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THE BRITISH NAVY.

Immense excitement was caused in England near the end of last year by statements being brought forward by skilled and competent authorities that the navy of Britain was not nearly powerful enough to uphold its supremacy with other nations. So persistently and, seemingly, well founded, were the statements put forward,—statements that were well supported by facts and figures—that the Government were forced to pay some attention to the outcry, and accordingly formed a Committee of enquiry under the presidency of Lord Ravensworth. The result of their deliberations was that, although there was not much cause for alarm, still the British navy in many respects was not up to the standard of efficiency that a Maritime power, such as she is, ought to be.

When we reflect upon the vast possessions of Britain, scattered as they are over the globe, and also on the fact that it is chiefly owing to the immense commerce done by Britain, that entitles her to be called the first nation of the world, one wonders at the apathy shown by the present and past Government's on a subject such as this. This subject is one of vital importance, because if Britain is not prepared to support and protect her immense mercantile marine, her commerce will decline, and her importance as a nation of the world will be greatly lessened. It is therefore, gratifying to learn that the agitation on this subject has, in some measure, produced satisfactory results.

"Engineering," commenting on the Admiralty proposals, says:—"The programme laid down is quite insufficient for the purposes of the country; while the manner in which it is proposed to be carried out is inexcusably dilatory, and inefficient. Five years is the most sanguine estimate that can be found by the Government of the time that will be occupied in carryout there present proposals. But judging from the slowness with which they are to be carried into effect, even this unnecessary length of time will probably be exceeded." This is rather strong language to use when we consider that the Government have resolved to expend not less than $30,000,000 in addition to what had been already proposed. That sum will be expended in building four ironclads, two torpedo rams, five belted cruisers, two "scouts," and thirty torpedo boats, besides naval ordnance, and coaling stations. These facts should surely show, on the part of the Admiralty, an awakening to their responsibility.

One point, on which all who have interested themselves on the matter are agreed, is the time taken in building any ironclad is, far too long, and one reason for this is that they are all built in Government dockyards. It is contended that if they were built by contract, the time taken would be considerably lessened, and the work done be more satisfactory.

The latter is, of course, much more important than the former, and one might overlook the length of time that is usually taken to construct an ironclad provided, when they *were* completed, that they gave satisfaction. But such has certainly not been the case, as has been admitted by the Admiralty Committee, as, for example, when they reported on H.M.S. *Inflexible*, in which report they recommended that no more ships of that class should be built, which recommendation, however, has not had the desired effect, as similar ships have since been built. It is to be hoped that the Imperial Government will give more attention in *future* than has certainly been the case in the past, to her navy, which, in times of war, is expected to protect not only Britain, but her vast Colonies.

RECENT USES OF ELECTRICITY.

It is difficult to realise that the telephone is barely eight years old. The first conversation over a wire occurred Oct. 9th, 1876. Little was then thought of it, scarcely more than of that wonderful but now forgotten toy, the phonograph. The notice of an astonished man of science from England first gave the "far-speaker" wide publicity, and then within a half-dozen years it has made great progress, which we have not seen exactly reported. Its use is growing, in every civilized nation, and the distance over which it is effective is lengthening, until sanguine inventors believe that a voice can soon be heard beneath an ocean, as indeed it has been one-third across America. The use of the telephone may grow as surprisingly as did the telegraph, but at most its field is, if not exactly limited, at least well defined.

With storage batteries, however, the case is different. The uses of "power" are illimitable and innumerable, and when, about 1881, it was declared that a fireless motor could be carried in a chest, great things were hoped and promised. Great things, too, have been done. An omnibus has been driven through the streets of Paris conveying its own power. A Yarrow launch has been driven six hours at a high speed. A tricycle, weighing only four hundred pounds all told, has been propelled at the speed of a cab. The balloon which, it was declared the other day, had solved the mystery of steerage in an "air-way," so to speak, was moved by "accumulated" electricity. Torpedoes have been driven and guided by these boxes of force. These things are wonderful in themselves, and more wonderful in their promise. Yet the "storage" or "accumulation" of electric energy is not a success, because it is too costly. Engines are cheap and last indefinitely. Storage batteries are costly and will wear out quickly. So long as this continues no storage battery can compare, under ordinary circumstances, with an extra engine full of steam and a banked fire ready for instant use. The trouble is not one of principle ; it is merely a question of cost and detail, and may be solved at any time. When that time comes the wonders of electricity will be indefinitely increased.

The transmission of power by electricity has been reported as measurably solved by M. Duprez, in France. The French Institute examined his invention in 1883—too recently, it will be observed, to expect as yet any practical results—and reported that he delivered one-half the original power at a distance of 38 miles. The waste is great. Yet, when it is considered how great is the economy and convenience of substituting one central source of power for many less ones, the percentage of loss is endurable. The problem is double—to transmit power in sufficiently large quantities for a factory and over considerable distances. There is little difficulty in transmitting small amounts of power for considerable distances, or considerable power for short distances. It is a question of conductors, and M. Duprez, according to the Institute, "vastly exceeded everything previously accomplished by the greatness of the transmitted power compared with the resistance of the conductor." If this be strictly true, the steam and iron horse may get a rest.

The first electric railway for the carriage of passengers was seen at the Berlin Exhibition in 1879. Shortly after, 82,000 passengers were carried at the exposition at Paris. They were not exactly toys, and yet they were not full-fledged. The distances were short, and the gauge was ridiculously narrow. In May, 1881, an advance was made by the opening of an electrical railway in the suburbs of Berlin. It was 3 miles long, and the speed had risen to 30 miles an hour. The next electrical railway ran to the Giant's Causeway, in Ireland. There are also little roads in Austria and Holland and under the Thames. The last was successfully opened in Cleveland, Ohio. America is not usually so slow in using new things, nor have her inventors been backward in attacking this problem. Daft and Edison and Field have each declared their systems perfect. But we believe no electric locomotive has yet earned a dividend. Dynamos seem to be like racehorses —neither handsome nor very useful at low speeds. When they are harnessed and brought down to practical velocities they are at a disadvantage. Obviously a locomotive which its best results only when rivalling the speed of a gale leaves something to be desired. Where such speed can be used safely (as upon a miniature track designed for the carriage of parcels, such as, for instance, mails), extreme rapidity can be obtained. Mr. Danchell has devised a single-track railway of this description, upon which he proposes to make 200 miles an hour. Perhaps no department of electricity promises better than this one of transportation, although as yet it lags a little behind its fellows.

Nothing has yet been said of the electric light, partly because it is so familiar to every one. We were the pioneers. It was not until the last days of 1880 that some of the streets of New York were lighted by Mr. Brush, and on September 5th, Mr. Edison's in-door system was tested in the *Times* offices. Soon afterward the system was extended upon a scale not yet equalled anywhere. The light is perfect. The theory is perfect. And yet we hear of no more "installations" upon a scale equal to the operations of even a small gas company. The use of the electric light for photography is growing. Excellent effects are got from it in any weather, but it is always costly and cannot always be had. A year or two ago Professor Bell was said to have deposited at the Patent Office a sealed description of the method of "seeing"—that is, we suppose, of transmitting images by electricity. Two of our professors promptly declared that effects of light could be sent over a wire by using mosaics of selenium, each section at one end being connected by a separate wire with the corresponding section at the other end. The currents of electricity transmitted would then depend upon the amount of light falling upon any given bit of selenium, and the corresponding distant fragment would register the result. Since then Mr. Bell has given no sign, and we are forced to believe "seeing by wire" is yet a philosopher's dream. That it must be always so is a hasty conclusion in view of the seemingly impossible deeds already done by the aid of the "virtue," as it was early called, which men have subdued without understanding.—*Ex.*

CARE OF BOILERS IN THE NAVY.

At a recent meeting of the Naval Institute, Assistant Engineer W. M. Parks, U. S. N., read an interesting paper on "The Care of Boilers in the Navy." Mr. Parks asserted that it must be evident to any one familiar with the subject that the lifetime of boilers fitted to the vessels of our Navy is too short, and that the cost of repairs during their brief period of service is far greater than the nature of their duty would seem to warrant. The boilers are well built, of the best material, therefore maximum efficiency and length of service ought to be expected from them. It is generally conceded that these expectations are not realized.

The rapid deterioration of naval boilers is attributed to rapid and disastrous formation of scale on the heating surfaces. In some cases, before the boilers have made one cruise, they are choked up with scale. The familiar results follow :—leaky tubes and burned sheets, with consequent expense and delay.

There is no reason why naval boilers should not last quite as long or even longer than ordinary marine boilers, unless it be that they are subjected to harder usage. Ordinary marine boilers, well cared for, enjoy a tolerably long life of efficient service. The question is, Why are not our naval boilers equally efficient and durable ? The explanation given in Mr. Parks' paper is that a standing order to naval engineers prohibits them from using boiler of a density exceeding $\frac{1\frac{3}{4}}{32}$

To work within the limit of concentration, an engineer has to use the blow-off cock very frequently, the waste of water being supplied from the sea. The sulphate of lime present in the sea water is then deposited on the heating surfaces. Atlantic steamers frequently make a voyage of ten days without opening a blow-off cock, but the concentration of salts in the water will often reach a density of $\frac{4}{32}$ or $\frac{5}{32}$; yet they do not deposit much scale, because the quantity of scale-making materials is dependent upon the quantity of fresh sea water fed, which is carefully restricted. Were the methods followed by well-managed merchant vessels permitted in our Navy, it is believed they would result in material saving to the nation and over supply of red tape alone, prevents the change from being made at once.—*Ex.*

TILE pavements for streets are being tried by the authorities of Berlin. The tiles are molded into blocks 7·8 inches square and 3·9 inches thick, and impregnated with bituminous products up to 20 p. c. of their volume. They are laid on concrete 6 inches thick, and the spaces between them are filled with hot tar.

NEW INLAND AND SHIP CANALS.

