coal is required.

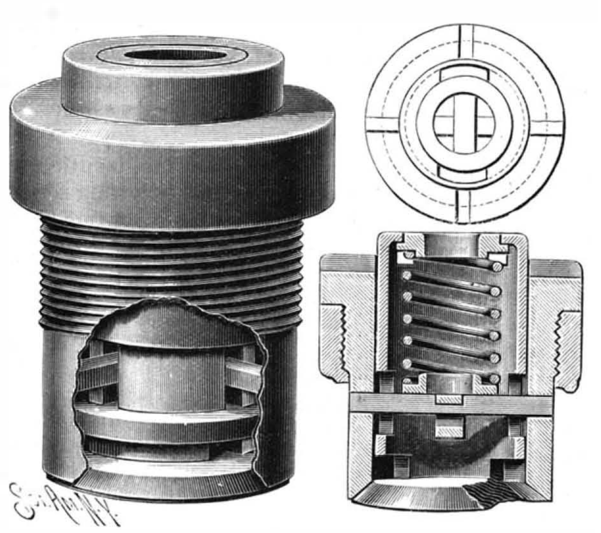


IMPROVED TRIPLE EFFECT VACUUM EVAPORATOR.

SOUTHERN Pacific locomotives will soon use for fuel bricks made of coal dust and asphaltum.

AN IMPROVED SUCTION VALVE.

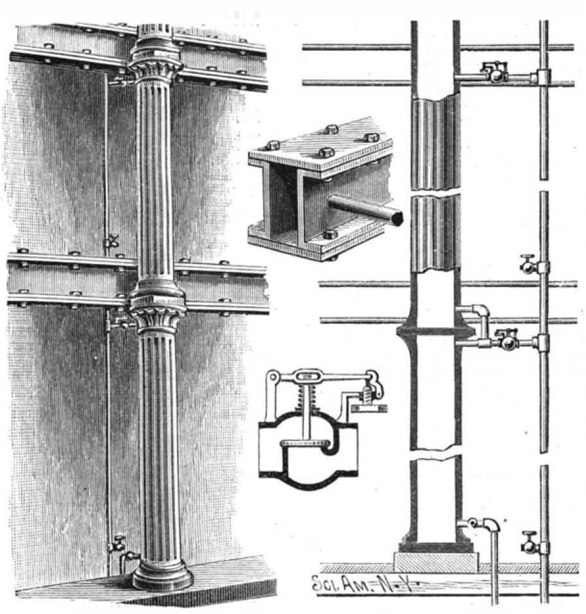
The valve shown in the illustration is especially designed for use on air compressors. It is of strong and simple construction and permits of ready access to all its parts, the arrangement of which is such as to prevent the valve from being accidentally drawn into the cylinder. It has been patented by Mr. William H. Brenner, Sr., of Port Carbon, Pa. The figures at the right in the picture represent plan and side sectional views, the valve casing being partially broken away in the view in perspective. The valve proper is formed with a cylindrical wall or extension fitted to slide in the valve casing, and in this wall, near the valve, are openings to permit air to pass into the cylinder when the valve is unseated. In this wall are also opposite openings through which extends a bar fastened to the valve casing, limiting the inward motion of the valve, and this bar is engaged at its middle by an eye of a rest forming a seat for the inner end of a coiled spring abutting at its outer end against a cap. This cap is formed with opposite lugs, so that it may be easily removed and access had to replace the spring while the compressor is in motion, and by removing the valve casing from the head of the cylinder any repairs that may be necessary may be made to the valve.



BRENNER'S SUCTION VALVE.

PROTECTING IRON WORK IN BUILDINGS FROM FIRE.

The iron columns and girders now so generally used in large buildings form an element of weakness in case of extensive conflagrations, which it is designed to obviate by the improvement shown in the accompanying illustration. The invention has been patented by Mr. Charles J. Williams, of No. 253 Fourth Street, Milwaukee, Wis. As shown in the perspective and sectional views, a riser connected with a water service pipe extends up through the building, the admission of water to the riser being controlled by valves, while leading from the riser to the hollow iron columns, at various elevations, are branches normally cut off by thermally-controlled valves. A detail view of a form of such valve is shown in one of the small figures, the valve operating automatically under the influence of heat, as in case of a fire, to admit water to a column, while a waste pipe connection is provided for draining off the water. It is not proposed to keep the hollow iron columns filled with water, but to simply flood them during a conflagration. A connection from this water service system also leads to the hollow girders, as indicated in another view, the thermal controlled branches being extended in such manner as to distribute the water wherever it may be required.



WILLIAMS' APPLIANCES FOR COOLING IRON STRUCTURES.

The Pope and the Phonograph.

The Pope gave a private audience on March 19, in his study, to Mr. Stephen Moriarty, who was introduced by Mgr. Merry del Val, the papal chamberlain. Mr. Moriarty had with him a phonograph, by means of which he delivered an address in Italian congratulating the Pope on the occasion of his episcopal jubilee. He went on to say that he felt deeply honored in being the bearer of two messages—one from the late Cardinal Manning and the other from Cardinal Gibbons, Archbishop of Baltimore, who would in their own voices express their devotion to his holiness. He concluded by begging the Pope to speak into the phonograph some expression of love and his blessing, which might be delivered to the Roman Catholics of America on the occasion of the opening of the Chicago Exhibition. He pointed out that if the Pope granted his request, it would be the first time in the history of the Papacy that the voice of the Sovereign Pontiff had been heard in America.

The Pope then listened to the message from the late Cardinal Manning, in which his eminence asked for a blessing and expressed a hope that the Catholic faith would soon spread over the whole world. The Pope was greatly affected when he heard the voice of the dead cardinal. He then heard the message of Cardinal Gibbons, who asked for the blessing of God upon the Pope. His holiness promised to send a phonographic message to the United States, and invited Mr. Moriarty to return for another audience. This was given on Monday, in the Pope's private study, the members of the Papal Court being present. At the request of his Holiness, the messages of Cardinal Manning and Cardinal Gibbons were repeated on the phonograph. The members of the Papal Court were amazed at hearing the voices of the two cardinals loudly and clearly reproduced, while the Pope sat back on his throne smiling at their astonishment. The Pope then said: "I will now send my message to the people of the United States," and, bending over the phonograph, he spoke into it. Then, turning to Mr. Moriarty, he said: "I hand you this message; guard it carefully, for it is the expression of my love for all the people of the United States. I wish you to deliver it with your own hand to the President." This message, which is in Latin, by the Pope's special request will not be published before it has been reproduced in America.

Harness Polish.

Glue	4	ounces.
Vinegar	$1\frac{1}{2}$	pints.
Gum arabic	2	ounces.
Black ink	8	ounces.
Isinglass	2	drachms.

Break the glue in pieces, put in a basin, and pour over it about a pint of the vinegar; let it stand until it becomes perfectly soft. Put the gum in another vessel, with the ink, until it is perfectly dissolved; melt the isinglass in as much water as will cover it, which may be easily done by placing the cup containing it near the fire about an hour before you want to use it. To mix them pour the remaining vinegar with the softened glue into a sand pan upon a gentle fire, stirring it until it is perfectly dissolved, that it may not burn on the bottom, being careful not to let it reach the boiling point—about 82° C. is the best heat. Next add the gum, let it reach the same heat again; add the isinglass. Take from the fire and pour it off for use. To use it, put as much as is required in a saucer, heat it sufficiently to make it fluid, and apply a thin coat with a piece of dry sponge. If the article is dried quickly, it will have the better polish.—*Phar. Era.*

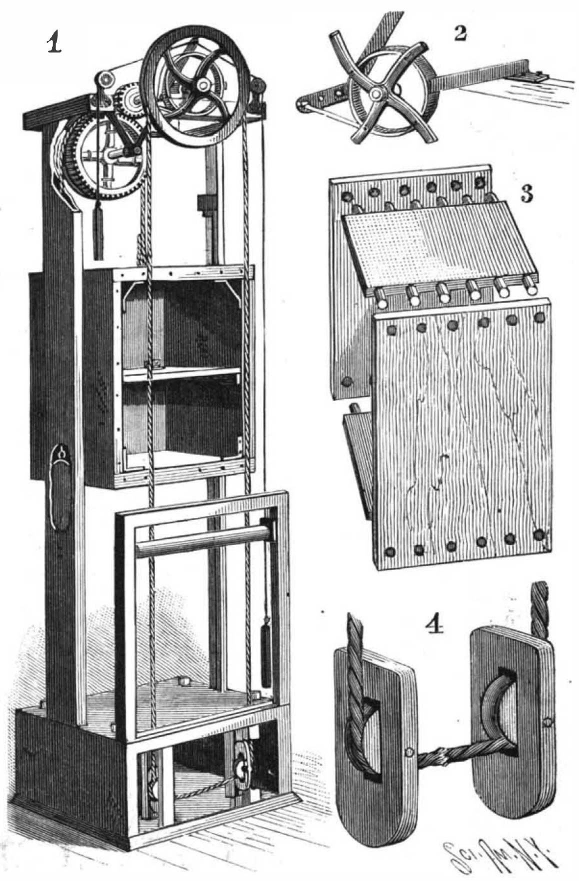
AN IMPROVED BOILER FURNACE.

A steam boiler furnace designed to afford a large heating surface, and so constructed that but little heat will be lost by radiation from the brick walls, is shown in the engraving, and has been patented by Mr. William J. Richards, Hotel Brunswick, Marquette, Mich. The sides of the fire box are formed by water legs consisting of two side boilers, which also form the side walls of the entire furnace. In the illustration, one of these side boilers is shown disconnected and swung away from its normal position, as it may be desirable to do sometimes in making repairs, etc. There is a combustion chamber to the rear of the bridge wall and at the back end of the boiler, the products of combustion passing thence through the flues to the smoke box in front. The feed pipe enters the bottom of the boiler at its rear, and branch pipes lead therefrom to the side boilers. The front end of the water space of the central boiler is connected with the side boilers by pipes, the rear ends of the boilers being also similarly connected, to establish free circulation of water in the three boilers. The steam dome is supported transversely over the middle boiler, pipes leading to it from the steam space of each of the three boilers. In case a series of such boilers are used in a large plant, all but the outer ones of the side boilers are then heated on both faces, whereby the fuel burned will be utilized to the greatest advantage.

AN IMPROVED DUMBWAITER.

The waiter represented in the illustration embodies improvements in construction for which a patent has recently been issued to Mr. Anton Larsen, Nos. 413 and 415 East 124th Street, New York City. Fig. 1 shows the device in perspective, Fig. 2 a portion of the brake, Fig. 3 the manner of constructing the frame, and Fig. 4 the means of keeping the hand rope straight, without danger of kinking, in all kinds of weather.

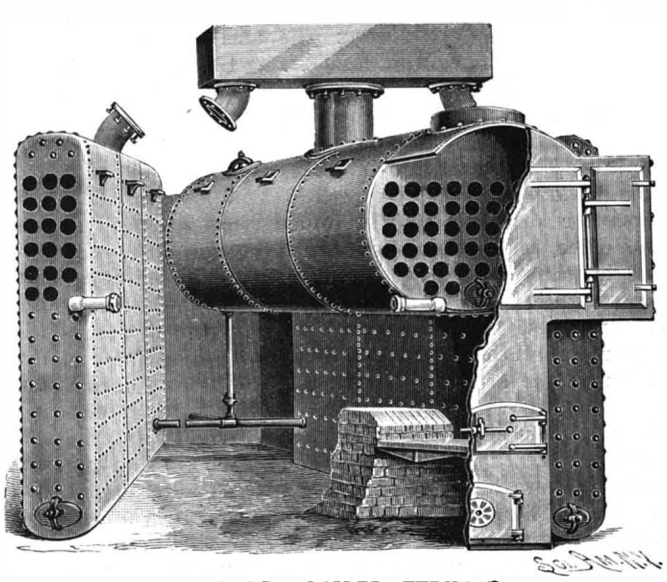
Upon the inner face of the hoisting wheel is an annular flange around which is held a spring metal brake strap secured at its ends to a pivoted lever, attached to which is a cord, extending in opposite directions over friction pulleys at either side of the shaft, counterpoise weights being attached to the ends of the cord. The position of the lever and the balance of the weights are so arranged that when the brake is applied or taken off it remains in the position in which it is left, the brake being prevented from sagging when held out of braking position by means of a spring. The construction of the frame of the waiter with dowels adapted to enter apertures, as shown in Fig. 3, is designed to afford an advantageous method of connecting the parts.



LARSEN'S DUMBWAITER.

The endless hand rope by which the waiter is operated passes over friction pulleys in the bottom of the shaft, as shown in Fig. 4, these pulleys being free to move up and down according to the tension upon them, and a friction roller is also journaled in the upper portion of the lower opening in the elevator shaft to prevent the usual wearing and chafing of the hand rope.

The drum shaft is at one side of and below the drive shaft, a pinion on the latter meshing with a gear on the winding drum, so that the lifting chain or cable is not interfered with by the drive shaft or its pinion. The end of the cable carrying the counterbalance weight of the waiter is inclosed in a casing, the weight being slightly more than sufficient to balance the waiter.



RICHARDS' BOILER FURNACE.

Correspondence.

The Diamond Toothed Circular Stone Saw.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN SUPPLEMENT of 1st inst. is an illustration of a stone sawing machine described by Mr. James T. Pearson, of Burnley, Lancashire. In 1875 at the Cincinnati Exposition I had and operated a diamond stone sawing machine, operated on substantially the same principle, and sawed more than 40 tons of freestone into slabs of 1, 1¼, 1½, and 2 inches in thickness and never made a miscut nor lost a single diamond. I set the diamonds as shown in our hand book for dressing emery wheels. The same machine was successfully used at the Philadelphia World's Fair in 1876, and that machine is still in existence.

But carbons became expensive, and no matter how much water was forced into the cut, they soon became dull, and the enterprise was abandoned. It is now claimed by a party that they have discovered a method of producing carbons, but of small sizes yet, but hope soon to produce them of larger sizes, and very cheaply. I am hoping for success in this line, when I may become interested again in the business.

J. E. EMERSON.

Beaver Falls, Pa., April 3, 1893.

How to Convert Incandescent Lamps into Geissler Tubes.

To the Editor of the Scientific American:

The idea of utilizing burned-out incandescent lamps for performing Geissler tube experiments may be new to many of the readers of your valuable paper, and if so, would be pleased to submit it.