For upwards of a generation after George Stephenson gave the world its first railway, canals every year declined more and more in importance, as a medium of traffic. Of late years, however, public interest in this mode of communication has everywhere revived, and canal property which had so long been in a depressed and languishing condition has been steadily improving in value. This result several circumstances have conspired to bring about. As regards ship canals intended for ocean going vessels, the change is of course due to the magnificent success of the Suez Canal, which brings Europe some five thousand miles nearer to the East. The stimulus which the triumphant issue of M. de Lesseps' bold enterprise has imparted to this class of waterways is evident from the number of great schemes of a similar character which have since been projected. The constructor of the Suez Canal is himself pushing on, with his characteristic energy, the cutting across the Isthmus of Panama, which is destined, ere many years have elapsed to revolutionize the extensive commerce of all the rich countries bordering on the western shores of the entire continent of America. Another great work of this kind, which has already made considerable progress, is the ship canal across the Isthmus of Corinth. This work, which is being carried out under the auspices of the Greek Government, will be completed within a couple of years, and will bring Constantinople and all the ports of the Black Sea and Sea of Azoff nearer to all the countries on the shores of the Western Mediterranean and Western Europe generally. A third instance is the great sea canal which has just been completed in the Gulf of Finland, It was originally projected by Peter the Great, but, like the Isthmus of Corinth Canal, which itself was actually begun by the Roman Emperor Nero 1,800 years ago, the idea was allowed to lie dormant until the example set by M. de Lesseps on the Isthmus of Suez inspired statemen and commercial men alike with the requisite courage to undertake the work. In addition to these three great projects, one of which is realized and the other two are now in process of realization, there are several other schemes of a similar description already before the world. There is first the Manchester Ship Canal, which the energetic men of the cotton metropolis intend sooner or later to have in spite of all that the merchants of Liverpool can do to thwart them. Then there is the important canal which Germany, after five-and-twenty years of deliberation, has at length decided to construct across the province of Holstein. This cutting will run from the Mouth of the Elbe near Glückstadt to a point on the Baltic coast near Kiel. The canal is to be of such dimensions as to enable the largest vessels in the German navy to pass through from the North Sea to the Baltic, and *vice versa*. It will be of the geatest benefit to the large shipping trade between England and the Baltic ports, and will save the long and dangerous voyage round the Peninsula of Jutland, for all vessels starting from ports south of Newcastle. The only fear we have is that the German Government may be tempted to fix the dues for foreign ships passing through the canal at too high a figure. This would be a mistaken policy, but as it would largely diminish the dividends of the shareholders the evil would, doubtless, cure itself in time. Another great waterway for seagoing vessels is the canal projected across the Peninsula of Florida, which will shorten the passage between the various ports of the Gulf of Mexico on the one hand and those both of the eastern portions of North America and Europe on the other. With reference to inland navigation, the increasing traffic is due chiefly to two causes: first, the cheapness of conveyance by boat as compared with the high and often almost prohibitive tariffs of the railways; and, secondly, the introduction of steam as the motive power in place of the old system of traction by horses. The use of steam tugs towing large barges and vessels up to 500 tons burthen is everywhere growing on navigable rivers, and some of the canals projected on the Continent are intended to accommodate this class of craft. Among the most important of the new schemes is one for a canal to connect the Danube with the river Oder. In Austria, Hungary, and Germany a strong movement has been inaugurated in favour of this plan which, when realised, will establish a complete system of inland water communication between the Black Sea on the one hand and the North and Baltic Seas on the other. The Danube and Oder Canal, which will be wide enough to enable 500 ton vessels to pass each other without hindrance, will be 171 miles in length. Its width at the bottom will be 50 ft. It will be intersected by eighty-four locks, each 28 feet wide, and 215 feet long. The course of the canal will be from the Danube, near Vienna, to the river March as far as Preran, thence up the river Botschwa Weisskirchen. From this stream up to the watershed line and down as far as the Oder will be the heaviest part of the cutting. —*Ex.*

HOW RUBBER BOOTS AND SHOES ARE MADE.

Did you ever see any crude rubber, and have you any idea how it is gathered and worked? There are twenty or thirty varities of crude rubber, varying greatly in quality, and of all these the best is known as Para, a South American product, obtained in Brazil, about 1,800 miles above the mouth of the Amazon. It is called Para from the city of that name from which it is shipped to foreign parts. The gum is gathered by tapping the rubber trees, as we tap maple trees for sap for maple sugar. The sap is gathered into a large pot into which the native dips a flat wooden paddle, to which gum adheres. He withdraws the paddle and holds it in a smoke made by burning palm nuts, which dries and cures the film of rubber on the paddle. He then dips again, and smokes again, repeating the process until he has on the paddle a bunch of gum weighing several pounds. Then he splits the ball or roll to get the paddle out, and it is ready for market.

These natives are not models of honesty, however, as these chunks of gum frequently contain palm nuts, rubber nuts, pieces of iron, or are freely mixed with sand to add weight, which often causes the manufacturer great trouble. The public, or a large share of the public, have an idea that crude rubber gum comes something like tamarac, and that it is melted and cast into whatever form is desired; but this is not true. A rubber shoe factory is not a foundry; it comes nearer being a printing office.

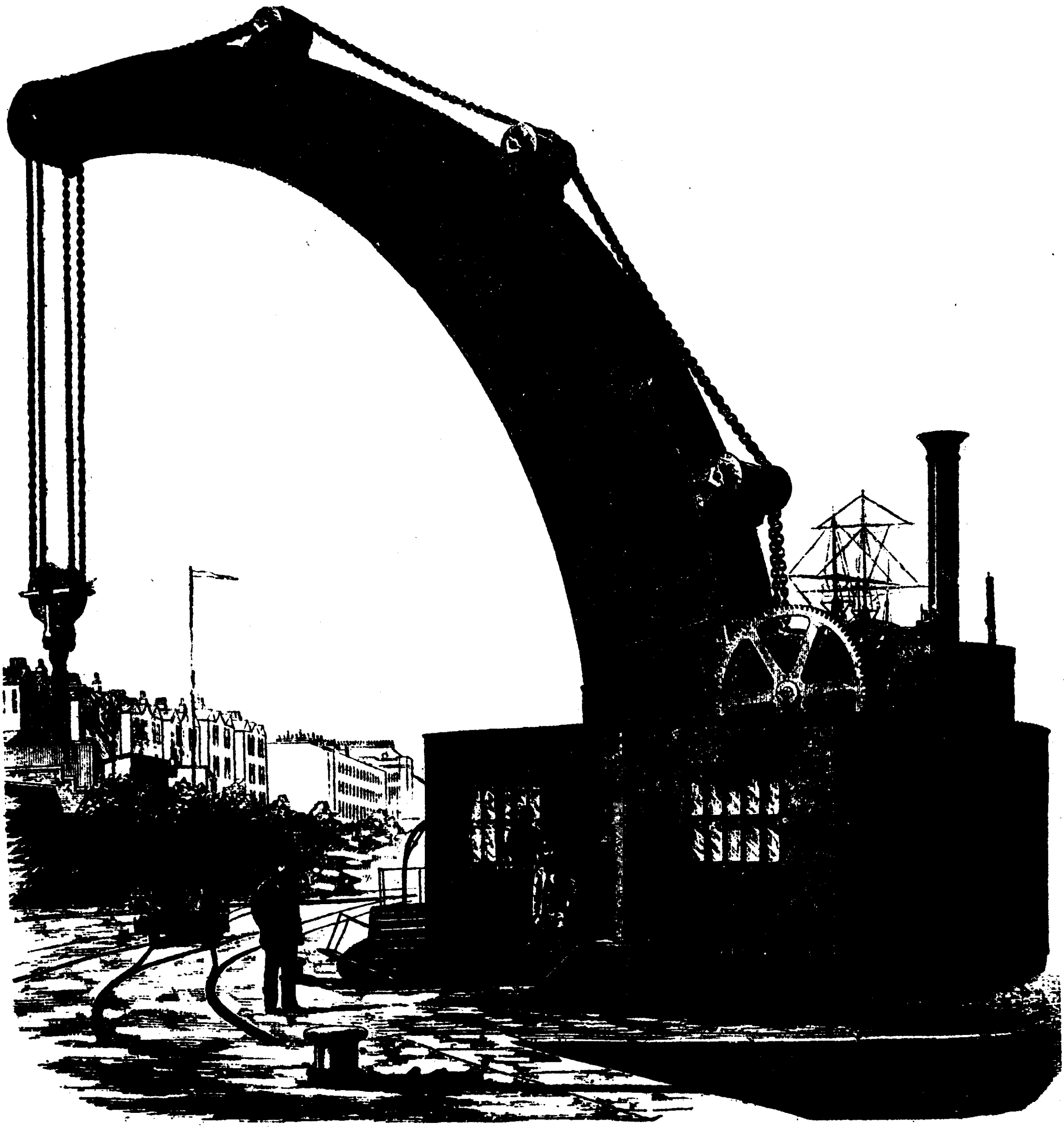
These chunks of rubber are sliced into steaks, you might say, by sharp knives revolving rapidly and kept constantly wetted. When one of these knives strikes an iron spike, there is apt to be "music in the air." The operators are on the lookout, however, and accidents are so thoroughly guarded against that they are very rare. These steaks are then put into a chopping machine, where they are made into an article closely resembling boarding house hash, only that this hash is the straight goods, except that it needs cleaning. The small pieces thus formed are then put through a machine which makes mince meat of them, and at the same time washes out all the dirt and sand. This (not the dirt and sand) is now shoveled into a rolling machine which compresses the mass into rough sheets. This is the first process. These sheets are then taken to another building and put into a steam drying room, where they remain about three months to free them from all moisture.

By the drying process they lose from 15 to 30 per cent of their weight. If the least moisture remains in the rubber when made up into shoes, the heat of vulcanization causes its expansion, and consequently causes blisters in the stock. The dry gum is then run between heavy iron rolls, heated by steam, called grinders, by which it is softened to permit the admixture of the vulcanizing material.

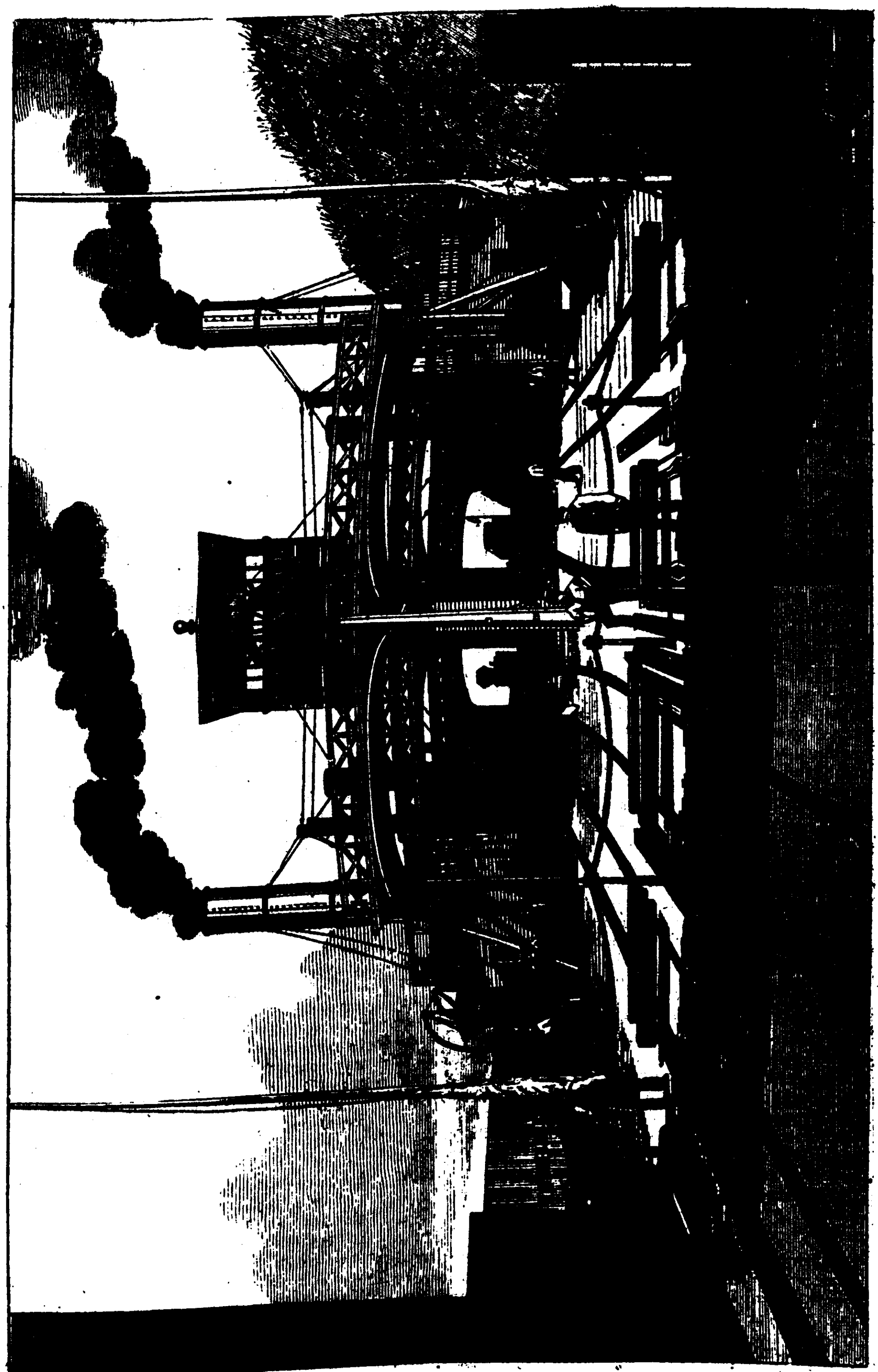
Rubber in its natural state is unfit for use, and Goodyear's process of vulcanization by the aid of sulphur is necessary to utilize it. This mixing is done by running the ground rubber through still another series of rollers, which press the rubber and sulphur together in one soft, fine body, which is finally run through a calender, between great steel cylinders; the mass is pressed out into long smooth sheets of any desired width or thickness. Then comes the printing process. These sheets are fed through steel cylinders on the face of which is engraved the pattern for sole, heel, and upper desired to be produced, and these impressions are as clearely printed on the rubber as this type impression is on this paper.

Then the sheets go to the cutters, who cut out the different parts and send them to their respective departments. The lasting is done similarly to that of other shoes, except that the parts are all put together by rubber cement, and, before removal from the last they are placed in the vulcanizing ovens, where they are subjected to a degree of heat that transforms the various parts into a homogeneous mass in the shape of a boot or shoe with a seam, nail, or peg. Then, if a dull finish is desired, the last is removed, and the goods are ready for market. Otherwise they are varnished to give the bright finish, and dried, when they are ready.—*Ex.*

A MONSTROUS earth worm, six feet five inches in length and proportionately thick, has been sent from Cape Colony, Africa, to the Royal Zoological Society of England.



STEAM "FAIRBAIRN" CRANE, FROM A PHOTOGRAPH OF A CRANE CONSTRUCTED FOR THE BRISTOL DOCKS.



FERRY BETWEEN BENICIA AND PORT COSTA, CENTRAL PACIFIC RAILWAY.

THE CENTRAL PACIFIC RAILROAD FERRY.

Until recently, trains running to and from Oakland upon the Central Pacific Railroad, were compelled to make a somewide detour to skirt the eastern and southern sides of Pablo Bay, which is one of the indentations of San Francisco Bay. Oaklands is situated immediately opposite the city of San Francisco that stands on the north point of the narrow strip of land forming the western enclosure of the bay; the distance between Oaklands and San Francisco is about five miles. Some thirty-five miles to the west, and a little to the north, Pablo Bay contracts until the distance between its north and south banks is only about two miles; this contraction forms the Straits of Carquinez, and on each side opposite each other, are the towns of Benicia and Porta Costa. It is at this point that the Central Pacific Railroad Company have established the ferry which forms the subject of the illustrations. By means of it the circuitous route around Pablo Bay is avoided, and passengers are taken direct to Benicia and thence to Oaklands, the terminus of the railway. Fig. 1 is a longitudinal section of the ferry, showing the arrangement of the stage by which the trains are transferred to and from the boat; this part of the work is also shown in Fig. 2. Fig. 3 is a transverse section of the ferry, and Fig. 4 is a plan showing the general arrangement of the boat as well as of the sidings and approaches. Fig. 5 is a perspective view of the boat, and Fig. 6 is a sketch of the whole work.

The ferry, which is named the Solano, is a vessel of 3,540 tons, and is of the following dimensions:

	ft.	in.
Length of main deck	494	8
" hull	406	2
Width over all	116	0
" between wheel casings....	64	0
Height amidships	18	6
" at ends	15	9
Draught when loaded	6	6

The boat is propelled by two separate vertical beam engines; they were built by Messrs. Harlan and Hollingsworth, of Wilmington, Delaware. The cylinders are 5 ft. 2.24 in. in diameter, and 11 ft. .28 in stroke; each engine is intended to develop 2000 H.P. There are eight steam boilers, each 7 ft. .25 in. in diameter, and 28 ft .24 long. They are made of steel, and have 143 tubes 3.94 in. in diameter, and 16 feet long; the total heating surface is 19,630 square feet. The wheels are 30 ft. in diameter, and have 24 floats; each wheel can be worked independently of the other. It will be seen from the engravings that the ferry has four lines of rails, and as they extend from end to end, there is sufficient accommodation for forty-eight freight cars or twenty-four passenger cars, with locomotive and tender. The boat is chiefly used for passenger service, freight being taken by the old route, and transferred at Oaklands to finish running to San Francisco. As the amount of freight thus carried is very considerable, the service is an important one, and the boats are large enough to carry a number of wagons, which are unloaded in the San Francisco depôt.

The general construction of the Solano is indicated in the illustrations. Beneath each line of rail runs a deep Pratt truss, the top flange of which is attached to the deck, and the bottom to the hull of the boat; the latter is divided by bulkheads into twelve compartments. There are four balanced rudders at each end of the vessel, 10 ft. 6 in. long, and 6 ft. 6 in. high: those are worked by hydraulic steering gear, but can be actuated by hand when desired. The pilot house is more than 40 ft. above the deck. The stages for embarking and disembarking trains are massive iron structures, 98 ft. 6 in. long, and weighing 150 tons. They are provided with four lines of rails, and are controlled by hydraulic gear to adapt their position to the rise and fall of the tide.—*Eng.*

ASPHALTUM.

In considering the history of the artificial materials employed for constructive purposes, we find that the necessities of earlier times were fully met by the use of tiles, asphaltum and concrete; and these, it would seem, if properly used, are quite adequate to the wants of our own times. It is worthy of remark, however, that asphaltum, which was largely employed in ancient times as a cementing material, and which has proved itself (from relics of highest antiquity) to be a most durable material for this purpose, should have fallen in o comparative disuse among modern nations. There is no material which is better fitted, by reason of its plasticity, tenacity, impermeability to water and indifference to atmospheric influences, to be employed for terraces, foot walks, roadways, hydraulic construction, etc. An admirable substitute for the asphaltum of the ancient builders is found in the bituminous limestones, which in some parts of Europe are extensively employed for the above named uses. The city of Paris has introduced this material perhaps more largely than any other for paving its more prominent boulevards and avenues. For this purpose the asphaltic rock is first roasted to render it friable, then reduced to powder, and introduced, in small quantities at a time, into a vessel containing some bitumen. When the mixture has attained the proper consistency, previously heated sand or gravel is added in suitable quantity, and the thoroughly mixed material is thereupon either introduced into molds and allowed to harden, or is at once spread in place.

The asphaltic rock which is found to make the best cement is that of the Val de Travers, in the canton of Neufchatel in Switzerland, which contains about 90 per cent of calcium carbonate and about 10 per cent of bitumen.

The admirable qualities of asphaltum for roadways in cities have come to be universally admitted, and the beautiful specimens of such roadways which may be seen in Paris and other European cities, is the theme of unstinted praise of observant tourists from our own less fortunate cities. What these superiorities are may be well worth a brief consideration. The genuine rock asphalt pavement, as seen in its best examples in French and German cities, is smooth-surfaced, homogeneous, hard, tough and elastic. It affords a minimum of resistance to draught and the minimum of wear to vehicles. In point of security of foothold it affords ordinarily, wet or dry, sufficient friction, although when covered with ice it becomes very slippery. It has been observed that while one horse in 1,308 falls on a stone-faced street, but one in 1,409 falls on asphalt. On levels and easy gradients, therefore, the asphalt roadway may be considered the equal of stone in the matter of foothold for horses. On steep gradients, however, while affording a minimum of resistance to draught, it does not afford sufficient foothold, and hence for such situations, especially where heavy traffic must be provided for, it must be discarded in favor of the small granite block, which for such locations has come to be looked on as the only adequate roadway. In another particular, namely, in respect to noise, the asphalt roadway has preëminent merits. The noise from an asphalt pavement is only a slight clicking of the horses hoofs; the wheels give out no sound thereon. It is absolutely dustless, and hence produces no mud. Its wear on traveled streets has been estimated at about one-25th of an inch per annum, and even this diminutive lessening in thickness has been by some estimated to result from compacting rather than from abrasion or wear. Being absolutely impervious, it absorbs no unwholesome liquids, and gives out no noxious vapors, consequently is always pure and clean when its surface defilement has been removed. Its merits from a sanitary standpoint in this respect cannot be too highly extolled, and deserve more than the passing consideration we can here devote to it. It may be readily and thoroughly cleansed by scraping, sweeping or washing. As regards durability, asphalt roadways can compare favorably with any others. Neither heat, cold, attrition, nor hammering sensibly affects it. In respect to the case, rapidity and thoroughness with which it may be repaired, it has no equal. In respect to cost, it may be ranked with the granite roadway, though in Paris its cost is about one-third less than granite.