The experiment may be performed as follows:

Procure a burned-out lamp, if possible one in which a piece of the filament has been broken off, leaving the ends separated about an inch. Solder a piece of wire to each terminal of the lamp, and connect to the secondary terminals of an induction coil yielding about a one-eighth inch spark. Start the coil in action, and holding the globe in one hand, begin to file off the glass point where the lamp has been sealed. This operation must be performed very cautiously, using a fine file with a gentle pressure.

The filing should be continued until the discharge diffuses the bulb, and then the point is quickly sealed in the flame. It is, of course, apparent that the object in filing the point is to allow a certain amount of air to enter the globe, producing a low vacuum, through which the discharge will readily pass.

The writer has obtained quite a number of beautiful and varied luminous effects in this manner by using the lamps of different manufacture and with very little trouble.

E. M. LA BOITEAUX.

Strange Effects of an Earth Current.

To the Editor of the Scientific American:

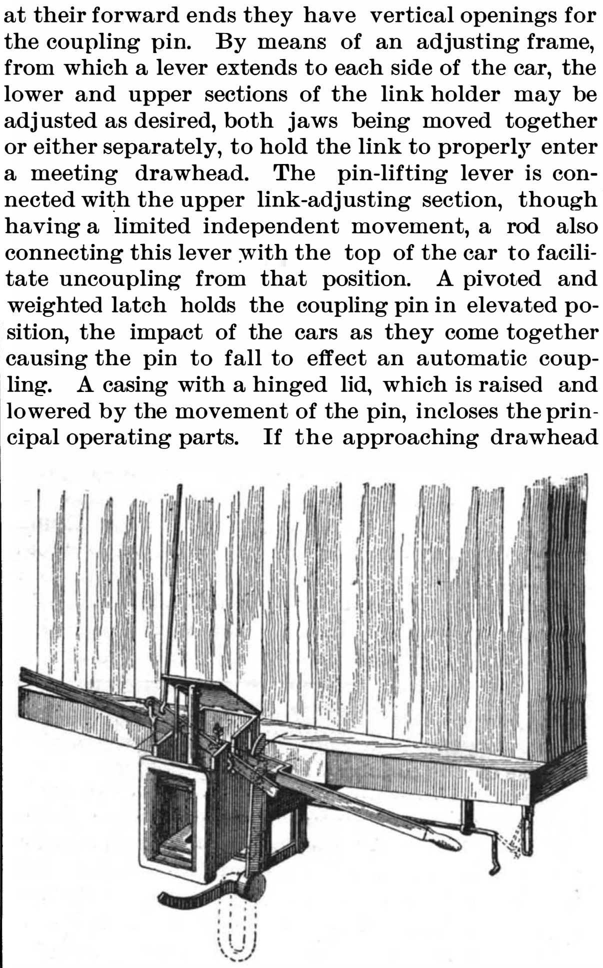
I give you below an account of the strange effect an earth current (I say earth current, because I cannot attribute its manifestations to any other cause) had on a telegraph line on March 15, 1893. The Atlantic and Pacific Railroad and the Southern Pacific run almost parallel for several hundred miles in Arizona east and west, converging at Barstow, California. A military telegraph line running in a general north and south direction connects Holbrook, Arizona, on the Atlantic and Pacific with Willcox, Arizona, on the Southern Pacific. The distance between these two points is about 250 miles. It was on this telegraph line that the earth current manifested itself. I at first supposed that either the operator at Holbrook or Willcox had made temporary connection with one of the lines of the railroads, but the operator of the military telegraph office at Holbrook (the northern terminus of the military telegraph line) states that his office is at least 100 yards from the railroad station, and that connection with the railroad telegraph line at that point was impossible. The military line was broken between Fort Grant and Willcox, so a connection with a railroad wire at Willcox was also impossible. The operator at Fort Grant grounded the line south at his office, that those between there and Holbrook might transact their business. In the forenoon of the date mentioned a powerful current on the military line was felt. It was so strong that it attracted the armature of all the relays on the line with such force as to cause the armature levers and trunnions to bend. The operator at Fort Grant, having had a galvanometer in circuit, states that the earth current was of an opposite polarity to that furnished by the battery, and that it threw the needle 90 degrees from the zero point in an opposite direction to that produced by the battery. Every operator on the military telegraph line distinctly heard "Hn," calling "N," "W," and "U" at intervals, these being not the call letters of any of the offices on the military, but those of offices on the Southern Pacific telegraph line. Curiosity prompted me to attempt to break in and ascertain if I could locate "Hn," but my attempt proved unsuccessful. As I said above that the wire on the military telegraph line was broken between Fort Grant and Willcox, it is apparent that the signals were reproduced through the agency of the earth current, which was felt for nearly half an hour. If you deem this article worthy of a small space in your valuable journal, it may prove interesting to many readers.

J. FETZER,
Sgt. Sig. Corps, U.S.A., Operator.

Fort Apache, Arizona, March 28, 1893.

AN IMPROVED CAR COUPLING.

An automatic coupler, which permits of the cars being uncoupled from either side or the top of the car, so that the brakemen do not have to go between the cars at any time, is shown in the accompanying illustration. It has been patented by Mr. A. G. Vogt, of Boerne, Texas. The drawbar is hollow and open at its rear end, so that the buffer spring of the ordinary drawbar may be used. The link holder, operating in the flaring link mortise, consists of two pivoted jaws, one above the other, and slightly separated, a spring holding the jaws normally nearly closed, while at their forward ends they have vertical openings for the coupling pin. By means of an adjusting frame, from which a lever extends to each side of the car, the lower and upper sections of the link holder may be adjusted as desired, both jaws being moved together or either separately, to hold the link to properly enter a meeting drawhead. The pin-lifting lever is connected with the upper link-adjusting section, though having a limited independent movement, a rod also connecting this lever with the top of the car to facilitate uncoupling from that position. A pivoted and weighted latch holds the coupling pin in elevated position, the impact of the cars as they come together causing the pin to fall to effect an automatic coupling. A casing with a hinged lid, which is raised and lowered by the movement of the pin, incloses the principal operating parts. If the approaching drawhead



VOGT'S CAR COUPLING.

also has a link in it, the link-operating lever is set to eject one link, which is caught by a receiving hook supported to swing below the drawhead, as shown in dotted lines. With this form of coupler all of the old styles of links, pins, keys, and bumper springs can be utilized, and automatic coupling is readily effected with cars fitted for the old style of link and pin coupling.

"Piperazine."

BY W. MAJERT AND A. SCHMIDT.

Erroneous statements have appeared in several modern text books regarding the physical and chemical characters of piperazine, $C_4H_{10}N_2$, which have been confused with those ascribed by A. W. Von Hofmann and by Ladenburg to the impure substances of like composition discovered by them, and termed respectively diethylenediamine and ethyleneimine or diethylenediimine. Our attention has been directed to the fact that this misunderstanding has partly arisen from a misconstruction of our views (*Ber.*, 1890, 3719) as to the identity of these substances; we, therefore, desire to correct this impression.

Piperazine, which was not known in its pure crystalline condition until prepared by us in August, 1890, by treatment of dinitrosodiphenylpiperazine with alkali, is a crystalline substance melting at 104—107° in capillary tubes, although when the melting point is determined on large quantities it is found to be 112°, the differences being due to the hygroscopic nature of the base. It boils at 140—145°. It is very readily soluble in water and alcohol, the aqueous solution having a distinctly alkaline action. It is very hygroscopic and readily absorbs carbon dioxide, being thereby converted into the carbonate melting at 162—165°.

Piperazine is especially characterized by the formation of an insoluble pomegranate red double salt with bismuth iodide and by a dibenzoyl compound melting at 191°.

The basic substance diethylenediamine prepared by Hofmann by the interaction of ammonia and ethylene bromide consisted of a liquid mixture of bases boiling approximately at 170°. That this mixture contained a small quantity of a base identical with piperazine is undoubted, but it was only after piperazine had been prepared from dinitrosodiphenylpiperazine that Hofmann succeeded in identifying it and isolating the pure crystalline product from the mixture, which, besides higher ethylene bases, contained also a number of vinyl compounds.

Owing to the difficulty of purifying small quantities of the base, Ladenburg's experiments with diethylenediimine, obtained by the decomposition by heat of ethylenediamine hydrochloride, were unsuccessful. The product described by Ladenburg as the base was undoubtedly impure piperazine carbonate, as proved by its melting point, 159—163°.

In conclusion, it may be interesting to mention that we have succeeded in preparing the following series of hydrates of piperazine, that most readily formed being a hexhydrate which crystallizes from dilute aqueous solutions:

$C_4H_{10}N_2 \cdot H_2O$, m. p. 75°,
" $2H_2O$, " 56°,
" $3H_2O$, " 39—40°,
" $4H_2O$, " 42—43°,
" $5H_2O$, " 45°,
" $6H_2O$, " 48°.

—*Chemical News.*

The Metals and their Physical Properties.

Name.	Atomic weight.	Specific gravity.	Specific heat.	Temperature of fusion F.	Linear expansion. 32°–212° F. 1 part in	Electric conductivity.	Heat conductivity.
Osmium	199·2	22·477	0·0311	3992	152	....	...
Iridium	198	22·4	0·0326	3992	1429	....	...
Platinum	197·4	21·46	0·0324	3592	1167	10·5	0·84
Gold	197	19 265	0·0324	2990	645	77·9	0·532
Uranium	118·8	18·33	0·0619	3632	....	....	....
Tungsten	184	16·54	0·0334	4352	....	....	....
Mercury	200	13·595	0·0333	—40	....	1·63	....
Ruthenium	104·4	12·26	0·0611	3935	1038	....	....
Rhodium	104·4	12·1	0·0588	3935	1176	....	....
Thallium	204	11·86	0·0335	529	331	9·30	....
Palladium	106·6	11·4	0·0593	3632	1000	....	....
Lead	207	11·256	0·0314	617	351	8·32	0·85
Silver	108	10·4	0·0570	1832	524	100	1
Bismuth	210	9·82	0·0308	507	719	1·19	....
Copper	63·4	8·94	0·0952	1990	581	94·4	0·736
Molybdenum	96	8·6	0·0722	3632	....	....	....
Cadmium	112	8·546	0·0506	442	428	22·10	....
Cobalt	58·8	8·5	0·1069	3272	809	17·22	....
Nickel	58·8	8·297	0·109	2912	781	13·11	....
Iron	56	7·844	0·1138	2012	819	16·81	0·119
Thorium	115·7	7·5	....	....	....	....	....
Indium	75·6	7·42	0·2934	176	237	....	....
Tin	118	7·29	0·0562	442	462	11·5	0·154
Manganese	55	7·14	0·0722	3452	371	....	....
Zinc	65·2	6·915	0·0956	707	321	29	0·190
Chromium	52	6·81	0·100	3992	....	....	....
Cerium	92	6·728	0·0447	....	....	....	....
Antimony	120·3	6·715	0·0508	842	923	33·76	....
Didymium	95	6·544	0·0456	....	....	....	....
Niobium	94	6·3	....	....	....	....	....
Tellurium	128	6·25	0·0475	752	596	....	....
Lanthanum	93·6	6·166	0·0448	....	....	....	....
Gallium	69·9	5·9	0·079	86	....	....	....
Arsenic	75	5 7	....	....	788	....	....
Vanadium	51·37	5·5	....	3992	....	....	....
Zirconium	89·6	4·15	....	887	....	....	....
Barium	137	4	....	1562	....	....	....
Aluminum	27·5	2·583	0·2143	....	450	19·6	....
Strontium	87·5	2·5	....	....	....	6·71	....
Columbium	94	2·1	....	....	....	....	....
Glucinum (Beryllium)	9·4	2	0·64	....	....	....	....
Caesium	133	1·88	....	....	....	....	....
Magnesium	24	1·743	0·250	1382	....	25·47	....
Calcium	40	1·578	....	1562	....	22·14	....
Rubidium	85·4	1·52	....	135	....	....	....
Water	....	1	....	....	....	....	....
Sodium	23	0·9735	0·293	194	....	37·42	....
Potassium	39·1	0·875	0·166	136	....	20·83	....
Lithium	7	0·594	0·9408	374	....	19	....
Erbium	112·6	....	....	....	....	....	....
Selenium	79·4	....	0·0701	....	271	....	....
Titanium	50	....	....	....	....	....	....
Tantalum	182	....	....	....	....	....	....
Yttrium	61·7	....	....	....	....	....	....
Terbium	?	....	....	....	....	....	....

NEWLY DISCOVERED METALS OF UNCERTAIN PROPERTIES.

Idunium.	Norwegium.	Columbium.
Davyum.	Vesbium.	Rogerium.
Mosandrum.	Neptunium.	Comesium.
Halmium.	Lavoisium.	Actinium.
Thalen.	Uralium.	*Ya*—*Yb*.
Samarium.	Barcenium.	

MECHANICAL PROPERTIES OF SOME OF THE LEADING METALS.

Order of hardness.		Order of tenacity.	
Platinum.	Tin.	Lead	0·1
Iron.	Selenium.	Tin	1·3
Antimony.	Bismuth.	Gold	5·6
Copper.	Lead.	Zinc	8
Silver.		Silver	8·9
Gold.		Platinum	13
Zinc.		Copper	17
Aluminum.		Iron	26

Malleability. Hammered.	Malleability. Rolled.	Ductility.
Lead.	Gold.	Platinum.
Tin.	Silver.	Silver.
Gold.	Copper.	Iron.
Zinc.	Tin.	Copper.
Silver.	Lead.	Gold.
Copper.	Zinc.	Zinc.
Platinum.	Platinum.	Tin.
Iron.	Iron.	Lead.

Steel Pontoons.

The draught of water through the Canadian canals, while nominally nine feet, is subject to season fluctuations, and anything over this draught requires pontooning. Mr. Lesslie, manager of the Collins Bay Company, has made two cylindrical steel pontoons, and with these placed alongside the vessel it is only necessary to ballast them with water to a sufficient depth, secure them to and under the vessel, and then pump out the water until the required draught of the vessel has been reached. The utmost success has so far attended the use of these steel pontoons, and it is expected that they will be largely used during the World's Fair season.

Country Roads and Electricity.

The Wheelmen's League is agitating a scheme for improved country roads which is modestly estimated to cost not more than $10,000,000 for this State. They have introduced a bill in the Legislature for the promotion of this object, and to mollify the farmers, who are expected to object to the trifling expenditure, it is announced that only a small part of the cost will be levied on the agricultural districts. It is not announced, however, where the weight of the levy is to fall, and in the absence of more definite information it is presumed that the main part of the cost will be assumed by the bicyclers themselves, the young fellows who compose the league. The cities are careless about bicycling, and it is not thought that they could be drawn into the scheme without even a greater effort than it takes to paddle a bicycle over a muddy road.

There is an alternative plan, however, which has been considerably agitated among electrical engineers and manufacturers, and it is one that cannot fail to be of great interest to farmers when it has generally been brought to their attention. It is a plan to lay electric railways on all the country roads, and, through the general distribution of electrical power, to enable the farmers to not only travel wherever they please to go, at about any rate of speed that they are willing to risk, in vehicles under their own private control, but to do a large part of their farm labor by electrically propelled agricultural implements. The arguments in favor of this plan may be summarized as follows:

First, it will make the cheapest and the only comprehensive system of road improvement that can be considered practicable for a country so large as the United States. In most sections of this country a district 10 miles square contains about 100 miles of roadway. In the Western States the mileage is greater; but in the East and South it is sometimes even less. But in a district 10 miles square there are 600 one hundred acre farms, or their equivalent total of 64,000 acres. Then, as the electric motor has a wonderful facility for running up hill and there will be little or no grading required, it is not difficult to estimate the cost.

Taking a district 10 miles square, the surface that can be served from a single central power station, and estimating on the cost of the track, poles, wires, and central power stations of the electric railways already in operation as a basis, it is maintained that a total capitalization of $10 per acre would be sufficient to provide an electric railway system in the country, not considering any further agricultural use of the electric power. This would mean an annual interest charge of 60 cents per acre, or $60 for each 100 acres of land in the district. It seems like a very trifling expenditure when we consider the magnitude of the service proposed. But, of course, to this estimate must be added the operating expenses, and the interest on the cost of the electric wagons owned or rented by the farmers. In the calculations of the electrical experts, however, the total is not made to equal the expenditures entailed by our existing road system when we count the saving of time as an incident of value. As to the profits of the operating companies, they would accrue to the farmers themselves if they become, as it is maintained they should be, the chief stockholders.

Next after the claim for greater economy comes the claim for greater efficiency in service.

The advocates of an electric system of country roads maintain that it costs a farmer who lives at any considerable distance from town more money to get his produce to market than it afterward costs to get it to New York, or even to Liverpool; and, whether this claim be well founded or not, it is certain that, if a farmer places any value upon his time, the marketing of his produce is a very expensive undertaking. But with an electric railway in operation he need go to no considerable expense for this work. The companies owning the electric plant could send cars or trains to the different farmyards, collect the produce, and deliver it at the nearest market town for a small part of the cost entailed by slow horses and wagons, even estimating time as of no value. But this would be only the beginning of the farmer's advantanges. The ability to travel at any hour of the day or night and through any kind of weather, in a perfectly protected vehicle, at the rate of eighteen or twenty miles an hour, would be a source of inestimable convenience and comfort.

The third advantage claimed for the system is still broader than even the claim of greater economy, greater convenience, and more generally efficient service. It is commonly known that during recent years the increase of population in this country has been flowing in a disproportioned ratio toward the cities and large towns along the line of railway communication, while the little country villages remain merely cross roads hamlets, without growth or progress of any kind. This is due to the fact that the manufacturing interests of the Union are rapidly growing, and that only the towns along the line of railway communication offer the advantages of cheap production and the cheap distribution of merchandise. It costs too much to distribute coal through the country districts to permit its use for anything but domestic purposes. But with a system of electric railways in operation this disparity would disappear. On account of the greater cheapness of lands and rents, the smaller villages would become the most available points for cheap production, even while the steam engine and coal remained the only source of manufacturing power. But with the general distribution of the current would come also the general distribution of electric power; and this would add to the inducements of the country as a field for the manufacturing industry. Then the rural villages would begin to receive their fair proportion of the increase of population, and this would react upon the farmers greatly to their advantage. Truck farming would soon become universal, instead of the exclusive industry of suburban farmers, and farming operations could be universally conducted with greater profit.

But the projectors of an electric system for the country do not limit their claims to merely material considerations. It is very well known that, owing to sparse population and the difficulty of intercommunication, the educational institutions of the rural districts are very defective. The curriculum of the country school is at best about limited to the three R's, and the farmer who wants to give his children an education above the most elementary studies is forced to board them at considerable expense in some neighboring town or village, where there may happen to be a high school or academy. So serious has this drawback to country life become that in Massachusetts, a State where something more than the three R's is universally thought desirable, the people are beginning to consolidate their schools, and to send out wagons at the expense of the town to bring the children together where they can be effectively taught by competent teachers. But it is suggested that with electric railways in operation only one school in a township would be needed, and that this school, while it could be made equal to the best city schools in every educational advantage, would be superior to the city schools, with their mixed attendance, in moral advantages. Children could be transported between their homes and a centrally located village school without serious loss of time, and the demoralizing associations incidental to attendance on city schools could be avoided. Then the country would become an ideal place for the training of children, and this would bring a further influence to bear in favor of a more rapid increase of rural population. It is certainly true that the superior educational advantages of the cities are among the chief causes for their rapid growth at the expense of the country.

Finally, the argument takes a range as wide as our political and social science. The effect of practically concentrating a territory 25 or 30 miles square into a space no larger than a 5 mile radius under the ordinary resources of transit is broadly considered, and it is concluded that the social results must be beyond calculation. First after the consolidation of schools and the coming of better teachers would follow the consolidation of churches and the advent of better preachers. The people of large districts would thus be brought into more intimate relations with each other, and a more cosmopolitan spirit would be engendered. Entertainments of an intellectual and innocent kind would be found also everywhere within reach, and country life, made larger socially and more varied, would lose the monotony and dullness which now drives so large a proportion of the sons of farmers to the cities. The country, indeed, would become an ideal place of residence. Even the postman and the newsboy could go their daily rounds and the morning newspaper would become as familiar a visitor at the farmhouse as it has long been at the urban or suburban dwelling. In truth, the number of post offices in the United States could be reduced three-fourths, it is believed, and a better service rendered from the remaining one-fourth than we can ever expect to see under prevailing disadvantages.

But even yet the arguments in favor of extending the electric system into the country are not repeated in full; and it may be thought by some persons that the reason still to come should have been placed first and made the inspiration of the entire plan. The farmers, it should be pretty well known by this time, are not altogether satisfied with their profits. They think that with their large capital invested, about the largest, according to statistical estimates, in the country, they should be able to get larger returns. But it is doubtful if they can ever get larger returns from exclusively agricultural operations, or not, at least, until all the arable land is taken up and the fatal facility with which new men may become farmers is checked by the cost of investment. What the farmers seem to need is an independent field for investment—a field that will enable them to put their savings into income-producing property beyond the reach of the fierce competition of the plow and the cultivator. This, it is claimed, is precisely the field that will be opened by the electric motor. The companies building and operating the electric power plant will find a wide source of profit. They will find it not merely among the farmers themselves, but in the rural villages, soon to become considerable manufacturing towns, demanding light and power. The day is not now distant, either, when the telephone patents will expire, and then the telephone may be brought into universal use and made to contribute largely to the profits of the companies. All this can be made to accrue to the profits of the farmer, if he will display sufficient enterprise to take advantage of his opportunities.

These are some of the arguments advanced in favor of pushing out the electric service into the country. But for the discomfiture of the Wheelmen's League there is still another argument which interposes with peculiar force against their expensive scheme for old-fashioned road improvement. It is urged that the general adoption of the railway system in this country of magnificent distances and difficult means of intercommunication is inevitable, and that any kind of improvement that contemplates the perpetuity of horse traction on the highways would be a mere waste of money. It is consistently claimed that there will be absolutely no occasion for any farmer or other citizen of the rural districts to go upon the roads except in electrically propelled vehicles after the electric system has been brought into general use, and that the time when it will be in general use is not distant in any event. The stimulus to activity will not be lacking, because it is believed to be the best field of investment in the United States, and too promising to be neglected, even should not the farmers themselves become the promoters. The capital invested in electrical manufacturing in this country now amounts to many hundreds of millions, and, in addition to this large total, the iron industry and other branches of industry engaged in manufacture of railway rolling stock will be equally concerned with the electrical manufacturers in the extension of the railway system. All these large interests will work together for a common end.

At present the electrical manufacturers are overburdened in filling orders for street railways, and they are compelled to continually enlarge their plant to meet the demand. But in the course of a few years, four or five years at the utmost, the urban and suburban demand will be pretty generally met, and the orders will begin to fail. Then we can look to see the next step taken. It would not be consistent with the character of the American manufacturer to abandon a portion of his plant when the whole continent remains to conquer. He will push out into new fields, and invade the country. The country stage coach has gone. The country road must follow, and it is not believed that it would be sensible to bond the State of New York for $10,000,000 for such roads, when in less than twenty-five years at the furthest they will have become a tradition, and the bonds alone would remain as a memento. A $5,000 a mile macadamized road would be no better foundation for an electric railway than a dirt road. It would not be so good.

It is possible that against these claims the advocates of improved roads may suggest the storage battery system, and urge that we may have both improved roads and electricity. But it has been observed that wherever the obstruction of cost—the present obstruction for the storage battery—throws itself in the way of electricity it proves to be a very obstinate obstruction. It does not look now as if the storage battery could ever be more than a subsidiary source of power. Then, again, electric vehicles could never be driven at the high rate of speed that would be demanded in the country, except over iron rails.

Magnesium Zinc-Eisen.

By H. N. Warren, Research Analyst.—This compound intended solely for pyrotechny is produced either by the electrolysis of magnesium sodium chloride in contact with zinc, or by the action of sodium metal upon that compound. As in the first instance, about ten or twelve pounds of zinc are introduced into a convenient size plumbago crucible, through the bottom of which is inserted a carbon rod; an excess of sodium magnesium chloride is next added, and a current of about 50 volts passed through the whole. The zinc speedily absorbs the magnesium thus set free, while chlorine escapes abundantly from the further electrode in contact with the magnesium chloride.

When an alloy containing about 70 per cent of magnesium has been obtained the current is broken, and a small quantity of ferrous chloride introduced; a further action is thus established, metallic iron being set free, which further alloys with both the zinc and magnesium to the extent of about 12 per cent. By this means a compound is obtained possessing so brittle a texture as to be readily reduced to the finest powder.

In the second instance a saturated alloy of sodium and zinc is caused to act upon a mixture of magnesium sodium chloride; the sodium speedily changes place with the magnesium, forming the above mentioned alloy, to which an equivalent portion of iron is introduced by the action of ferrous chloride. These alloys are invaluable in photography for flash light and in pyrotechny as signals, being equal to the pure magnesium as a light-producing agent, at the same time being produced at a much lower cost.—*Chemical News.*

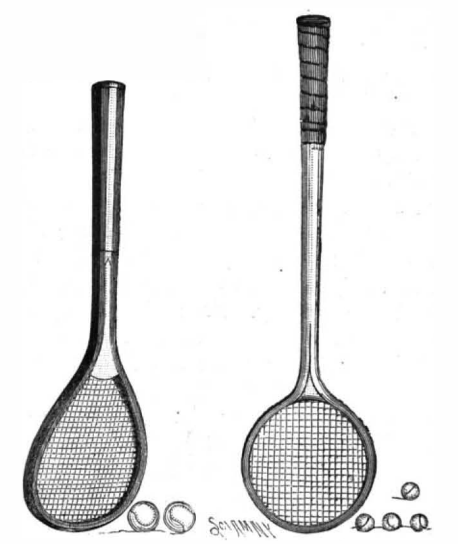
THE RACQUET AND TENNIS CLUB OF NEW YORK.

This is pre-eminently the age of athletics. Within the past twenty-five or thirty years a very remarkable revival in athletics has taken place in this country. Before that time foot ball was practically unknown and unpracticed, lawn tennis had not been invented, would-be bicyclers had nothing to ride, track athletics did not exist, rowing was in its swaddling clothes; in fact, the only full fledged field sport of any prominence was base ball—the national game. Now there are few towns of any size or importance in the more settled parts of the country where there are not base ball, athletic, or tennis clubs. There are, it is said, over 48,000 members of the Bicycle League, and there are thousands of wheelmen who do not belong to any of the regular organizations.

New York City, owing to its peculiar geographical situation, is singularly unfortunate in not having any accessible rural suburbs where athletic sports can be fostered. This defect has, in some respects, been artificially remedied by its handsome athletic clubs. The three leading clubs devoted to athletic sports are the New York Racquet and Tennis Club, with a membership of 800; the New York Athletic Club, with a membership of 2,500; and the University Athletic Club, which was only started last year, with a membership of 600, which is rapidly increasing. The Manhattan athletic Club, with a membership of 2,500, and with one of the most beautiful athletic club houses in the world, has, unfortunately, just been disbanded, owing to financial embarrassment arising out of bad management.

The Racquet and Tennis Club has been selected as the subject of this article for the reason that it is complete and ideal in the way in which the object for which the club was founded has been carried out. Unlike the other clubs mentioned, it was not founded for the purpose of encouraging track athletics, nor is it connected with the cinder path in any way. The club is a luxurious home where the members may shut out the busy world, don their flannels, and after an hour or more of such form of active exercise as may please the individual fancy of the member, may, if tired and exhausted, enjoy the delightful lassitude of a Turkish bath, or, if his mind turns to a less enervating form of treatment, he may take a plunge in the capacious swimming tank. Then a half hour on a divan with, perhaps, a cooling beverage at his elbow, our refreshed athlete is ready to stand on the scales and find how much his exercise has reduced his weight. A book is provided in which each member may make an entry and keep a complete record of the increase or decrease of his avoirdupois. As may be seen by examining the general plan of the club on the first page, the club rooms proper are located on the first and part of the second floor. On the first floor are the pool and billiard rooms, the dining room and two reading rooms, and a reception room. The visitor had better, after visiting them, take the elevator and descend to the basement. Here will be found the bowling alleys and admirable shooting galleries. Also the plunge and the Turkish and Roman bath rooms, all fitted up in white marble and tile. The kitchen and boiler and engine rooms are also situated on this floor. The elevator will now take the visitor to the second floor, where he will pass at once into the lounging room, where the members usually sit while waiting for their turn to secure a court. Large slate slabs are set in the wall about this room, and those who desire to make use of the courts write their names on the slates and they then become entitled to the use of the court according to the order of entry. It is the general practice, however, for players of about the same grade or class to try and arrange to play matches together. At the left is the card room and at the right the dressing alcoves, and at the extreme end (see view on front page) are the shower and needle baths. The visitor will find on the next floor a large and completely appointed gymnasium. Here are also the sparring and fencing rooms and the barber shop.