We have dwelt at some length on the properties of asphaltum for roadways, for the reason that American cities are, as a rule, woefully behind the age in the paving of their streets, for the reason, probably, that it is so very difficult in this country to apply the rules that hold good in private business transactions to public work. The result of this has been that the idea entertained of an asphaltum roadway in this country, is associated in the minds of most Americans with the abominations in which coal tar figures largely in the place of asphaltum, and which have not unfitly been dubbed "poultice" pavements. This association does grave injustice to the true asphaltum roadway, of which some fine examples may be seen in American cities, and which will undoubtedly become more and more generally adopted as it merits are made manifest.

Summing up the comparative merits of the several materials employed for this purpose, we may say that while for very heavy traffic granite blocks are the best adopted, and for steep gradients, wood; for all other and general purposes, pavements made from the natural rock asphalt, or from true asphaltum and hard fine gravel, or sharp sand, will give the most satisfactory results.—*Ex.*

THE NEW ORLEANS EXHIBITION.

The great exhibition which was opened with impressive ceremonies on the 16th of December at New Orleans, will doubtless take rank among the most important events of its kind. It was originally proposed in 1882, by the Cotton Planters' Association, as a suitable means of signalizing the one hundredth anniversary of the cotton exporting industry, but it gradually assumed the proportions of an international industrial exhibition under governmental sanction and financial support.

Every effort appears to have been made by those in charge of the enterprise to contribute to its success, and the participation of nearly all the nations of the earth has been secured.

The main building, in which the machinery department is also located, covers an area of 33 acres, being 1,378 by 905 feet, or one-third larger than the main building of the Centennial Exhibition in Philadelphia. There are no partitions in this building, and the machinery display occupies a space 300 feet in width—the whole length of the building.

The government exhibit, which is large and varied, is placed in a special building erected for the purpose, 885 by 565 feet in dimensions. Besides loaning the enterprise the sum of $1,000,000, the government has made a liberal appropriation in order to permit the various departments and bureaus to make a proper display. In this building, likewise, the various State exhibits are located. There are also provided a horticultural department, located in a special building of permanent character, erected by the city of New Orleans, and 600 by 194 feet in dimensions; and an art gallery, 250 by 100 feet, also designed to remain permanently after the exhibition.

The Mexican government has taken much interest in the exhibition, and has erected a national building for the display of its products and manufactures, 300 by 190 feet in size. The contributions of Mexico, Central America and the West Indies are said to be very large and constitute the principal attractions. One of the immediate results of the exhibition will undoubtedly be the giving of an important stimulus to the trade relations of the States of the Mississippi valley with the States of Mexico, Central and South America, which at present seem to afford the most promising field for the growth of our foreign commerce.

Although the participation of European countries will not probably be made upon the extensive scale which made the Centennial Exhibition so attractive and instructive, there will nevertheless be a very large representation. The Great Eastern will bring a large portion of these exhibits over, and the great vessel itself will form one of the noteworthy sights for the visitor.

The exhibition grounds are located in what is known as the City Park, about four miles from the heart of the city. The grounds proper embrace 247 acres. They have a frontage of about half a mile on the Mississippi river, and are readily accessible both by steamboat and rail.

The following classification has been adopted by the administration having charge of the enterprise: 1st. Agriculture; 2nd. Horticulture; 3rd. Pisciculture; 4th. Ores and Minerals; 5th. Raw and Manufactured Products; 6th. Furniture and accessories; 7th. Textile Fabrics, Clothing and accessories; 8th. the Industrial Arts; 9th. Alimentary Products; 10th. Education and Instruction; 11th. Works of Art.—*Ex.*

STEEL BRIDGE IN SOUTH AFRICA.

The first steel bridge in South Africa, and the first bridge in the Orange Free State, was recently built over the Caledon River between Smithfield and Rouxville. It is of the bowstring type, is in four spans 650 feet long, and the total length, including approaches, is 1,200 feet. It stands 50 feet above low water mark, and the lowest part of the superstructure is 10 feet above the highest water mark ever known. The piers are 12 by 30 feet, are of stone masonry laid in cement, and rest on solid rock. The whole weight of the superstructure is 350 tons including all necessary timber. It was erected on a staging made of steel wire ropes, one inch in diameter, stretched from pier to pier, with wooden trestles on top to make up for the sag caused by the weight of each span. This method worked admirably, and the structure was completed without hitch or accident of any kind. The bridge cost $160,000, including $5,500 duty paid to the colonial government for material; it was built by Messrs. Scrimgeour Bros., of Port Elizabeth. —*Ex.*

IMPROVEMENT IN SHIP BUILDING.

Messrs. Langille & Westhover, of Mahone Bay, N. S., are the proprietors of a new patent granted to them, in the United States and Dominion of Canada, for an improvement in the construction of ocean going ships. One of its principal objects is the saving and utilizing of the drainage arising from cargoes of sugar and molasses, which can be saved in its original state, free from extraneous substances, and which, on long voyages, is said to amount to about ten per cent of the entire cargo. It is also claimed that no acids will form in the bilge water, the acids usually acting injuriously on the iron and fastenings in the ship's bottom, and that the generation of noxious air and unpleasant gases will be avoided.

In constructing the hold of a vessel according to this improvement care must be taken in the first place to calk the vessel carefully and make it tight. The ceiling and inside skin is also carefully calked from the keelson up to the air streak and made perfectly water tight, and at the ends of the vessel there are dead woods and timbers fitted to the keelson, the ends of the ceiling being fitted to those timbers and calked, by which the fore and aft parts of the vessel are both strengthened and made water tight.

In the bottom of the hold thick planks are set on edge and extend out to the turn of the bilge. The planks are set at a distance of about twenty-two inches from one another through the length of the hold, and are made tapering on their under side to come to a point at the turn of the bilge. They are held in place edgewise by substantial cleats, which are spiked or otherwise fastened to opposite sides of the keelson and also by cross beams. Upon these beams rest removable flooring planks, which are spaced apart to leave narrow open spaces. When the vessel is used for shipping grain, salt or similar merchandise in bulk, the openings are closed by strips. The top of the thick planks is about three inches above the level of the flooring, which enables the casks resting on their quarter hoops upon the ribs formed by the planks to clear the flooring with their bilge. The planks are cut away on their under side to form apertures, through which the drainage that drops down through the openings in the flooring is permitted to run back to a well. There can be one or more of these collecting wells, each consisting of a hollow block sunk down through the ceiling and timbers—one on each side of the keelson—forming basins or reservoirs to receive the drainage, and from which this may be pumped up whenever desired and filled into empty casks which are carried for the purpose.

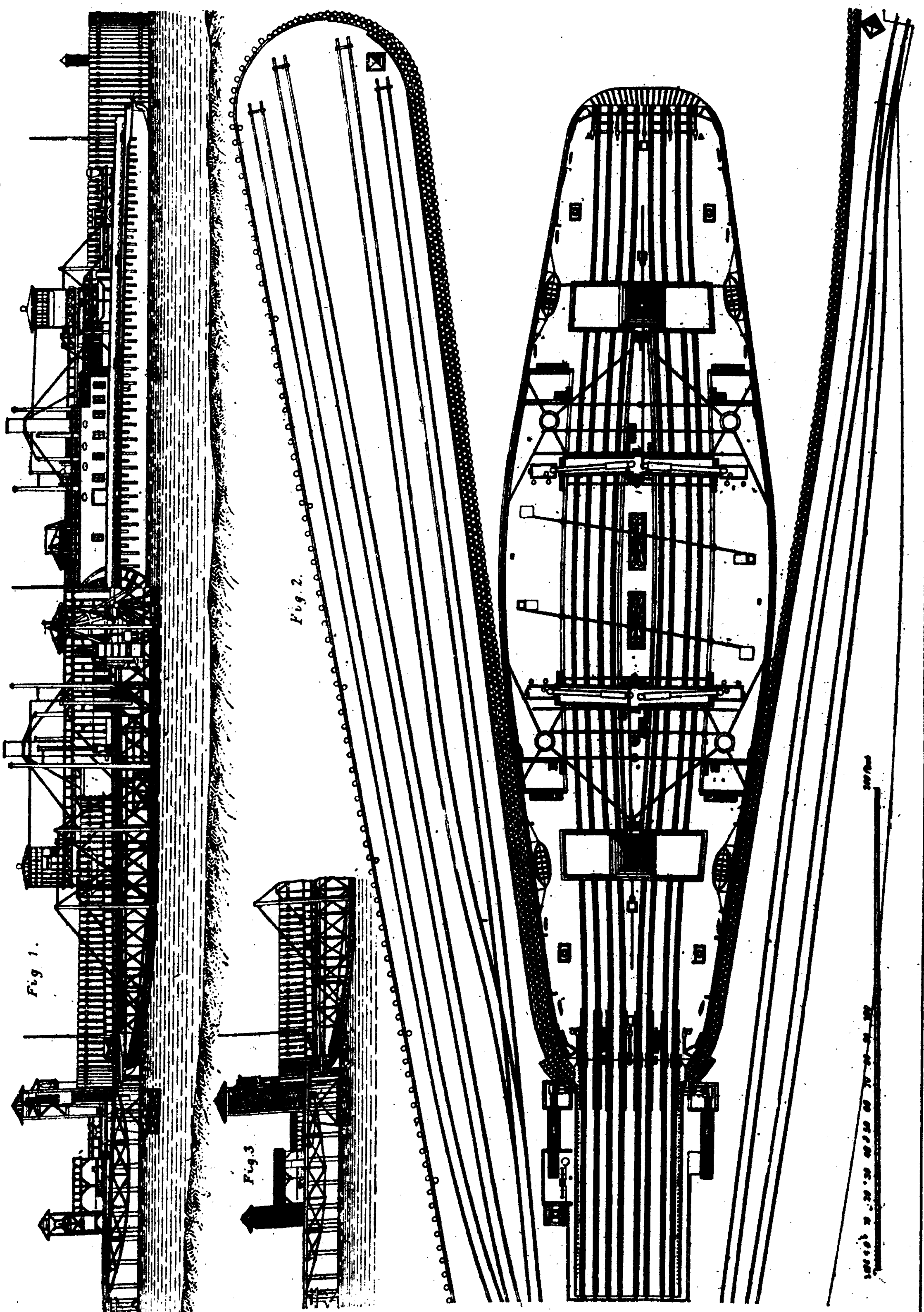
With this arrangement should the ship receive a leak or hole in the bottom, it can still be navigated with safety and without damage to the cargo. It will be a great security against loss of ships and cargo in case of stranding, and is not liable to damage her cargo by sea or bilge water. It is an ineffectual remedy against the choking of pumps and ships becoming water-logged, by which immense losses are so frequently sustained in ordinary built vessels. These are some of the advantages to be obtained by this system of construction.—*Ex.*

INVENTION OF GUNPOWDER.

In a paper recently read before the Shanghai branch of the Royal Asiatic Society, Dr. Macgowan affirms the claims of the Chinese to be the originators of gunpowder and firearms. This claim was examined in an elaborate paper some years ago by the late Mr. Mayers, and decided by him in the negative. Dr. Macgowan admits that gunpowder as now used is a European discovery. Anterior to its granulation by Schwartz its was a crude compound, of little use in propelling missiles; this, says the writer, is the article first used in China. The incendiary materials stated by a Greek historian to have been employed by the Hindoos against Alexander's army are stated to have been merely the naphthous or petroleum mixtures of the ancient Coreans, and in early times used by the Chinese. The "stink-pots," so much used by Chinese pirates, are, it appears, a Cambodian invention. Dr. Macgowan states also that as early as the twelfth or thirteenth century the Chinese attempted submarine warfare, contriving rude torpedoes for that purpose. In the year 1000 an inventor exhibited to the then Emperor of China "a fire-gun and a fire-bomb." He says that while the Chinese discovered the explosive nature of niter, sulphur, and charcoal in combination, they were laggards in its application, from inability to perfect its manufacture; so, in the use of firearms, failing to prosecute experiment, they are found behind in the matter of scientific gunnery.—*Ex.*

FERRY BETWEEN BENICIA AND PORT COSTA, CENTRAL PACIFIC RAILWAY.

THE RAILWAY FERRY BOAT "SOLANO," CENTRAL PACIFIC RAILWAY.



THE GEOGRAPHY OF THE GREELY ARTIC EXPEDITION.

The only definite statement of any value that has yet been made public respecting the geographical results of the late Greely expedition, apart from the ill digested notes that in various shapes were obtained from members of the party by agents of the daily press, is contained in the paper recently read by Lieutenant Greely before the British Association for the Advancement of Science. From this paper we learn that the geographical work of the Lady Franklin Bay expedition nearly covered three degrees of latitude and over forty degrees of longitude. The successful issue of Lieutenant Lockwood's sortie, if so it may be termed, resulting in planting the stars and stripes on a point of the Northern Hemisphere some half dozen miles nearer to the North Pole (eighty-three degrees, twenty four minutes; eighty-three degrees twenty minutes, Markham, 1876), then the highest point ever attained by man before, has added, it appears, nearly 100 miles of new cost line to our geographical knowledge, and given to Greenland a northward extension of upwards of forty miles. Whether or not Greenland exists as a large continental island, circumscribed in the north by about the eighty-fifth parallel of latitude, or extends practically to the region of the pole itself, still remains to be solved, although from tidal indications it would seem as though direct intercommunication existed between the land locked sea immediately north of the American continent, and the open sea lying to the east of it. The farthest point seen on the Greenland coast is estimated to be situated in about latitude eighty-three degrees, thirty-five minutes north, and longitude thirty-eight degrees west, or still some 450 miles removed from the pole. There were no direct indications of a "land's end." The interior of the country, seen from an elevation of about two thousand feet, showed a confused arrangement of mountain masses, eternally clad in snow, or bound in a perpetual ice cap. The immediate coast was in general high, rugged and precipitous, receding in its geological conformation —the rock consisting in great part of schistose slates, with a sprinkling of quartz—the shore line about Discovery Harbor.

Despite the very high northern latitude, neither vegetable nor animal life was quite extinguished. Specimens of the Artic poppy and saxifrage were obtained from positions north of the eighty-third line. Traces of the Polar bear, lemming and Arctic fox were observed, and a hare and ptarmigan were killed at the farthest point reached. The song of the snow bird was also heard. An extraordinary occurrence was here noted, in the existence of a prodigious "tidal crack," or ice fissure, which was found to extend from Cape Bryant, all along the coast, cutting the various fjords in a direct line from headland to headland, and measuring from one yard to several hundred yards in width. Soundings at this point failed to indicate bottom at a depth of 800 feet.

Perhaps the most striking and interesting physiographical feature presented by the Far North, was the condition of Grinnell Land. Between the heads of Archer and Greely Fjords, for a distance of some seventy miles, the vertical face of an immense ice cap, with an average height of 150 feet follows closely the east and west extension of the eighty-second parallel. From the summit of Mount Arthur, 4,500 feet elevation which the leader of the expedition successfully ascended in the month of July, the ice cap, with its secondary "caps," was found to cover an enormous area estimated at no less than 6,000 square miles, or not very much less than half the area of Switzerland. Many of the larger glacers trace their origin to this vast ice mass. The country between the eighty-first and eighty second parallels, extending from Kennedy and Robeson channels, the western branch of the polar sea, was found in the month of July to be almost entirely free from snow. Lieut. Greely reports that in upwards of 150 miles' travel in the interior his foot never touched snow! Vegetation, on the other hand, abounded, and contrasted sharply with the much less luxuriant vegetation of Capes Hawkes and Sabine, further to the south. Dead willow is stated to have been found dead in sufficient abundance in some localities to be serviceable for fuel. Saxifrages, grasses and other plants flourished in such profusion as to cover large areas with a mantle of green; and, indeed, the valleys are described as affording excellent pasturage to the musk cattle, which habitually frequent the region of the sea coast during the summer months. The reindeer, which must have been plentiful at one time hereabouts, has entirely disappeared, having either migrated or become extinct. As to the elevation of the snow line, Lieutenant Greely fixes it on Mount Arthur at not far from 3,000 feet, or on nearly the line corresponding to the average altitude of the crest of Grinnell Land.—*The American.*

FIELD OF THE TELEPHONE.

Professor Bell is sanguine that the usefulness of the telephone has by no means as yet attained its natural limit. Since the recent decision sustaining the patents of the American Bell Company, he has been devoting himself with assiduity to experiments intended to improve the telephone, with the idea of making it feasible to speak over longer distances than is now possible. In a recent interview with a newspaper reporter, he predicted that it would in time be as easy "for a subscriber in New York to call up a friend in San Francisco, and to engage him in conversation, as it would be to call another subscriber to the telephone in the city of New York." The service between New York and Boston, by means of a circuit of double copper wire, is now said to be working very satisfactorily; but Professor Bell thinks that all wires in cities should be placed underground, that "the efficiency of the telephone cannot be fairly judged and tested in a large city, where the wires are supported on poles and buildings."

Prof. Bell does not believe in the relay system for strengthening the current along the line, but believes that the sound can be so intensified at the receiver as to be heard in the remote corners of a large room. As to this point, he says: "We find this difficulty—when the sound is intensified, it is at the expense of distinctness and of perfect articulation. This fault can probably be corrected in a measure, so that if persons desire it they will be able to sit some distance from the telephone and hear all that comes through the receiver. The transmitter can also be made to convey sounds brought to it from a distance."

Besides his direct experiments with the telephone, Professor Bell has long been actively interested in efforts to promote the education of deaf mutes. He has, in this connection, invented an instrument for accurately measuring the hearing capacity of the human ear. It is composed of one stationary and one sliding coil, between two horizontal rods, on one of which is a graduated scale reduced to the metric system. A telephone receiver is attached to the instrument, and the current is supplied by a magneto-electric machine which has a wheel composed of alternate sections of conducting and non-conducting surfaces, by means of which the current is rapidly and regularly closed and opened. A musical sound is produced, which the telephone receiver communicates to the ear. Holding the receiver to the ear, the operator moves the sliding coil from the stationary one, and as the distance between the coils increases the sound grows fainter and fainter, and finally is lost altogether. The scale on the side rod marks the point which the sliding coil had reached when the sound ceased to be heard. If a standard of normal hearing capacity can once be obtained, it will be an easy matter to measure the exact capacity of every ear which is tested. Every element, by the use of this instrument, is calculable.

Professor Bell has tested this instrument in some of the New York public schools, and estimates that ten per cent of the children attending them have slight defects of hearing. He says that "one per cent of this number are so deaf that they derive no benefit from the usual methods of instruction. The scholars know, of course, when their hearing is bad, but the teachers, as a rule, do not, and often think a child dull when it is only deaf. If the teachers were aware of the infirmity, and understood it, the pupil whose hearing was defective could always be given a position in the room and classes which would enable him to profit by the instruction which he is now, in many cases, losing. I find a great difference in the hearing capacity of people. Some persons can hear equally well with both ears, but most persons have a greater hearing capacity in one ear than in the other. The hearing capacity ranges from zero to an abnormal degree of acuteness."

SOME idea of the extent of the London smoke nuisance may be gathered by a glance at the statistics lately published of the duration of sunshine in London and in the provinces for 1883. In the city, during that year, the sun shone for 974 hours out of a possible 4,456 or an average of two hours forty minutes per day. At Kew, in the same time, there were 1,484 hours' sunshine, or a daily average of four hours three minutes, while at Hastings the total was 1,825 hours, or exactly five hours a day.

LIFE RAFT.

We give illustrations of a life raft, which received the first prize at the recent Tynemouth Naval Exhibition. It consists as will be seen, of two similar hulls, or tubular chambers, connected by a horizontal platform P along their whole length, and joined at the ends, as shown in the plan, Fig. 1. Along the top and bottom of each chamber is a strip K, which serves either as a keel or gunwale, according to which half of the boat, which is reversible, is above water. The hulls are made of 13 B.W G. steel plates, provided with water-tight bulkheads B, as shown. The deck is open, and for a ship's boat is made of rope network, so that it can be launched without davits, and in any position, it being a matter of indifference which side comes uppermost in the sea. For special purposes, such as the Transport Service, the boat can be made to open in half, along the horizontal axis of the hulls, so as to form rafts for artillery or troops. As a life-boat, it was demonstrated during the Tynemouth Exhibition to be extremely efficient, not only being safe in very heavy weather, but easily handled, and travelling fast through the water. The inventors are Mr. A. Timmis, of 17 Great George-street, Westminster, and Mr. J. N. Hodgson, 19 Emmet-street, Poplar.—*Eng.*

SMALL TURNTABLE.