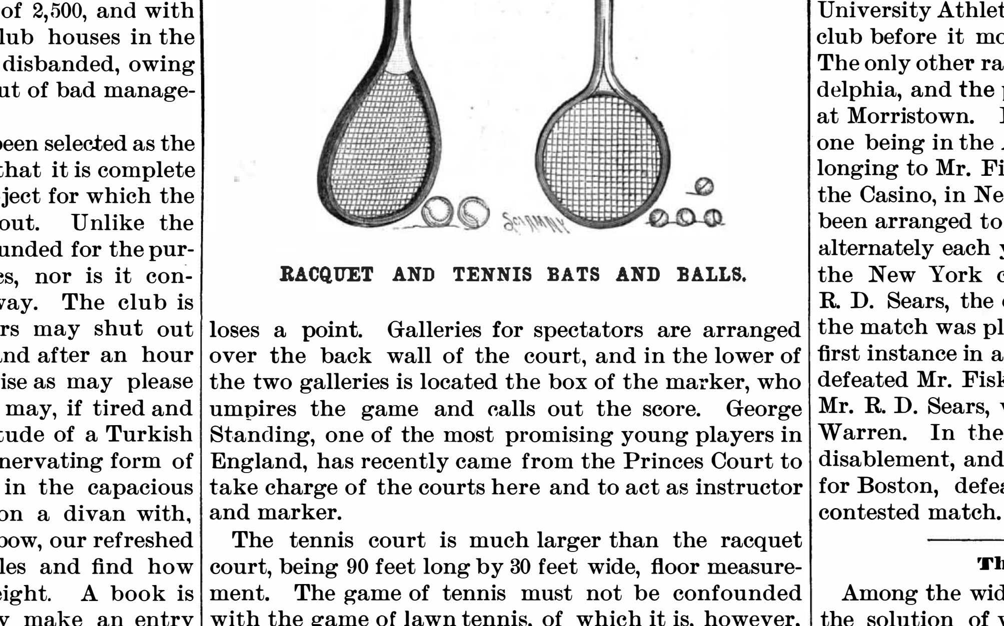
On the top floor will be found perhaps the most interesting feature of the club—the tennis court. A view of this is shown on the front page. In an adjoining room is the fives or squash racquet court. There are two racquet courts, one at each end of the building, and extending at right angles thereto. As they are located at the rear of the building, they do not show in the general plan of the club, which is a section through the front part of the building. These courts are about 60 by 30 feet in size and are very lofty, extending from the second floor to the top of the building. The courts are all lighted from above and have no windows. They are painted black, and the lines or chases indicating where the players are to stand or play are painted orange or green in color. Black has been selected as the most desirable color, owing to the fact that the ball stands out from it distinctly and because there can be no delusive shadows. The racquet and ball used in this game are shown in a cut on this page. The handle of the racquet is quite long, giving the player considerable reach, and the ball is so small (about an inch in diameter) and so hard that tremendous speed is imparted to it, and it requires the greatest agility to "take" the ball as it bounds off the hard cement walls. The ball must be played against the wall at the end of the court, and the player who fails to return the ball to that wall



RACQUET AND TENNIS BATS AND BALLS.

loses a point. Galleries for spectators are arranged over the back wall of the court, and in the lower of the two galleries is located the box of the marker, who umpires the game and calls out the score. George Standing, one of the most promising young players in England, has recently came from the Princes Court to take charge of the courts here and to act as instructor and marker.

The tennis court is much larger than the racquet court, being 90 feet long by 30 feet wide, floor measurement. The game of tennis must not be confounded with the game of lawn tennis, of which it is, however, the prototype and direct ancestor. Tennis is, perhaps, the most venerable of all athletic games. Although the modern tennis court cannot be traced back perhaps much beyond the period of the Renaissance, still every student knows that a game somewhat in the nature of tennis (at least a game in which a ball was played against a wall) was indulged in by the ancients. The residence of the Roman patrician was sometimes provided with a court where ball games could be played, but it is not until the middle ages that definite relationship can be traced between the primitive game of those rude times and the highly developed sport of



SPARRING ROOM.

to-day. The game is not only venerable, but it has at times been the favorite game of kings and princes. There was a court at Windsor in the fifteenth century. Francis I. built one adjoining the palace of the Louvre, so did Henry VIII. at Hampton Court, after having appropriated the palace of the favorite cardinal to his own use. Tradition says that Charles I. and Louis XIV. were both tennis players in their youth, and Chaucer before any of these speaks of the use of the ball and racquet.

The interest in the game lies largely in the fact that various qualities of quite a different kind are necessary to a proper development of the sport. The head is called into play more perhaps than the brawn. Tennis is to athletics what chess is to drawing room games. It requires accuracy, agility, skill, endurance and a good eye on the one hand and on the other good judgment, perseverance, decision, patience and the faculty of seizing an opportunity quickly or changing one's style of play completely according to the play of one's adversary.

The bat used is rather heavy, and seems to the novice to be a clumsy, unwieldy weapon. The ball is about the size of a lawn tennis ball, but is solid and heavy. The stroke, when properly made, imparts a cut to the ball which makes it die away in the corners of the court or drop suddenly off the back walls.

A marker stands in an alcove in the wall at the middle of the court, near the net, and calls the score, the counting being practically the same as in lawn tennis.

Albert Tompkins, who comes of a tennis family, and had formerly been marker of the Manchester (England) Tennis and Racquet Club, is the instructor and marker.

Tennis is a comparatively new game in this country, and the court pictured on the first page is the first and only one ever built in New York. Owing to the expense of building and maintaining both tennis and racquet courts, these luxuries are naturally confined to the large cities. The only racquet courts in this city, besides those described, are the two courts of the University Athletic Club, formerly belonging to this club before it moved into its present quarters in 1891. The only other racquet courts are in Boston and Philadelphia, and the private court of Mr. Eugene Higgins, at Morristown. Boston boasts of two tennis courts, one being in the Athletic Club building, the other belonging to Mr. Fiske Warren. There is also a court at the Casino, in Newport. Championship matches have been arranged to be played in Boston and New York alternately each year. The first match took place in the New York court, last year, and was won by Mr. R. D. Sears, the ex-lawn tennis champion. This year the match was played in Boston, and resulted in the first instance in a tie. Mr. De Garmandia of New York defeated Mr. Fiske Warren, and was then defeated by Mr. R. D. Sears, who was then in turn defeated by Mr. Warren. In the play-off, Mr. Sears retired, owing to disablement, and Mr. Warren won the championship for Boston, defeating Mr. De Garmandia in a closely contested match.

The Age of the Earth.

Among the wider problems of natural science toward the solution of which contributions have been made during last month, the most striking is that of the age of the earth. Mr. Clarence King, the well known American geologist and explorer, contributes an elaborate article on the subject to the *American Journal of Science* (ser. 3, vol. xlv., pp. 1–20, pls. i., ii.), in which he claims to have advanced Lord Kelvin's method of determining the earth's age to a further order of importance. He discusses the experimental investigations of Dr. Carl Barus on the effect of heat and pressure on certain rocks, and particularly selects the case of diabase, which has a specific gravity approximately equal to the average specific gravity of the earth's crust. In the light of the new facts, he then reconsiders the probable rate of cooling of the earth, rendering more precise the conclusions of Lord Kelvin. As the result of the detailed discussion, Mr. King concludes that the earth's age probably does not exceed twenty-four millions of years—in fact, that the estimate of the physicists is approximately correct, while that of the geologists is "vaguely vast."

Relief Map of the Inter-Continental Railway.

The Inter-Continental Railway Commission have prepared a fac-simile in miniature of Central and South America to show the surveys of the proposed railroad intended to unite the systems of North and South America. The work was done by the hydrographic office, and is a faithful representation of the topography of the countries named. It is about twenty-five feet long and will be sent to the World's Fair as a part of the government exhibit. In addition to the lines surveyed for the railroad, the map also shows the routes of the present and prospective steamship lines from North to South America, with the names of their terminal ports and intermediate stopping points, if any.

CORN husks boiled in caustic soda are being utilized for the manufacture of paper. The cooking process results in the formation of a spongy, glutinous paste, which is subjected to heavy pressure so as to eliminate the gluten, the fiber remaining being made into paper in the ordinary way.

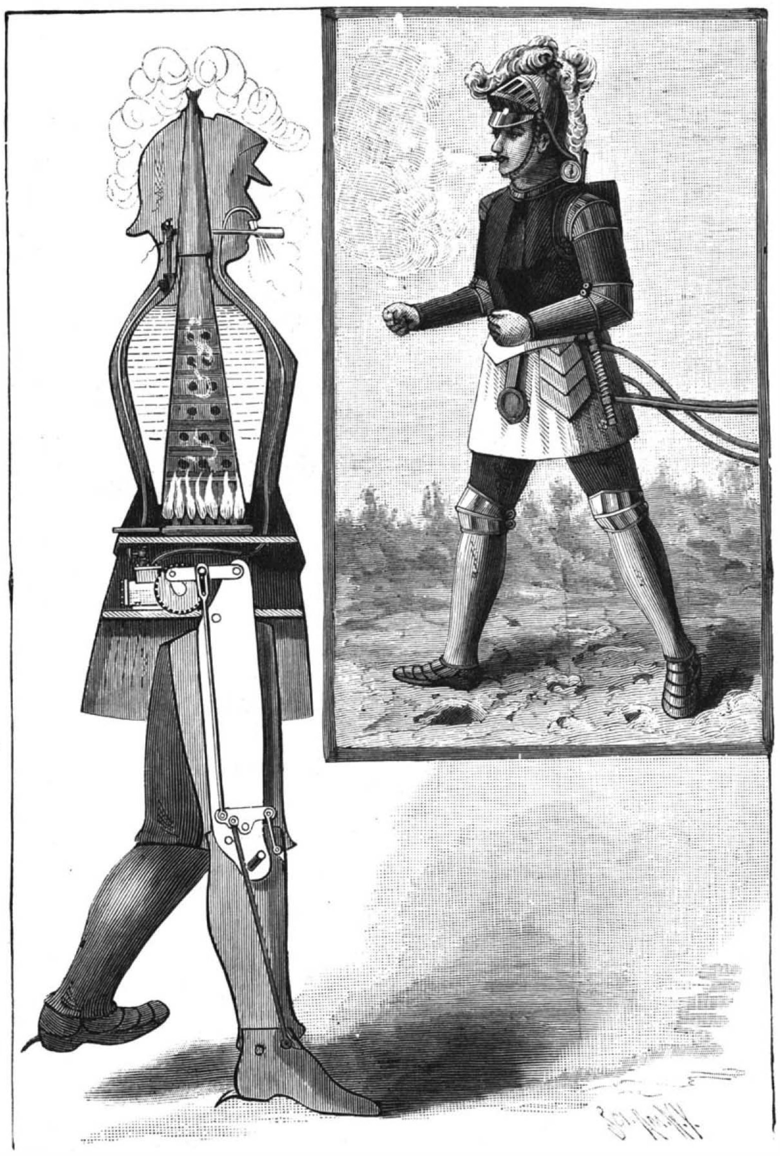
THE STEAM MAN.

A number of years ago what purported to be a steam man was widely advertised and exhibited in this city. The remains of the individual in question were quite recently to be seen in one of the downtown junk stores. Within the last two years the project has been taken up by another inventor, and a practical steam man that actually walks and exerts considerable tractive power has been exhibited in actual operation in this city and elsewhere. It was invented and constructed by Prof. George Moore. Prof. Moore is of mixed Scotch, English, Irish, and Dutch extraction, and is a native of Canada. His steam man seems to be a native of America.

In our illustration we show the section and general view of the steam man. In the body is the boiler, containing a very large heating surface, and which is supplied with a gasoline fire. Below the boiler is situated the engine. While small in size, it is a high speed engine running up to 3,000 revolutions per minute or more, and hence is of high power, the combination of boiler and engine giving about ½ horse power. From the engine the exhaust pipe leads to the nose of the figure, whence the steam escapes when the machine is in motion. Through the head the smoke flue is carried and the products of combustion escape from the top of the helmet. The steam gauge is placed by the side of the neck. The skirts of the armor open like doors, so as to give free access to the engine. The main body of the figure is made of heavy tin. By reducing gear the engine is made to drive the walking mechanism of the figure at reasonable speed.

In our sectional view we show the combination of levers by which the figure is made to walk. The engine imparts a swinging to the whole length of the leg from the hip; a second swinging motion, from the knee downward, is accomplished by a similar system of levers and connections, and, finally, a true ankle motion is given to the foot by the rod running down through the lower leg. The heels of the figure are armed with calks or spurs, which catch on the surface on which it is walking and give it its power. As exhibited the steam man is connected to the end of a horizontal bar about waist high, which is fastened to a vertical standard in the center of the track. Thus supported, the man walks round in a circle at quite a rapid rate of progress.

For the last eight years the inventor has been at work on a larger steam man, which he hopes to have in operation during the present year. The new one is designed for use on the open streets and is to draw a wagon containing a band. In the upper figure we indicate the method of attachment to the wagon which has been adopted. By the long spring at the side of the figure an elastic connection is secured, so that the figure shall always have its weight supported by the ground. The present man, which is about 6 feet high, when in full operation, cannot, it is said, be held back by two men pulling against it. The larger man, built for heavier work, is expected to pull as many as 10 musicians in his wagon. Our cuts show the general appearance of the figure, which is attired in armor like a knight of old, and which appears to be thoroughly operative. The action is quite natural, and the hip, knee, and ankle motion of the human leg have been very faithfully imitated. The figure moves at a brisk walk and can cover about four or five miles an hour.



THE STEAM MAN.

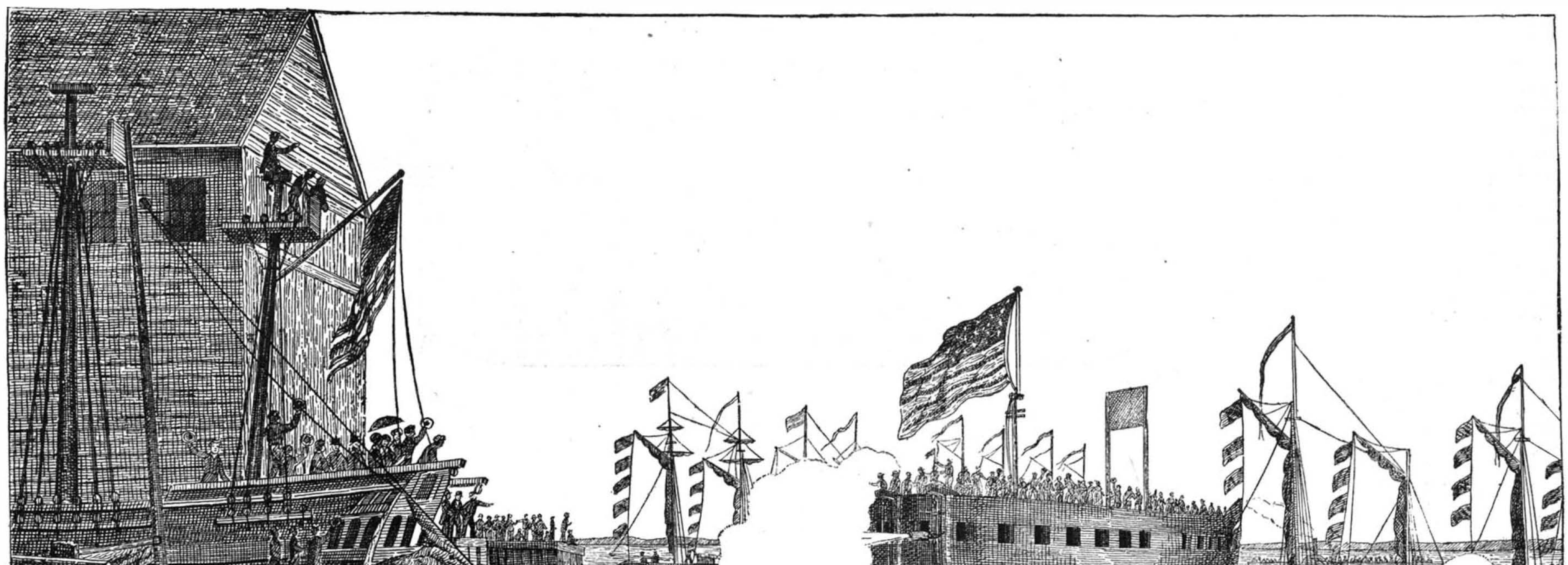
THE FIRST WAR STEAMER OF THE WORLD.

Robert Fulton, illustrious from his connection with the early invention of steam navigation, was not content to apply his inventive and constructive genius to passenger ships alone. During the war of 1812, when our navy was making a glorious record at sea, its disproportion to the work which it had to do in protecting the great line of coast was evident. For the defense of cities and harbors, Fulton designed a steam ship of war, which he called the Demologos, the first war steamer of which there is any record. Fulton's original design for the Demologos presents a double-ended ship with two keels, flat bottom, and with a gun deck and main deck. Her sides were to be 5 feet in thickness, diminishing below the water line. In her center was a well containing a paddle wheel designed for her propulsion. A single cylinder engine was to be provided to turn the shaft; the weight of the engine on one side was counterbalanced by the weight of the boiler on the other. Twenty guns were to be carried by this craft. Her length was to be 140 feet, width 42 feet. The engraving, page 234, represents the original sketch submitted by Robert Fulton to the President of the United States. Fulton intended it to carry a strong battery, with furnaces for red hot shot, and to be propelled by steam alone at the rate of four miles an hour. It was proposed to have submarine guns suspended from each bow to attack a ship below the water line. An engine was to have been added to discharge hot water upon the enemy to repel boarders.

By special legislation a law was passed in 1812, authorizing the construction at New York of one or more floating batteries of this description. A sub-committee of three gentlemen obtained recognition by the government as agents for the construction of the ship: Samuel L. Mitchell, Thomas Morris, and Henry Rutgers—three good New York names.

The work of construction was carried out under the direction of Fulton as engineer, and Messrs. Adam and Noah Brown, of this city, as the naval constructors. Her keels were laid in the shipyard at Corlaers Hook, on the East River, New York, on June 20, 1814, and on the 29th of the following October she was launched in the presence of many spectators. She was named the Fulton the First. We give below a view of the launch, as drawn on the spot by the artist Morgan.

Our sketch of the launch shows her safely embarked in the water, firing her bow guns, while in the distance

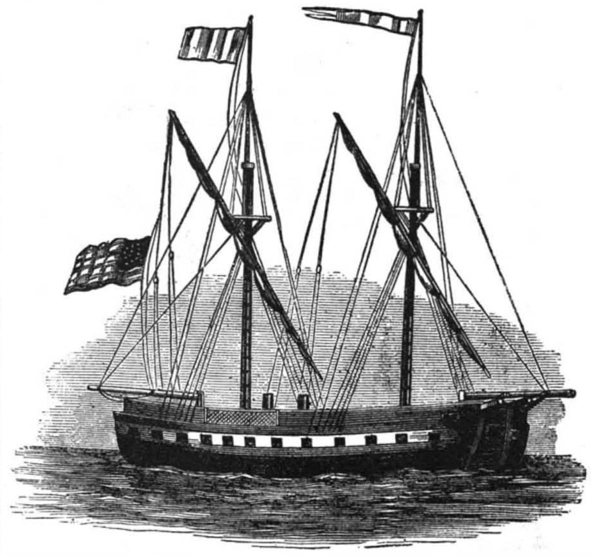


LAUNCH OF THE FIRST WAR STEAMER, THE FULTON FIRST, AT NEW YORK, OCTOBER 29, 1814.

the low shores of Long Island are visible, not showing a single house where now is the great city comprising the Eastern District of Brooklyn. As launched, she was considerably modified from the original plans. She was 156 feet long, 20 feet deep, and 56 feet broad. Instead of a small well for the paddle wheel, a long channel, 15 feet wide and 66 feet long, was provided for it. On one side of the hull was a copper boiler, 22 feet long, 8 feet deep, and 12 feet wide. On the other side was the engine with one cylinder, 48 inches in diameter and 5 feet stroke. The paddle wheel was 16 feet in diameter and 14 feet wide, giving a clearance of 6 inches from the sides of the channel. It dipped 4 feet. Her tonnage was computed at 2,475 tons—a very large vessel for that period. Her hull was designed by Samuel Humphreys, of New York, and cost $144,949. The boilers and engines were designed by C. W. Copeland. The engine cost $40,199 and the boiler $93,396. Great difficulty was experienced by the commissioners in getting men to work on her. It was war times. Many of the New York ship builders were gone up to the lakes. Material was very difficult to supply; guns were transported by land from Philadelphia, over the "miry roads of New Jersey," as the commissioners described them. Twenty heavy cannon were thus brought to New York. As completed, she was to carry thirty long 32-pounders and two Columbiad 100-pounders. In the daily papers of these times are found a few notices of the progress of matters. Captain David Porter expresses, in 1814, the highest ideas of her capacity. He expects her to draw no more that 10 feet with all her machinery, guns, and crew on board.

In the New York *Evening Post* of October 14, 1814, it is announced that "the Albany steamboat will postpone its trip to Albany until the Sunday following the launch." "The steamboat Williamsburg," it is announced in the *Post* of October 28, 1814, "will accommodate such persons as may apply at the foot of De lancey Street." Finally, in the *Evening Post* of October 29, we find that "the Fulton the First was triumphantly launched amid the roar of cannon and the shouts and acclamations of upward of 20,000 people." A 32-pounder was discharged from her deck to give warning to the people. The jar of this discharge started her down the ways a quarter of an hour ahead of time. Her subsequent career was uneventful until the end came. In June, 1815, her engine was in a condition to try her, and on the first of the month at 10 o'clock, she went down New York Bay to the Narrows, on her first trial trip. On the Fourth of July of the same year she made a 53 mile passage out on the ocean and back in 8 hours and 20 minutes, and in September she made another trial trip, going against a three mile tide at the rate of 2½ miles an hour.

The war terminating, she was moored on the flats abreast of the Navy Yard in Brooklyn, where she was used as a receiving ship. On June 4, 1829, about 2:30 P. M., she blew up; 24 men and a woman were reported killed, 19 wounded, and 5 missing. But a few minutes before the explosion, Commodore Isaac Chauncey, Commandant of the Navy Yard, had been on board her. While in his office he heard the explosion, which seemed to him no louder than a 30-pounder. Owing to her very decayed state, she was blown to pieces, although there were not more than 2½ barrels of damaged powder on board. There is no question that if she had been used in the war she would have proved a very formidable ship for those days, and would have done execution as great in degree as that done during her brief career in the civil war by the famous Merrimac.



THE WAR STEAMER FULTON THE FIRST.

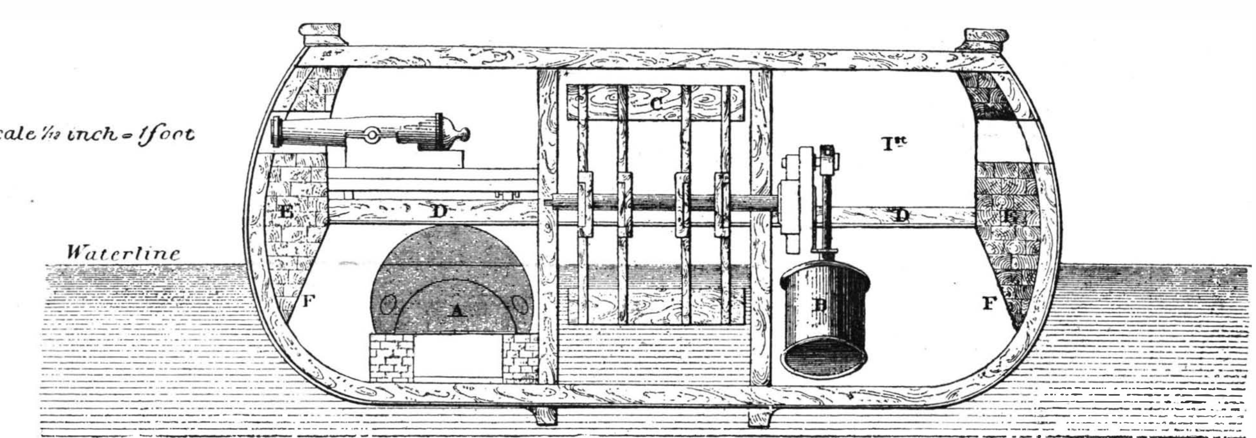
We give a small engraving representing the appearance of the Fulton the First when finished and rigged. For this cut we are indebted to the publishers of the Memorial History of the City of New York, edited by James Grant Wilson. No description is given of the vessel, nor is any reference made as to the source from which the picture was derived. We have not been able to find an authentic portrait of the vessel, except that taken on the day of her launch by Morgan.

We give a copy of the original drawings of the ship as prepared by Fulton, which we take from the "Naval and Mail Steamers of the United States," by Charles B. Stuart, published in 1853. The name proposed by Fulton for his novel craft was Demologos, a term derived from the Greek and signifying "Voice of the People."

"DEMOLOGOS"

Figure I[st] Transverse section A her Boiler. B the steam Engine C the water-wheel. E E her wooden walls 5 feet thick, diminishing to below the waterline as at F F. draught of water 9 feet. D D her gun deck.

Scale 1/12 inch = 1 foot



Scale 1/24 inch = 1 foot

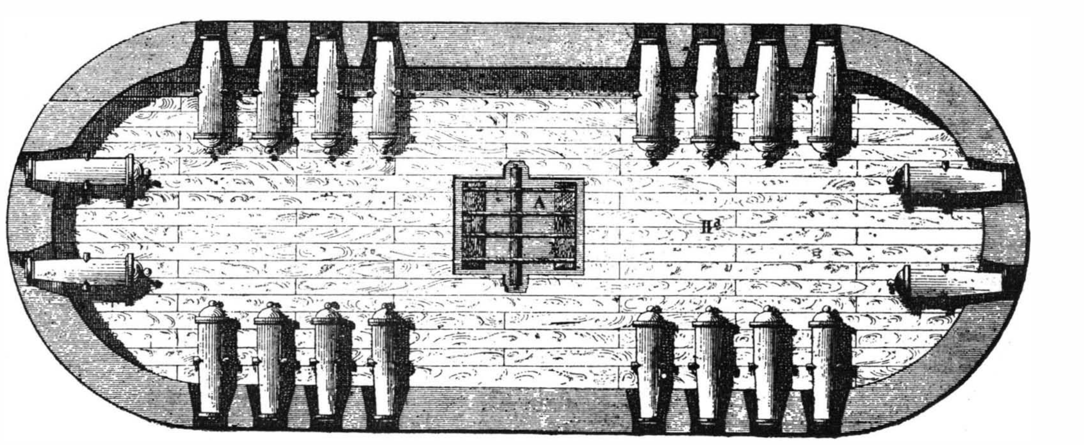
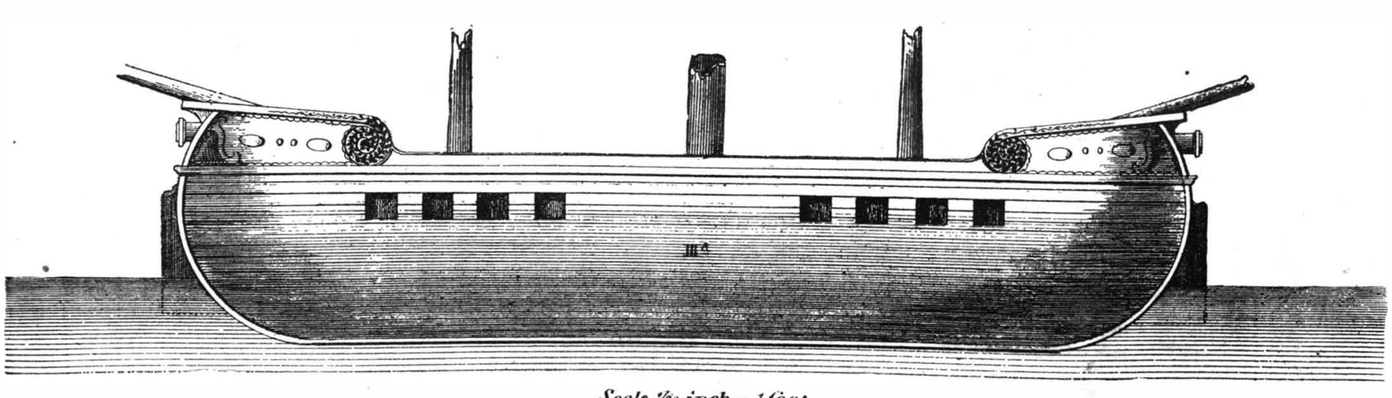


Figure II[d] This shews her gun deck. 140 feet long. 24 feet wide; mounting 20 guns A the Water wheel

Figure III[d] Side-View



Scale 1/24 inch = 1 foot

ROBERT FULTON
November 1813

THE WAR STEAMER FULTON THE FIRST.

The Panama Canal and Lesseps.