The illustration shows a neat and good design for a small, light turntable up to 15 feet diameter. The revolving top is cast iron, with steel bush centre, and rails rivetted on; there are six wheels turning on spindles on outer frame.

MANUFACTURE OF PORCELAIN AT THE ROYAL WORKS, DRESDEN.

These works are at Meissen, near Dresden. The china for ornamental pressing is not used in a clay state, but as a liquid, slip-like, thick cream. This is poured into the orifice of the mould left for the purpose, and then allowed to stand for a short time; when sufficient slip has adhered to the mould, the remainder is poured back into the casting jug. The slip having remained in the mould for some minutes becomes sufficiently solid to enable the workman to handle it. He next proceeds to arrange all the pieces on a slab of plaster before him. He then trims the superfluous clay from each, and applies some liquid slip to the parts, and so makes a perfect joint, each part being fitted to its proper place, until the whole figure is built up as it was before it was moulded; as each joint is made, the superfluous slip is removed with a camel's hair pencil.

The object is next propped with various strips of clay having exactly the same shrinkage and is then ready for the oven. The shrinkage or contraction to which we have alluded is one of the most important changes, as well as one of the greatest difficulties encountered in the art of pottery. The change will be more or less, according to the materials used and the process employed in making. Thus earthenware will not contract so much as porcelain, and a pressed piece will not contract so much as a cast one. The contractions are sufficiently well known to the modeler, and he makes allowance in the model accordingly, the design being fashioned so much larger than is actually required; the shrinkage from the original model to the finished object being sometimes equal to 25 per cent.

The ware up to this point in all the stages of manufacture we have described is most tender, and can only be handled with the greatest care.

The manufactured objects being now ready for baking, are taken to the placing house of the biscuit oven, where may be seen some hundreds of seggars of all shapes and sizes. These seggars, which are made of fire clay and are very strong, are the cases in which the ware is to be burned. Common brown wares, when the fire is comparatively easy, may be burned without any protection, as the fire or smoke cannot injure them; but for porcelain or white earthenware these cases are necessary. The seggars are made of various shapes to suit the different wares. Flat round ones are used for plates, each china plate requiring its own seggar and its own bed in it, made of ground flint very carefully prepared, for the china plate will take the exact form made in the bed of flint. Cups and bowls are placed, a number of them together, in oval seggars, ranged on china rings to keep them straight. These rings must be properly covered with flint to prevent them adhering to the ware burned upon them.

The seggars when full are piled one over the other most carefully in the oven, so as to allow the pressure to be equalized as much as possible; this is absolutely necessary, as when the oven is heated to a white heat (calculated as equal to about 25,000° Fah.) the least irregularity of bearing might cause a pile to topple on one side, and possibly affect the firing of the whole oven, causing a great amount of loss. Calcined flint is used for the purpose of making beds for the ware, because being pure silica it has no melting properties, and will not adhere to the china.

The form of oven seems to have been much the same in all ages, viz., that of a cone or a large beehive. A china oven is generally about 14 feet in diameter inside. It is built of fire-bricks, and is incased several times round with bands of iron to prevent too great expansion from the heat inside. There are generally eight fireplaces around the oven, with flues which lead directly into the oven in different directions. A china oven takes about forty hours to fire; it is then left to cool for about forty-eight hours. In order to test the burning, the fireman draws small test cups through holes in different parts of the oven made for the purpose. These tests show, both by contraction and the various degrees of translucency, the progress of the fire. The test holes are carefully stopped with bricks, so that cold air cannot be drawn into the oven.

The porcelain having been burnt is now in the state called biscuit; it is translucent and perfectly vitreous. Having had the flint rubbed off the surface and been carefully examined, it is sent into the dipping room.

The dipping room is supplied with large tubs of various glazes, suitable to the different kinds of ware. The glaze is really a kind of glass, which is chemically prepared of borax, lead, flint, etc., that when burned will adhere to the porcelains and will not craze or crackle on the surface. This glaze is ground very fine (being on the mill for about ten days) until it assumes the consistency of cream. The process of glazing is simple, but requires a practical hand, so that every piece may be equally glazed and the glaze itself equally distributed over the surface.

From the dipping room the ware is brought into the drying stove, where the glaze is dried on the ware. It is then taken by women into the trimming room, where any superfluous glaze is taken off, and defective places are made good. From this room it is taken to the glost oven placing house, where the greatest care and cleanliness are required, as should any dust or foreign substance get on the glaze it will adhere in the fire, and very likely spoil the piece.

The glost oven is of the same construction as the biscuit. It takes sixteen hours to fire, and the tests are made in the same manner as in the biscuit oven. The average heat is equal to about 11,000° Fah. In about thirty-six hours the oven will be sufficiently cool for the ware to be removed. It is then sent into the white warehouse, where it is sorted and given out to the painters and gilders, to be decorated according to the orders on the books.

Visitors generally look forward with pleasure to the mysteries of the decorating department. It is interesting to watch the painters, some on landscapes, others on birds or flowers or butterflies. All are interested in their work, which to the uninitiated may appear at first sight to be very unpromising, the colors being dull, and the drawing unfinished. As the work advances, it will be better understood. After the first "wash in" has been burned, and the painter has worked upon it for the second fire, the forms and finish, both in style and color, begin to appear.

The colors used are all made from metallic oxides; thus copper gives green and black; cobalt, blue; gold, purple; iron, red, etc.

The painters are trained from about fourteen years of age under special instructors; they thus acquire a facility of drawing and general manipulation of the colors which is found almost impossible to attain at a later period of life.

The gilding process is carried on in rooms adjacent to the painting. The elaborate and finely executed patterns in gold are all traced by the hand. The workmen require special training for this department also, correct drawing and clean finish being absolutely necessary. For the purpose of getting correct circles and speedy finish on circular pieces, a simple mechanical contrivance is used. A small table or stand with a revolving head receives the plate or saucer or cup, which is carefully centered so as to run truly. The time required for enamel kiln firing is about six hours.—*Pottery Gazette.*

TIMMIS AND HODGSON'S REVERSIBLE LIFEBOAT.

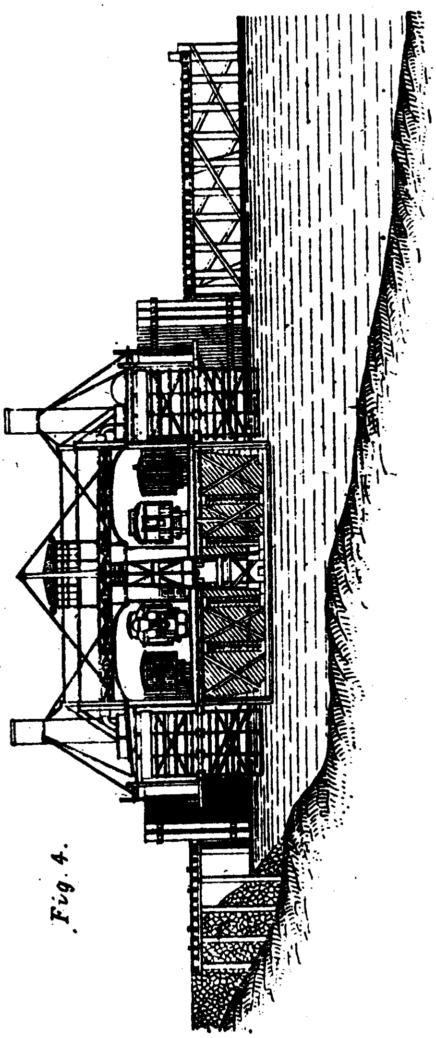


Fig. 4.

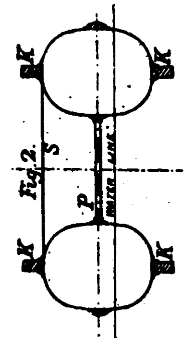


Fig. 2.