In the *North American Review* for February, Rear Admiral Daniel Ammen, United States Navy, Chief of the Bureau of Navigation, who represented the United States at the Panama Canal Congress of 1879, gives his recollections of the proceedings. He remarks that he got suspicious at an early point in the proceedings that the congress was not called to discuss, but to assure and confirm what had already been prearranged. Mr. Menocal, an American engineer, pointed out the difficulties to be expected with the Chagres River, and Sir John Hawkshaw drew attention to the fact that the rivers should be retained for the natural drainage, in which case locks would have to be used. In short, the admiral states that the ablest engineers at the congress favored the Nicaraguan route, while virtually all the other delegates advocated the Panama route. M. De Lesseps told his adherents that it was their business to vote for a sea-level canal and his to make it, but the ablest members of the Paris Society of Engineers absented themselves when the vote was taken. On June 20 of that year this society discussed the question of isthmian canals, when M. De Lesseps appeared unexpectedly and appealed to the society to discontinue the discussion, it would be greatly to the injury of French interests, and this unreasonable request was immediately complied with. An eminent member of the society informed the admiral that he had little conception of the professional injury one would suffer by incurring the displeasure of M. De Lesseps.

RECENTLY PATENTED INVENTIONS.

Engineering.

COMPOUND ENGINE.—Johann Klein, Frankenthal, Germany. This improvement relates especially to the valves, providing a simple valve for connecting the cylinders of a compound engine, and for exhausting them. The steam inlet and outlet is effected in the two cylinders by one single valve, arranged close to the large cylinder, to slide in the steam chest. The valve is connected with the engine in the usual way to move in unison with the pistons, the passages of the large cylinder being very short and the clearance very small, and the passage of the steam from one cylinder to the other taking place in two separate chambers in the valve itself, and nearly the whole force of the steam being utilized.

Railway Appliances.

RAIL JOINT.—John M. Stamp, Carterville, Mo. This joint is especially designed for jointing rails upon curves, the improvement providing a long joint or bridge over several ties, and making a support that will firmly and snugly hold the rails. In connection with a suitable base plate having upright projections and flanges on each side, fish plates of novel form are used on the inside and outside of the rails, lapping the joint, the fish plates being especially designed to afford great strength and be easy of adjustment, while being comparatively light. To suit curves of different degrees it is designed that these fish plates be manufactured in numbers or series, with their inner surfaces convexed or concaved, each part to be stamped to indicate the curve intended for.

RAILROAD FROG.—Cassius C. Andress, New York City. This is a simple and durable frog, having a shifting rail, which may be easily operated in the same way that a switch rail is operated, and shifted to provide a safe and smooth crossing, being used when necessary for a switch rail. The device has a bed with fixed converging rails at the ends, and the shifting rail is held to swing between and register with the fixed rails, lugs secured to the bed limiting the movement of the shifting rail, so that there is no strain on the pins and bolts which hold the rails, as the pressure of the wheel flange on the rail jams the rail firmly against one of the lugs.

STAKE POCKET FOR CARS.—Justo P. Cagigal, San Augustin, Cuba. This is an improvement in pockets and also in stakes for flat cars, and in their arrangement, so that the cars may be conveniently loaded and unloaded, and the stakes easily fastened and unfastened and slipped to one side when necessary. The pockets are designed to be cheaply and strongly made, and means are provided for opening them and releasing the stakes, a number of the latter being held on a horizontal supporting rod.

GUIDE ATTACHMENT FOR CARS.—Thornton E. W. Fay, Philadelphia, Pa. A long rod is suspended longitudinally beneath the car, being firmly held to the car bottom by hangers, and this rod is adapted to loosely fit in and freely move through short open top sockets attached to the sleepers. The improvement is designed to effectually prevent the cars from jumping the track, and is especially adapted for use on curves and grades.

CAR COUPLING.—Gamaliel Jenkins, Queensbury, N. Y. A frame beneath the car is divided longitudinally by a partition and transversely by cross ribs, one of the latter serving as a stop for the drawbar of an opposite car, and the other serving as a drawbar support, the shank of the drawbar sliding through the frame, and having at its rear end a collar. The drawbar has a flattened head adapted to enter the frame of an opposing coupling, and a spring is arranged to twist the drawbar, whose position is fixed by a clutch. With this improvement the cars are automatically coupled as they come together, and they may be uncoupled from the sides or top. The arrangement provides for the use of two drawbars, one for each end of each car, so that if one should break the other would hold the cars.

CAR COUPLING.—William W. Smith, Traverse City, Mich. Two patents have been granted this inventor for devices which will automatically couple the cars as they come together, the uncoupling being readily effected from the sides or top of the car, so that the trainmen do not have to go between the cars, while both forms of coupling are of durable and inexpensive construction and very simple in their operation. According to one patent the brawbar has a mouth in its lower front end, leading to a narrow opening in the top, the link being secured to a sleeve on a transverse shaft in the lower opening, and a locking pin extending from the sleeve into the top opening. A crank shaft on the front end of the car has an arm and rod connection with the link by which the latter may be brought into any desired position, the pin moving in unison with the link. The coupling cannot be accidentally detached, and is not liable to clog with snow and ice. The other patent is for a coupling of the side-latching type, in which the drawhead has an integral forward horizontal tongue, a slotted latch block forming two horizontal flanges, a pivot bolt connecting the flanges and the tongue. A key is adapted to slide vertically in a slot of the drawhead and bear laterally on the inner edges of the latch block flanges, a latching shoulder being formed on the latch block.

Miscellaneous.

SCOURING FIBROUS MATERIAL.—John H. Bickley, West Medway, Mass. This invention relates to apparatus for the cleansing and washing of wool, and the treatment of various fibrous materials, providing for intermittently fading the wool or staple, and supplying the liquid with which it is treated, in a normally filled flushing flume or tube. A staple and liquid feeding wheel or drum is divided into a series of successive compartments, and a liquid supplying cistern above the wheel has a sprinkler with its discharge to one side of the axis of the wheel, there being an automatically engaging stop bar device by which the movement of the wheel is regulated.

HOISTING MACHINE.—John E. Ennis, Duluth, Minn. The elevation of bricks, mortar, and other material in building construction, and other similar work, is especially provided for by this apparatus, which can be operated to bring the hoist cage floor always in the same horizontal plane with the workmen's platform. A vertically movable elevator frame is arranged to support alternately operated cages, in connection with vertically adjustable platform-supporting frames, and mechanism adapted to operate the elevator and the platform frames at the same time, and raise the platform to a greater degree than the elevator frame. The platform adjusting devices and the elevating supporting sheaves can be simultaneously elevated to variable heights by a single operating lever.

FIRE ESCAPE.—William E. Bradley, Middletown, N. Y. Suspended at a convenient point on a building, adjacent to a window, is a frame containing a winding drum and a governor, a brake pulley and brake mechanism, with a lowering cable on which is a hook. A person or weight to be lowered may be fastened to the hook, when the weight causes the cable to unwind with a regulated speed. The lowering to the ground is thus automatically effected, when the cable is automatically wound up again for further use. The device is light and portable but very strong, and not likely to get out of order.

LUMBER TRUCK.—Edward Dodge, Longview, Texas. This is a device of simple and durable construction to conveniently load and carry lumber to and from kilns and other places. It has a pair of double flanged wheels journaled in independent frames connected with each other by cross bars, forming a skid for the lumber to be carried. It is very strong and adapted to carry a heavy load, a number of the trucks being placed at suitable distances apart, according to the length of the lumber.

TRACE.—Ernest F. Saettler, Giddings, Texas. It is the design, according to this improvement, that the portion of the trace in which the eye is located, and which engages a singletree, will be rendered more durable. A re-enforcing plate is located between the straps at the eye portion, the plate having a slot registering with the eye of the trace, while slides receiving the edges of the plate extend over the edges of the trace at the eye, and are secured to the side surfaces of the trace.

CALKING TOOL.—Joseph O. Walton, Titusville, Fla. A roller is journaled in each end of the curved handle of this tool, one roller having a concave face, and there is a longitudinal groove in the handle adapted to receive a pivoted hook, one end of the handle being also provided with a pivoted chisel. The calking material may, with this tool, be thoroughly worked into the seams, or may be dug out of old seams with the hook.

DESK OR CABINET.—Theophilus Billington, Dallas, Texas. This cabinet may be economically manufactured, and is especially adapted for holding typewriting machines. When the cabinet is closed the machine will be completely concealed and protected, and when opened an extensive table is provided at each side of the machine. The table is provided with a drawer, and the roll top is constructed of a series of slats or strips connected by a flexible material.

CENTRIFUGAL HONEY EXTRACTOR.—Oscar M. Hill, Santa Paula, Cal. A frame, mounted to turn, carries shafts supporting the baskets, and the position of the shafts and baskets is reversed by a mechanism of special construction, so that the honey is extracted from both sides of the combs. The device is of very simple and durable construction, and the baskets carrying the combs can be reversed without interrupting the revolving of the frame supporting the baskets.

CHURN.—William F. Martin, Ambia, Texas. The churn body, according to this invention, may be of any suitable construction, but the improvement provides for the ready and convenient attachment thereto of a frame supporting gears and shafts and a crank handle by means of which the dasher rod is operated. The construction facilitates the easy and rapid operation of the dasher rod, and the frame may be readily adjusted to churn bodies of different sizes.

DRESS SKIRT.—Mark Aronson, New York City. This is a lady's garment so made that it may be perfectly fitted on various sized waists, obviating the usual sagging of the waist band and heavy plaited portion at the back of the skirt, and entirely dispensing with the slit or opening in the back of the skirt. The waist band is connected in front, so that it may be perfectly fitted, and the cut-out portion here, as well as the fastening device, is designed to be closed by a flap forming a graceful trimming for the skirt.

BREAST SUPPORTER.—Marie Tucek, New York City. A plate curved to conform to the wearer's body at the front has partial pockets at opposite sides at the top to engage the under side of the breasts, shoulder straps connected with the ends of the plate crossing each other at the back. The top edges of the plate are made concave and the pockets are preferably of silk, canvas, or similar material.

PORTABLE CONFESSIONAL.—Michal H. Sullivan, Fall River, Mass. This is a neat and ornamental structure, which may be put up without tools and has two places for the reception of oral communications from penitents to a confessor occupying a central compartment. It folds compactly into a substantially rectangular package for convenient transport.

DEVICE FOR ADMINISTERING MEDICINE.—F. H. Olmsted, Yokohama, Japan (inquiries to be made of F. H. Henry, 54 Wall Street, New York). This is a graduated glass receiver for liquid medicine, connected at one end with a rubber hand bulb, and having at its other end a detachable tube to be inserted in a bottle from which medicine is to be drawn, whereby the receiver may be charged with the amount of medicine to be given, as measured by the marks on the receiver. A removable mouth is provided to facilitate the giving of medicine from the receiver to infants. The device can be made at a low price, and the glass receiver can readily be thoroughly cleaned.

INDICATOR FUNNEL FOR CANS.—Henry B. Watson, Glen Cove, N. Y. This is a simple and inexpensive attachment, more especially designed to facilitate the pouring of oil from an oil can into a lamp or other vessel, to avoid spilling and prevent overflow. The funnel has a looped supporting arm, and in the funnel slides an indicating float; it is preferably attached to the can spout by a conical sleeve, such a length being given to the arm as to allow the funnel to swing freely, while at the looped end of the arm is a counterbalance weight, automatically adjusting the funnel to suit the inclination of the can body and spout.

TWINE HOLDER AND TAKE-UP.—William Bentley and James D. Fuller, Lethbridge, Canada. From a suspensible holder cup adapted to deliver the twine strand freely is suspended a take-up device, consisting of a tubular casing in which is a vertically sliding weight by means of which the operation of a tension bar is regulated. The too free delivery of the twine is thereby prevented, while the twine is fed as needed, and after the desired length has been severed, the strand is locked to prevent further unwrapping of the ball.

CIGARETTE ROLLING CASE.—Eugene Schmidt, Stillwater, Minn. This is a pocket case to hold tobacco, paper, matches, etc., for the convenience of smokers of cigarettes. It is of stamped sheet metal, and arms jointed to the cover are attached to a roller in such a manner that when the case is closed the roller passes along on the bottom, carrying a sheet of silk or other flexible material, in a trough-like bend of which a sheet of paper and the tobacco have been placed, the cigarette being discharged complete.

SPINNING TOP.—Nathaniel McLaren, New Perth, Canada. This is an improvement in tops rotated by an internal spring, the spring being coiled upon a rotatable spindle and held under tension by a ratchet mechanism which is released at the will of the operator.

TOY PISTOL.—Carl Neuhaus, Vienna, Austria. This is a self-cocking pistol more especially designed to explode paper percussion caps. The invention consists principally of a fixed block, a casing containing a ribbon of percussion caps and adapted to pass in front of the block to be exploded by a hammer, the hammer imparting a traveling motion to the ribbon.

RUBBER TOY.—Orville Carpenter, Pawtucket, R. I. The toys are, according this invention, made of varying thicknesses of rubber, the thin parts of rubber being in those portions of the toy which may be selected to represent the form in greatly exaggerated size, and this exaggeration is then produced as the body of the toy is squeezed in the hand, the thin parts becoming puffed out or elongated, making some exceedingly grotesque and comical figures.

SURGICAL APPLIANCE.—Frank Orth, 89 Brown Street, Anderson, Ind. This is an apparatus to be fastened to the body, by means of which, under certain conditions, an application or douche of cold water will be automatically made on a part of the body.

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

NEW BOOKS AND PUBLICATIONS.

"THE ELECTRICIAN" ELECTRICAL TRADES DIRECTORY AND HANDBOOK FOR 1893. Eleventh year. London: George Tucker. 1893. Pp. cxxxi, 844. Price $3.

This work is a very valuable contribution to the current biography of electricity, independent of its very exhaustive directory of the names of electrical concerns and individuals connected with the electrical and allied industries. In the biographies we note that they are well kept up to date, and the portraits with them are of special value.

BUILDINGS AND STRUCTURES OF AMERICAN RAILROADS. By Walter G. Berg. New York: John Wiley & Sons. 1893. Pp. xxxiv, 500. Price $7.50.

In this beautiful work the publishers give a second contribution to American railroad engineering which may rank as a worthy companion to their recent work upon the locomotive engine. The title of the work describes its contents. It is enough to say that in it passenger depots of the largest and smallest size and train sheds are treated, while in the smaller line signal towers, protection sheds, sleeping quarters, reading rooms, and the smallest details of the structural work of railroads are included. A very exhaustive table of contents and a very full index illustrate the principles followed by the publishers in all of their technical publications.

DES INGENIEURS TASCHENBUCH. Published by the Academic Society "Hutte." 15th edition. 1892. Berlin: W. Ernst & Sohn. New York: Gustav E. Stechert, 828 Broadway. Price $3.