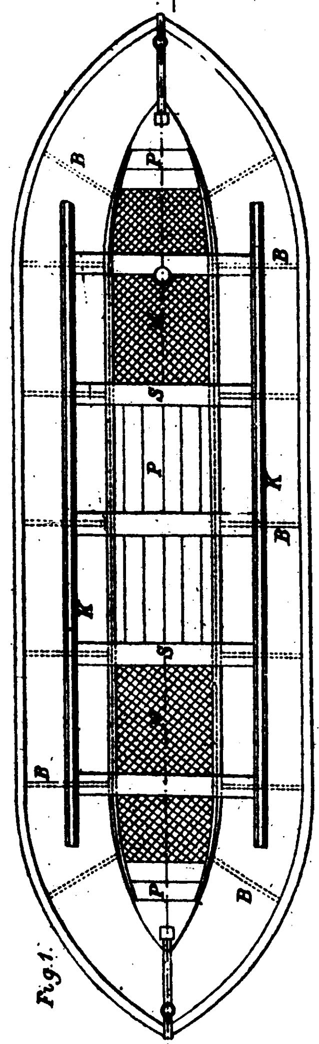
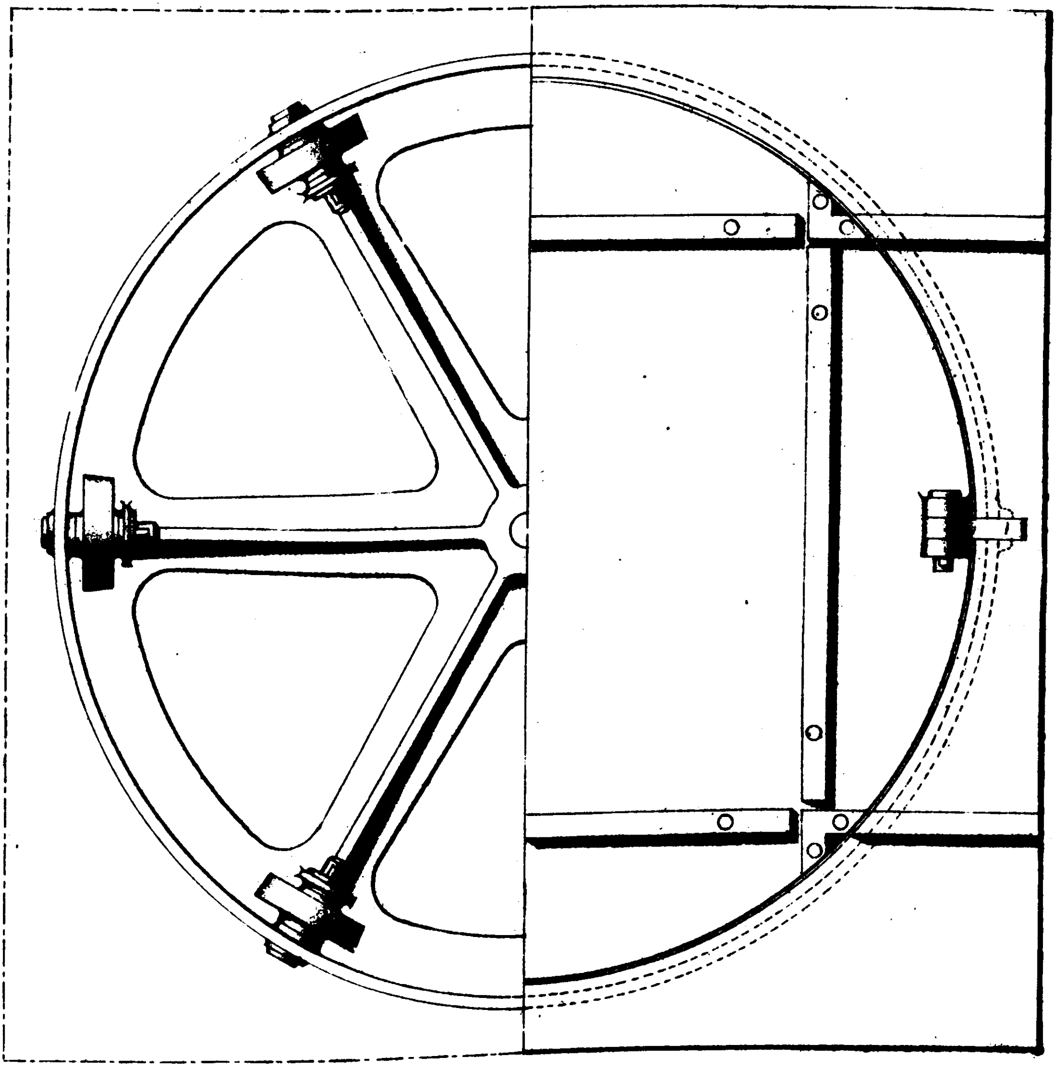
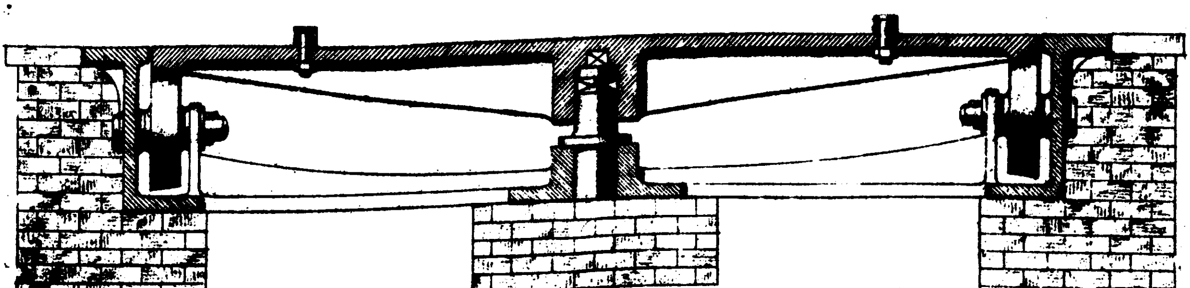


Fig. 1.





DESIGN FOR A SUBURBAN RESIDENCE.

The *Manufacturer and Builder* seldom gives its readers a design for a more attractive and comfortable house than that illustrated this month. The compact arrangement of all parts. and the simple yet effective treatment of the exterior, make possible a great deal of room at comparatively low cost.

Everything in the interior arrangement is suggestive of great comfort, and the attention given to certain details makes the house one of high class. Thus, the hospitable entranse hall, with its open fireplace and broad staircase, the places for a cheerful open fire in all the downstairs rooms, the complete separation of kitchen from dining-room by means of a butler's pantry, the position of the back stairs and the situation of the bath-room, where least possible plumbing work is necessary, are all indicative of careful thought given to the plans. Then, too, there are pantries and closets in abundance downstairs and upstairs. Each bedroom has its own closet, and in addition a good closet is placed at the end of the house for storage of linen, etc.

The rooms are all large and well lighted, and in addition to the smaller windows in the entrance hall, a large double window on the landing between the first and second stories throws light down into the entrance hall and serves to well light the upper hall.—*Ex.*

PRESENT AND FUTURE OF THE ISLAND OF MADEIRA.

There are few colonial possessions so justly celebrated as the little island of Madeira, which lies in the Atlantic Ocean, 270 miles north of the Canary Islands, and at about an equal distance from the coast of Morocco. Madeira was discovered by the Portuguese navigators Joan Gonzalvez, Zarco and Tristan Vaz, in 1420, a year after its small sister island, Porto Santo, had been taken possession of by them. Madeira was at the time so densely wooded that the Portuguese set fire to the timber, and this destruction continued until, after a couple of years, not a vestige of forest was left. The ashes of this vegetation may, together with the volcanic nature of its fertile soil, have contributed much to prepare Madeira for viticulture and that particular flavor of the grape which distinguishes it and the wine made therefrom. A mountain range forms the backbone of the island at an average height of 4,200 feet, reaching 6,000 feet at some points. Being well watered, a system of irrigation, which was soon introduced after it became a permanent Portuguese colony, has led to the splendid results which agriculture has reaped from this favored spot.

The climate is very mild—Madeira being situate on the border of the tropic—neither too moist nor too dry, and so even that the island has become the favorite resort of invalids suffering from pulmonary ailments. The marvellous cures effected there have rendered this spot in mid-ocean justly famous. Hence the European steamers bound to the West Indies and Brazil mostly call there to leave and take passengers and at the same time load the celebrated wine.

Madeira has a population of 130,213 souls and Porto Santo of 1,738 ; when discovered, both were uninhabited. Funchal, the capital and chief port, has 21,000 inhabitants.

The sugar-cane, which was noticed for the first time by the Crusders in the East in 1239, was introduced by the Moors into Spain and cultivated by them at Granada and Valencia in 1312, whence, in 1425. the Portuguese carried it to Madeira, where, in 1455, it was a flourishing crop, producing 120,000 arrobes of 25 pounds annually. Gradually the vine superseded it, until in 1852, the oidium destroying the latter, it was again cultivated, and has continued a regular agricultural pursuit and industry ever since.

The vine was introduced from Sicily, and proved such a success that in 1547 the Malmsey of Madeira had become the favorite wine at the Court of Spain. In 1646 there were exported 1,400 pipes, and in 1660 several Englishmen settled on the island for the purpose of viticulture. From that time dates the celebrity which this wine acquired in England ond on the Northern Continent. In 1774 there were exported 7,000 pipes ; in 1801, 11,000 ; in 1808, 13,000 ; in 1809, 15,000 ; in 1820, 13,000, and in 1825, 14,000. The export between the latter year and 1852 varied between 9,000 and 14,000 pipes annually. The oidium then made its appearance, and, after it had been overcome, the phylloxera followed in 1871, and in its turn was got under control in 1876, when American vines were procured, and on these hardy stocks the native vines were grafted. Since then the amount produced has been steadily increasing. During the five years 1878-1882 the increase was as under :

Export.	Litres.	Value—Milreis.
1878	829,022	419,808
1879	1,139,697	529,854
1880	1,438,515	663,987
1881	1,344,420	665,723
1882	1,660,800	859,988
Totals	6,412,514	3,139,360

During the past eighteen months the island has suffered a great deal, in many ways. There have been prolonged droughts, followed by cyclones, and agriculture in every branch but wine-growing has given poor returns, so that famine has prevailed in various quarters, and the local authorities, aided by private charity, have had to come to the assistance of the peasantry. Sugar planters of the Sandwich Islands have contracted for immigrants from Madeira on an extensive scale, and every month a thousand of them have been taken off by steamers destined for that part of the Pacific.

This wholesale departure of valuable farm-hands and their families from Madeira has, as may be presumed, alarmed the local authorities and the government at Lisbon, so that at length they have been stirred into activity to ameliorate if possible the condition of farming interests. Taxes have been reduced ; food and aid in money have been distributed ; harbor improvements are being made ; ships' dues are reduced, and a thorough administrative reform has been inaugurated to preserve the island from depopulation and decay.

The port charges for loading and unloading at Madeira were so heavy that the Canary Islands have taken away a great many vessels which used to go there for revictualing.

The Portuguese are a sober, thoughtful people, not given to revolutions; but, however well they may manage affairs at home, they have mismanaged and neglected their valuable colonies, and the consequence is that on the west and east coast of Africa other nations are beginning to encroach on them. In fact the Congo Conference now in session at Berlin would never have been convoked if the Portuguese had bestowed more attention on their colonial empire. But the Congo Conference will at any rate effect this much good—that Portugal will have to thoroughly reform its colonial system in accordance with modern ideas.

The resources of Madeira as a producer of excellent wine and as a place of resort for invalids and of call for vessels are so valuable and great that the energy now shown in rescuing the garden the garden of Africa from rapid decline can hardly fail to be attended with the desired success.

While other European nations are now making a great effort to improve and acquire colonies, it is to be hoped that there may be buoyancy enough left in the descendants of Henry, the navigator, to once more bring prosperity to the valuable remnant of colonial possessions which he and his illustrious followers bestowed in the little state at the extremity of Western Europe.—*American Mail and Export Journal.*

THE BEAUTY OF COAL.