This well known engineer's hand book has again been thoroughly revised to make it one of the foremost reference books in all branches of engineering, and to bring it up to the requirements of the present day. It is not issued by a single individual, but by a German society having as its contributors for the different branches the most eminent talent to be found in the German and Austrian empires. It contains nearly 1,500 pages of valuable reference matter.

PUMPING MACHINERY. A practical hand book relating to the construction and management of steam and power pumping machines. By William M. Barr. Philadelphia: J. B. Lippincott Company. 1893. Pp. 447. Price $5.

This work purports to be a type of hand book on the subject of steam and power pumping machines. It appears to be a valuable contribution on the subject, treating on all kinds of pumping engines, with numerous examples of high duty machines. Under the Worthington engine, we find the compensating cylinders with their accumulators treated of at considerable length. It is so for other features of all the different classes of pumping apparatus. The details of the subject, such as valve and packings, are also included, and numerous cuts add to the value of the work.

A TREATISE ON PUBLIC HEALTH AND ITS APPLICATIONS IN DIFFERENT EUROPEAN COUNTRIES. By Albert Palmberg. Translated from the French edition and the section on England edited by Arthur Newsholme, M.D. London: Swan Sonnenschein & Co. New York: Macmillan & Co. 1893. Pp. xx, 539. Price $5.

This excellent and exhaustive work deserves warm commendation as a contribution to the sanitary engineering of European countries. Such works are of special service in America, where, while sanitary engineering has attained a great development, it is in danger of becoming too much Americanized. A work of the present sort, bringing us face to face with the best European practice in these matters, will be found of particular value to our sanitary engineers, as we are too apt to believe that we in this country possess all the requisite knowledge of the subject, while it may be doubted that we possess even the best in many respects.

THE VOLTAIC CELL: ITS CONSTRUCTION AND ITS CAPACITY. By Park Benjamin. Illustrated. New York: John Wiley & Sons. 1893. Pp. iv, 562. Price $5.

In this large work we at last have what, on its face, would appear to be an analytical and satisfactory treatment of a very large subject. The author in it describes a great number of different batteries, with numerous illustrations where required. He treats of the theory of the cell, of its measurements, of different cells classified into general divisions, and after giving some general practical data, devotes a section to the storage cell or secondary battery. A final chapter is devoted to the various sources of electricity and the bibliography of the subject. It will be seen, therefore, that Mr. Benjamin has done an excellent work in putting all this information into shape. As frontispiece we have a reproduction from Sulzer's book of 1767, giving in a foot note what is claimed to be the first suggestion of the voltaic cell.

FROM DARKNESS TO LIGHT. Author's edition. San Francisco, Cal.: Terrence Duffy, author and publisher. 1893. Pp. vi, 280.

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Notes & Queries

HINTS TO CORRESPONDENTS.

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

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

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

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.

(4859) G. F. O.—We give three formulas for marine glue from our new Cyclopedia of Receipts: 1. Caoutchouc, 1 ounce, genuine asphaltum, 2 ounces, benzole or naphtha, q. s. The caoutchouc is first dissolved by digestion and occasional agitation, and the asphaltum is gradually added. The solution should have about the consistency of molasses. 2. Take of coal naphtha, 1 pint; pure (not vulcanized) rubber, 1 ounce; cut in shreds, and macerate for ten or twelve days, and then rub smooth with a spatula on a slab, add, at heat enough to melt, 2 parts shellac by weight to 1 part of this solution. To use it, melt at a temperature of about 248° Fah. 3. Elastic Marine Glue.—Dissolve unvulcanized rubber in chloroform, benzole or bisulphide of carbon. Ropes or other material exposed to the action of air and water are coated with this glue. Whiting or fine sand may be added.

(4860) S. B. L. asks: 1. A mother obtains a divorce and marries again. Is this husband the stepfather of her children, although their father be still living? In other words, have they both a father and a stepfather? A. According to the "Century Dictionary," and assuming the validity of the second marriage and possession of the children by the mother, they would be stepchildren of the new husband. 2. In using a solution of hydrosulphate of sodium in the laboratory as a substitute for sulphureted hydrogen, are the results in all cases identical with those produced when the latter is used, and are the precipitates of the same composition? If not, does the composition vary by any fixed rule? If so, please give same. A. The precipitates as far as produced would be the same. But as sulphureted hydrogen is used to precipitate acid solutions, the other could not conveniently be used as a substitute, as a large addition of acid would be required for the H_2S group of bases. 3. What is the chemical formula for hydrosulphate sodium? A. NaHS.

(4861) E. H. N. asks: 1. How many cubic feet of gas will one gallon kerosene oil give off when heated under the best conditions? Sp. gr. of oil 0·78, test 160° Fah., and normal barometer; and what is the probable temperature of the gas burning as it escapes from the vent holes in a coil of heated pipes? This coil is kept hot by the burning of this gas. The oil is converted into gas in this coil. A. If simply vaporized, you should get at the boiling point of the oil about 24 cubic feet of vapor. The temperature cannot be given, as it will depend on the conditions of combustion. 2. What chemical will wash off the red ink used by book dealers on rubber marking stamps in marking books? It must not injure the paper or printing. A. The ink is practically ineradicable. 3 In a semicircle why does not the center of gravity come on the versed sine at the intersection of line dividing the area equally and not $\frac{2r}{\pi}$ from the diameter? A. This is not a question of areas only, but of moments and areas. The product of the area on one side of the center of gravity by the distance of its own center of gravity from the main center of gravity is its moment. The moments on both sides must be equal.

(4862) F. H. asks: 1. How can I prevent chemical action in a Bunsen pile on an open circuit, the zinc being amalgamated? A. There is no way of preventing it except by removing the zincs from the solution. The Bunsen battery is not adapted for open circuit use, as the two solutions diffuse and gradually mix. 2. How can I prevent the deposit of zinc sulphate on the amalgamated zinc plate of a Bunsen pile, and at the same time prevent chemical action on an open circuit? A. You let your solution get too concentrated. You probably have run your solution until exhaustion. Renew your solution more frequently. Thorough amalgamation and the use of a little mercuric nitrate in your solution will help to protect the zinc. 3. Please give me (in millimeters) the length and thickness of a platinum wire, by which, using 4 Bunsen piles, I may boil 300 cu. cm. of water, and what length of time will it take for the water to boil? A. This question cannot be specifically answered. Three centimeters of wire 0·26 millimeter diameter in the open air would be heated to about 200° C. above the atmosphere. It seems doubtful if you could boil the water with such a battery.

(4863) G. F. A. writes: I would like to know what diseases are caused by sewer gas. Have alternating currents ever been used for killing disease microbes? How can I make a direct current converter for lowering the voltage of 120 volt current? What is the cause of sparking on the commutators of motors, and what substance is it that is used for covering and filling the spaces between the coils of wire on armature, and how can I make it? Also please tell me of a good polish for black walnut. I want to polish on the lathe. A. Sewer gas is apt to produce malaria, diphtheria and fevers. We do not know that alternating currents have been used for killing disease microbes. You can convert only by means of a motor dynamo to reduce the voltage of a current. Sparking is due to an overload or to bad adjustment. For polish for black walnut use alcoholic shellac varnish 2 parts, boiled oil 1 part, shake well and apply with a cloth.

(4864) E. O. S. asks: How fast would the simple motor described in Hopkins' "Experimental Science" run a boat 12 feet long and 28 inches wide? What should be the size of the propeller? A. A great deal depends upon the model of the boat. If it is well proportioned, the motor might be made to run it at the rate of three or four miles an hour. The propeller should be a two-bladed one, 6 or 7 inches in diameter. 2. I noticed in the issue of January 23, 1892, page 59, query No. 3925, that you state that two storage batteries would run the motor. How long would they run it? A. The storage battery ought to run the motor for 4 or 5 hours. 3. What kind of storage batteries could I use? Could I use batteries having an electromotive force of 2·3 volts and a capacity of 20 ampere hours per cell? A. Probably two such batteries would answer your purpose.

(4865) E. S. B. asks if a generator (such as used in telephone sets) can be wound so as to serve as a motor. Would it have to be demagnetized, and about what size wire would the field require? Same as is on the armature? A. The magneto will answer as a motor. It is not necessary to demagnetize the magnets, but unless you use a very high electromotive force, it would be advisable to rewind the armature with coarse wire and provide a commutator. For use with a Bunsen or plunge battery probably. No. 18 wire would be about right.

(4866) H. D. asks: What battery is best suited to run the simple electric motor described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641, and how many cells would it take to run the motor to its full capacity? A. Use 7 or 8 cells of bichromate battery, with zinc and carbon plates 6 x 8 inches. 2. Also do you know of any acid-proof varnish that could be used to varnish battery boxes made of wood? A. You might saturate your wooden boxes with paraffine.

(4867) R. W. S. asks: What is the voltage and the amperage of a cell of gravity battery? How many cells will be required to run a motor requiring four volts and six amperes? If the motor is run day and night, how long before I will have to recharge the battery? A. A gravity battery has an electromotive force of nearly 1 volt. The amperage, of course, depends upon the resistance. If the battery has an average resistance of 3 ohms, it would only have a current of one-third of an ampere. A battery of this kind is not suitable for running a motor. Better use the Bunsen battery.

(4868) H. M. H. says: Please tell me in Notes and Queries how I can incorporate tin and phosphorus to make phosphor tin. A. Phosphor tin is made by mixing phosphide of tin with the melted tin. The whole process of making the phosphide of tin and phosphide of copper for the phosphor bronzes, and also for the alloys of phosphor bronze and phosphor tin, is described in "Metallic Alloys," by Brannt, pages 204 to 207.

(4869) O. F. E. asks for a simple method to test adulterated vinegar. A. Place some white sugar on a saucer, moisten thoroughly with the vinegar, place the saucer over a kettle or saucepan containing water, and evaporate to dryness by boiling the water. A blackening of the sugar indicates the presence of sulphuric acid.

(4870) J. C. C. asks what sandever is. A. It is a polishing material made by collecting undecomposed salts which rise to the top of melted glass in the glass house.

(4871) J. McK. asks: In the manufacture of permanent magnets, what is the best material for the magnet, and to what depth should they be wound as compared with the thickness of the bar? A. Any good steel that will harden will answer for permanent magnets. The steel should be hardened and the temper drawn to a purple. The depth of the wire surrounding the arms of the magnet should not exceed the diameter of the arms.

(4872) E. D. asks for a cement for cracks in wood. A. Put a suitable quantity of fine sawdust of the same kind of wood into an earthen pan, and pour boiling water on it; stir it well, and let it remain for a week or ten days, occasionally stirring it; then boil it for some time, and it will be of the consistence of pulp or paste; put it into a coarse cloth and squeeze all the moisture from it. Keep for use, and, when wanted, mix a sufficient quantity of thin glue to make it into a paste; rub it well into the cracks, or fill up the holes in your work with it. When quite hard and dry, clean the work off, and, if carefully done, you will scarcely discern the imperfection. From the Scientific American Cyclopedia of Receipts, Notes and Queries.

(4873) H. D. says: I wish to insert some cogs in a cast gear wheel of 2 inch face. Dovetailing is not sufficient to hold them, as rim of wheel is too thin to get deep cut. Can you tell me of some means of soldering or brazing that will be of use in addition to dovetailing? Cogs to be of wrought iron. Also please give best method of mending broken castings, with plain directions for use. A. You can not solder or braze a tooth to your cog wheel that will stand any strain. Broken casting may sometimes be mended by splicing pieces. For instructions in all kinds of brazing and soldering, see the "Metal Worker's Handy Book," by Brannt, $2.50 mailed.

(4874) A. E. F. writes: A telephone is connected between two towns, say from A to B, a battery being in use at A and also one at B. When I speak into the transmitter at A, which battery transmits my speech and which battery causes my speech to be received? And why? A. The battery connected with the transmitter is the one which produces the current that transmits the message. A little study of the theory of the telephone will furnish you with an answer to your query and the whys and wherefores as far as they can be known.

(4875) W. M. L. asks the best process for coppering cast iron. A. The castings should be first pickled in a sulphuric acid bath, 1 part acid, 2 parts water, to remove all scale; scoured with clean sand and brush; wash quickly, and dip in a bath of sulphate of copper in water saturated, when the articles will become covered with copper, then wash in hot water. Small castings may be tumbled in sawdust saturated with the sulphate of copper solution.

(4876) E. D. H. asks: Would a live electric light wire have any influence over a telephone wire about 100 feet distant, wires running parallel? During the day, when the current is shut off in the electric light wire, the telephone works all right; but at night, by placing the ear to the receiver, a buzzing sound can be heard. Can you tell me the cause of this? A. Your telephone line undoubtedly suffers from induction from the electric light wire. The only remedy for this is to use a metallic circuit.

(4877) E. Y. asks: 1. Does the supply of practical electricians exceed the demand? In your judgment, will it be possible for electricity to supplant steam in railroading? A. The supply of first class electricians does not exceed the demand, and probably never will; but there are thousands of so-called electricians who scarcely know the first principles of electrical science. It is supplanting or competing with steam to some extent already. 2. Does Edison's low potential non-insulated railroad give promise of success? A. We believe Mr. Edison has not yet completed his experiments with the low potential railroad.

(4878) F. C. asks: If an electro-magnet be wound with two wires instead of one, wound side by side at the same time as one wire, so that each shall have the same number of ampere turns; and the wires carefully insulated from each other; if a current be sent through one coil, then a current of the same strength be sent through the other coil, but the second current sent around the core in the opposite direction from the first; the first trying to polarize the core north and south; the second working for an opposite effect; will not the result be, that as the two forces in opposition are equal, the one will neutralize the other, and the coil fail to be polarized either way? If not, what will be the result? A. If the current is switched from one wire to the other at perceptible intervals, the polarity of the magnet will be reversed at every change in the direction of the current; but if the changes are of very high frequency, the magnetic effect will be practically nothing.

(4879) A. H. writes: A and B are partners and have a small planer that requires four horse power to drive it at the speed of 2,500 revolutions per minute. C offers A and B choice of two engines. No. 1 is 4 × 5 inch cylinder and has 18 inch pulley. No. 2 is 4 × 6 inch cylinder and 24 inch pulley. Both run at 200 revolutions per minute. A says that both have the same power, that the extra inch in No. 2 stroke is to make up for the large pulley. B says that No. 2 has the most power. Which is right, A or B? A. B is right; the 4 × 6 has the most power. The larger pulley gives the greater belt speed.

(4880) R. A. C. asks: Is the current generated in the secondary coil of an ordinary transformer alternating or continuous? A. The secondary current of the transformer is alternating.

(4881) F. L. G. asks: 1. How many storage cells with six lead plates, one foot square each, coated with red lead solution, would it take to develop enough power to run two or three sewing machines, using motor described in "Experimental Science"? A. It will require from four to six such cells to run the motor referred to. 2. Could I use four gravity cells to charge two storage cells by charging one at a time? A. Yes. 3. How long does it take to charge them? A. From five to seven hours.

(4882) E. L. S. asks: 1. Have you ever published description and construction of a motor suitable for running a sewing machine or small lathe? If so, what number contains it? A. SUPPLEMENT 641 contains a description of a motor for running sewing machines. We also refer you to SUPPLEMENT 759. 2. Will an incandescent circuit furnish sufficient power to run it? A. Yes; but the motor must be wound to adapt it to the circuit upon which it is to be used. 3. Please give me a rule for figuring what weight a beam will support if supported at both ends and weight in middle, if the tensile strength of the material is known. A. Haswell gives the following formula: $\frac{l^3 W}{24 b d^3 C} = D$ and $\frac{24 b d^3 C D}{l^3} = W$. l representing length; b breadth, and d depth, all in inches; W, weight or stress in pounds or tons; C, a constant; and D, deflection in inches. 4. Has Thomas A. Edison ever invented a machine so a person in one place can see another person, miles off, by the aid of an electric wire? A. Edison is reported to have worked upon something of the kind; but the details of his experiments have not been made public. 5. If an incandescent lamp has a certain resistance and a resistance equal be placed in the circuit, will it extinguish the lamp? A. Yes, practically, if the lamps are put in series.

(4883) H. McK. asks: 1. Suppose the ground freezes 3 feet deep before much snow falls, then there comes 2 feet of snow. After a month's time will the frost be as deep as it was before the snow came, or not? A. There is a slight tendency to lessen the depth of the frost when deeply frozen earth is covered by deep snow, from the warmth of the earth below. 2. Do you know of any cheap silver plating outfit that will plate small articles like watch cases that will do fair work? If so, where can I get one? A. A simple galvanic battery and a silver solution is all that is needed for plating small articles.

(4884) W. L. C. says: I am a moulder in a brass foundry, and the fumes or smoke from the molten brass make me sick. Do you know of a remedy for allaying such fumes? A. The fumes arising from a brass melting pot are oxide of zinc and are injurious. There is no remedy, but you can keep it from your lungs, while pouring the metal, by covering your nose and mouth with a thin handkerchief folded cornerwise and tied around your neck, so that it will loosely hang over the lower part of the face like a close veil.

(4885) J. W. S. asks: Is it possible to build a cigar-shaped balloon of aluminum of sufficient strength to resist the pressure of the atmosphere, after exhausting the air from the inside, and yet be of such specific gravity as to float in the atmosphere like an ordinary balloon filled with gas? If so, what dimensions should such a balloon have to lift 1,000 pounds over and above its own weight? A. We think it is impracticable to build a balloon to float in the air, with the internal air exhausted, or in other words a vacuum balloon, as you suggest.

(4886) R. R. S. writes: 1. A drilled well here, 400 to 500 feet deep, furnishes water which in 1887 contained 7½ grains dissolved solids to the gallon, in 1889 13½ grains, and in 1891 still more. Is it very unusual for a permanent water supply to increase each year the amount of solids it dissolves? And if so, has such a thing been known before? A. Deep bored wells are supposed in most cases to draw their water supply from a distance, receiving its mineral constituents possibly from several kinds of rock and from gravel beds of varying mineral elements. When such wells are drawn upon for a long time the water coming from a distance or from several directions may be impregnated with mineral matter of varying kinds and quantity. This has been often observed. 2. A party claims that a current of electricity passed from the ground up a tree, to a height of five feet, then went from the tree to a house close by, passing thence into the clouds. I told him I thought the current must have passed downward to the earth, as the earth is negative while the clouds are positive. He then asserted that authorities say the earth is sometimes positive at certain points, and in such cases the current may go upward from it. Please give us some light as to the truth in the case. A. The upstroke or return shock of atmospheric electric discharge is well known, and has been observed as producing severe effects, as the killing of persons and animals. It is supposed to be caused by the inductive action of a thundercloud upon bodies placed within the sphere of its action. These bodies are then, like the ground, charged with the opposite electricity to that of the cloud, but when the latter is discharged, it is far less violent than the direct shock.

(4887) F. L. M. says: Please give directions for repairing mirrors, where the amalgam or silvering has been scratched. A. It is done by transferring the silvering from some old broken mirror to the mirror that is to be mended. Proceed as follows: Remove the silvering from the glass around the scratch, so that the clear space will be about a quarter of an inch wide. Thoroughly clean the clear space with a clean cloth and alcohol. Near the edge of a broken piece of looking glass mark out a piece of silvering a little larger than the clear space on the mirror to be repaired. Now place a very minute drop of mercury on the center of the patch and allow it to remain for a few minutes, clear away the silvering around the patch, and slide the latter from the glass. Place it over the clear spot on the mirror, and gently press it down with a tuft of cotton. This is a difficult operation, and we would advise a little practice before trying it on a large mirror. From the Scientific American Cyclopedia of Receipts, Notes and Queries.

(4888) I. W. N. writes: Owing to the severity of our past winter, the subject of how to battle with the elements in keeping out wind and cold from our houses has been discussed a good deal by builders, architects, and others interested. Many are in favor of hollow walls. Others state that if the space between the bricks were filled in with some substance, such as crushed mica (size of fish scales) or dry cinders or sawdust, it would be warmer than hollow wall. Then those in favor of hollow walls ask, if that is the case, why would not a solid twelve inch wall be as warm as two four inch brick with four inch space, which nearly all acknowledge is warmer than solid wall twelve inch. Will you kindly say whether a wall of say four inch brick, four inch space, then four inch brick, is as warm, or warmer, than if the space were filled in with cinders or other material. A. Air is a non-conductor of heat or cold, and when confined in a hollow wall, so as not to become a circulating medium between distant parts of a house that is unequally heated and closed from roof circulation, becomes one of the best insulators that can be used. For the perfection of air space insulation, the outer wall should be not less than 8 inches thick, well made to prevent the strong cold wind driving through the brick work, when the air space may be only 2 inches thick, with a four inch inner wall, with headers lapping on the outer wall at short intervals to thoroughly support the inner wall. Any material put into an air space only packs hard and becomes in time as much a conductor as the brick.

(4889) F. H. writes: I am running an engine 14×16 center crank, 200 revolutions per minute, with two driving pulleys 48 inches in diameter, and am troubled with the wrist heating, and crank has no counterbalance. Size of crank pin is 4¾ inches in diameter and 3¾ inches in length. If two 72-inch pulleys were used instead of the two 48-inch pulleys driven at same rim speed, would they stop the heating, and if not, please give remedies. A. We cannot recommend a change of pulleys, for, although the speed will be lower, the crank pressure will have to be increased in proportion, to develop the same power. We fear that the trouble lies in the quality of the oil that you are using. We recommend a trial of the best oil that can be obtained for use on the crank pin. Such oil should contain 50 per cent of pure sweet lard oil. If this fails, consult with the maker of the engine or some experienced engineer as to the condition of the wrist and boxes.

(4890) B. A. H. asks how to proceed to pull down the standing walls of a large three-story brick building, that has the inside burned out, in a way to save the most brick. We have a building to wreck of that kind in Hampton, and I will be much obliged to you if you will answer this through the SCIENTIFIC AMERICAN. A. To pull down the walls of a burned building, pass a rope at least 1 inch in diameter over the wall, which can be done by throwing a lanyard over the wall, or, if too high, start with a strong string tied to a stone, when the lanyard can be drawn over and the rope following. Fasten one end of the rope at the bottom of the wall through a window or by breaking a hole through the wall, then carry out the other end of the rope to a safe distance, and as many men as can man the rope commence to rock the wall by all working in unison, when in a few minutes the wall will tumble. This can be repeated on all the walls, outward or inward, as convenient.

(4891) T. A. S. asks for a receipt of process of soldering aluminum to brass or other metals. A. For soldering aluminum, the surfaces to be soldered should be scraped clean and covered with paraffin as a flux, then coat the surface with a solder made of zinc 5 parts, tin 2 parts, lead 1 part, using a soldering copper charged with the alloy. Then put the parts together that are to be united and flow the above alloy or pure tin through the joint, as in the common method of soldering, using paraffin as a flux.

(4892) J. J. asks the actual height the Lick Observatory is above the surrounding country. A friend of mine had an argument with me about looking through a brick. I claimed it was done by reflection. He said the reason you could see through it was on account of its being porous. He said he saw through the brick by looking into one of those machines they have on the street. A. The Lick Observatory is 4,302 feet above the sea. The surrounding country is of mountain peaks of about the same height. Your friend looked around the brick, as you claimed.

(4893) C. N. H. asks to which class of levers an oar belongs. I hold that it is second class, that the boat is the weight, the water the fulcrum, and that the weight is attached between the fulcrum and power. A. The oar is a lever of the second order, as you describe.

(4894) E. T. S. says: I want to finish a guitar, and would like to know of some good polish, that has no oil in it, that I could use for that purpose, and what would be the best way to bend rosewood or mahogany without breaking or splitting? A. For guitars use the same varnish as for violins, made by dissolving 2 ounces sandarac gum, 1 ounce mastic gum, dissolved in ¾ gill turpentine and 1 pint 95 per cent alcohol. Steam the wood before bending.

(4895) D. S. N. asks: At what speed can a fly wheel 3 feet in diameter, 6 inches wide on face, and rim 1 inch thick, be run with safety? Will the strain be less on a larger wheel, provided the speed of the rim is the same? A. Your 3 feet fly wheel, if properly made, can run 600 revolutions per minute with safety. The strain is equal with equal rim velocities for any size. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 891, on centrifugal force in fly wheels, 10 cents mailed.

(4896) C. M.—The phenomena that you describe is a halo, corona, and sun dogs, familiar to observers in Europe and America. The principles appertaining to the reflection and refraction of sunlight during certain conditions of the air as to moisture is well known and are described in works on meteorology.

(4897) C. T. asks how to take out scratches on a plate glass. The glass is used for blue printing and has been scratched by a diamond. A. A diamond scratch cannot be taken out by the ordinary polishing process. You might try rubbing the scratches with a piece of soft cork and rouge wet with water.

(4898) J. B. U. asks how many cubic inches there are in a bushel heaped measure? A. A struck bushel is 2150·42 cubic inches. A heaped bushel has no meaning without full dimensions.

(4899) I. M. A. asks: How can plaster of Paris be prepared so that a quantity can be mixed and not set quickly? A. Mix the plaster with fine cream lime, such as used for hard finished walls. Equal parts or variable, according to the time required for setting. Whiting and white chalk also make a good mixture to retard setting.

(4900) A. B. writes: The iron gas pipes that we use here to deliver the water from the city water works reservoir (200 feet head) rust very much. Is there any thing that can be painted on or the pipes dipped in that will make them last longer and not hurt the water? There used to be advertisement in your paper of rustless pipe, but don't see it of late. Was it a success or failure? A. Dipping the pipes in hot asphalt and draining is a method largely used to prevent rusting. There is still one or two companies treating iron pipe with the Bower Barf process, one of which is called the Bower Barf Rustless Iron Co., 31 Nassau Street, New York. Of all the methods, there is probably none so largely in use as the galvanizing of iron pipe for water service. Galvanized iron pipe is on the market everywhere, and is the most convenient to procure and use. It is perfectly safe as a sanitary water pipe, if the water that stands in the pipe overnight is not used for drinking.

(4901) A. A. asks if there is a rule of some kind and what it is to find the output in volts of an armature of a dynamo of under 1 horse power, or 746 watts, when you know the length of each coil of wire on the armature. A. For a drum armature allow 2 feet per volt and for ring armatures allow 3 feet per volt.

Replies to Enquiries.

The following replies relate to enquiries published in the SCIENTIFIC AMERICAN, and to the numbers therein given.

(4655) X. Y. in query 4655 asks for something to soften glass so as to bore holes in it with an awl. I would recommend his trying the following: Make a solution of camphor in turpentine, using all the camphor which the turpentine will dissolve. With this I have bored holes with a common rat tail file. Roll the file between the hands and be sure that the glass lies on a perfectly level surface.—A. F. KINGSLEY, Leonidas, Mich.

TO INVENTORS.

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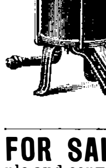

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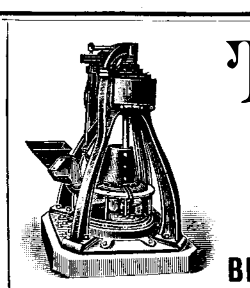

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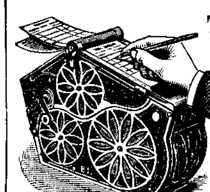

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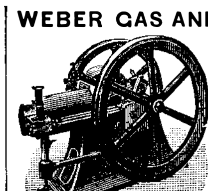

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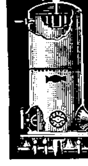

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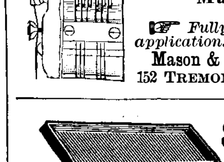

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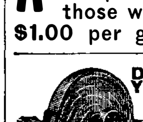

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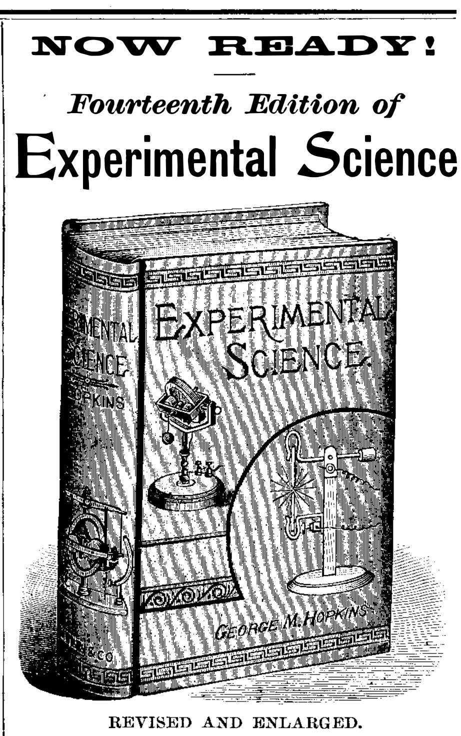

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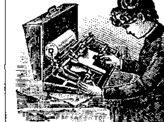

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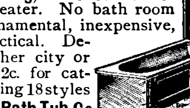

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