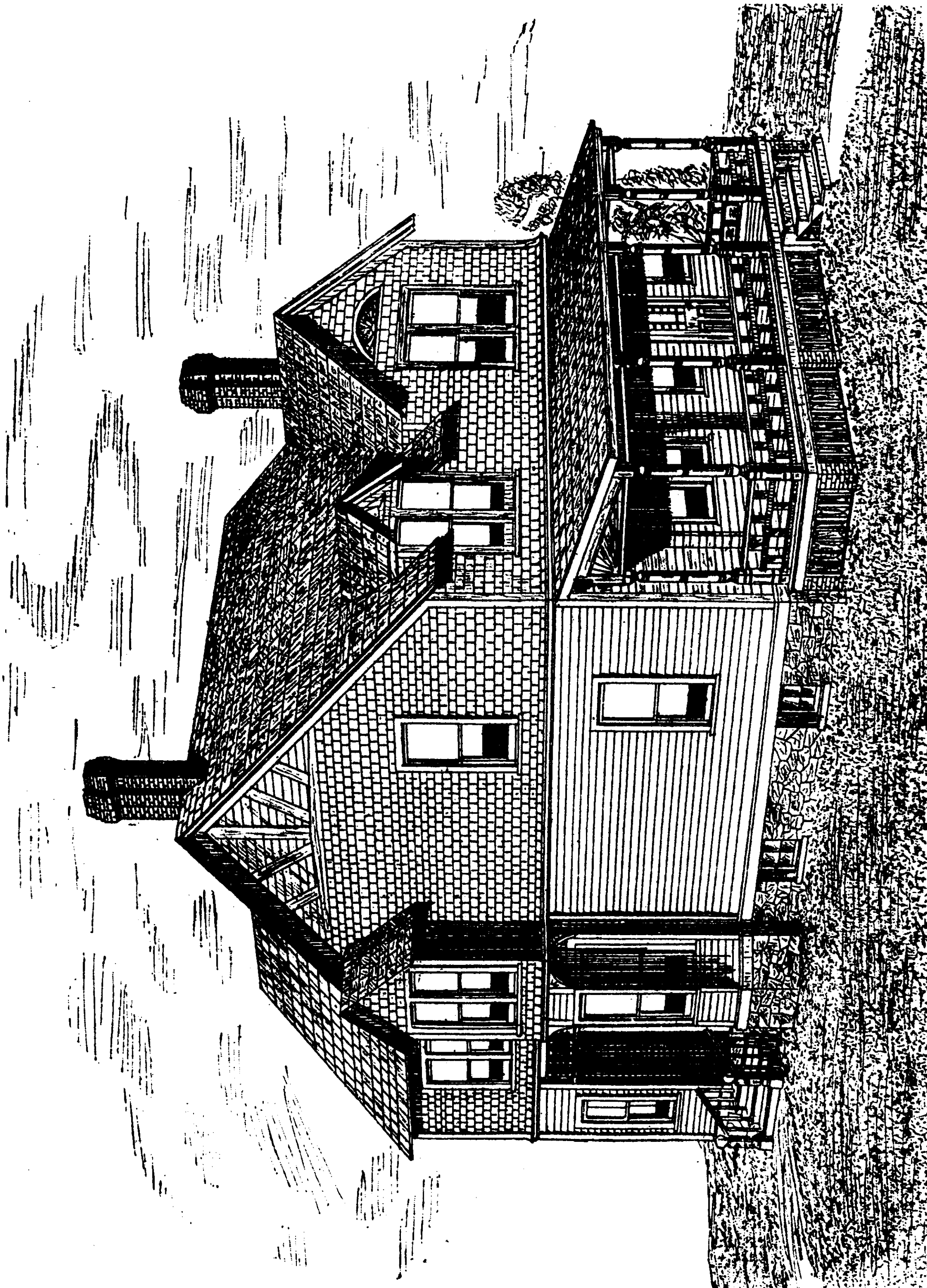
Lyell, in his experiments with coal, remarks "that after cutting a slice so thin that it should transmit light, it was found that in many parts of the pure and solid coal, in which geologists had no suspicion that they should be able to detect any vegitable structure, not only were annular rings of the growth of several kinds of trees beautifully distinct, but even the medullary rays, and, what is still more remarkable, in some cases even the spiral vessels could be discerned." Again in another place, "the high state of preservation in which many of the objects occur, the perfect condition of the leaves, and other parts of many of the ferns, the preservation in which many of the sharp angles of numerous stems and plants known to be of a soft and juicy nature, with the surfaces of a sagillariœ, especially marked with lines, streaks and flutings so delicate that the mere drifting of a day would have inevitably destroyed them, together with the occurrence of certain fruits which are found in heaps and clusters, together with many other facts of like nature leading to similar conclusions, convince us that these objects have never been subjected to drift, but were buried on the spots where they lived and flourished." We quote these evidences of the perfect preservation of fragile plants and of fruits of a remote age as an important reason why further inquiry as to its cause should be made. If these plants were suddenly immersed in a fluid which excluded light and air and preserved them while becoming solid, it is analogous to the preservation of plants and insects in gum copal, and does not require unusual arguments to obtain relief. The presence of trees standing upright where they grew and imbedded in coal suggested a probability of immersion in the same way. The recent discoveries of immense deposits of petroleum in subterranean cavities or streams suggests the theory which is here offered—that this "mineral oil," as it was at first called, may be the origin of coal and not its product. Note the thickness of many strata of coal—some are sixty feet thick and are of uniform structure—with slate limestone floors and roofs; and coal also has stratification closely resembling stratified rocks which deserves attention. Petroleum, bitumen, and asphaltum are classed together as of a similar nature, although the first is a liquid and the last named a solid. If these substances are, as we believe, elementary, (of the same class as salt, sulphur, etc.), the solution of this question will be comparatively easy. We find a great difficulty in believing petroleum to be a vegetable product. If any species of vegetation yielded more resinous or oily products in former ages than do those of to-day, these products were either drawn from the earth, water, or air to supply the vegetation that held them. It also seems unreasonable to have so much vegetation derived from the vegetable fiber, when the entire growth of vegetation of any soil or climate appears inadequate to represent a uniform body of coal sixty feet thick.—*Ex.*

STEAM BOILER EFFICIENCY.

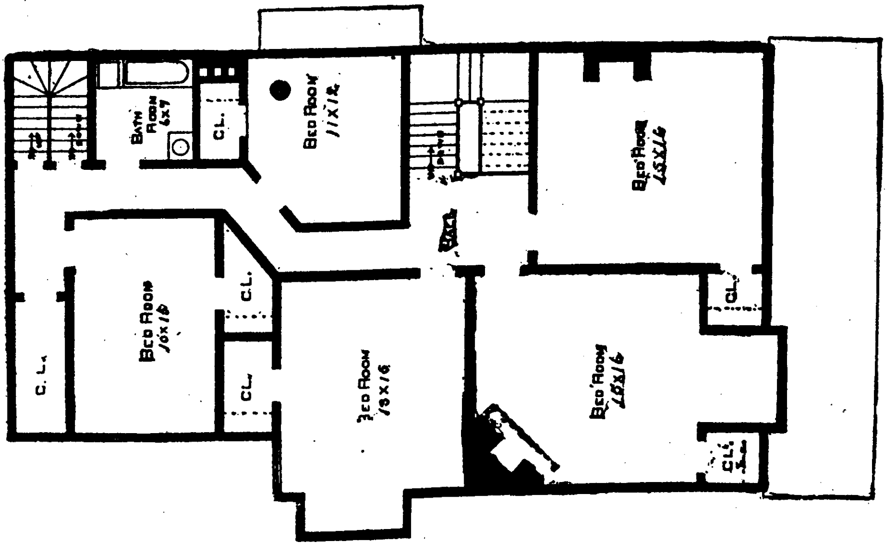
The efficiency of a steam boiler is to be measured mainly by its evaporative power and its economy in fuel, and the more widely these two factors diverge—other things being equal—the more perfect the efficiency of the steam generator. It is to the attainment of either or both of these ends that invention is usually directed, although not always with success. Inventive genius, however, is put to the test in the present day by reason of the undoubted tendency of steam engineering practice towards high pressures wherever practicable. In order to attain them various expedients are resorted to, both in the construction of the boiler and furnaces and in the use of auxiliaries, chief among which is forced draught. This latter principle is pushed to its extreme limits in torpedo-boats, in which class of vessels as a result the water evaporation is very low and the consumption of fuel disproportionately high, thus giving a low efficiency from an economical point of view. This will be readily assented to by those who have been present at trial runs of vessels of this class, and who have had to dodge the burning lumps of solid fuel as they are chased by the blast out of the funnels, and who at the close of the run have seen the deck thickly covered with cinders—although a common one—of waste fuel, but it is to be observed that economy in torpedo boats is a secondary consideration, the primary one being high and long sustained speed. But there are other cases in connection with land as well as with marine boilers where they are forced up to high pressure, so as to get as much steam out of them as possible. In order to produce the necessary heat for this purpose, coals are hustled into the furnace pell-mell and a thick fire is formed which chokes the draught. Then we have the use of fans or blowers in order to force into the furnace the required amount of air for combustion. Out of this practice arises several evils. In the first place, the supply of air is often twice or thrice that which is necessary for proper combustion, and this air absorbs and carries off a large amount of heat. This large accession of cold air, moreover, condenses the gases as they are evolved from the fuel, and these in part create smoke, which, when once formed, cannot be burned. Further the large quantity of air forced into the furnace, precludes the possibility of the gases properly combining, owing to want of time thereby preventing proper combustion. The heat that is developed is, moreover, drawn so rapidly through the boiler tubes that it has not time to penetrate the plates and form steam. Thus from first to last the system of forced draught is beset with evils, the sum total of which is the very opposite of economy. This may be a satisfactory condition of things for those who sell coal, but hardly so for those who have to pay the bills.

The subject of steam boiler efficiency has for some years past formed a matter of careful practical study with Mr. A. C. Engert, and we have from time to time brought his inventions in this direction under the notice of our readers. Last year Mr. Engert designed and had put up at his works a boiler, having two flat flues with vertical tubes and very high steam space, and which possessed great heating surface. The firebars were short, the grate sloping, and there was no ash-pit. Independent tests showed that this boiler evaporated as much as 11.3 and 11.85 pounds of water per pound of coal from 81° F., the steam being very dry. The combustion was most perfect, as shown by the absence of smoke from the chimney noted by us upon several visits which we made to the works. After this Mr. Engert turned his attention more particularly to the furnace, with the view of obtaining the most perfect combustion at the earliest possible moment, and of retaining the flame in contiguity with the boiler plates, so that every atom of heat developed might be utilized in forming steam. In effect, he sought to assimilate the action of his furnace to that of the blowpipe, and to produce a flame similar to that which results from the use of that appliance. This he has succeeded in doing in what he terms his blowpipe-flame furnace, which formed the subject of a paper which was read at a meeting of the Society of Engineers, on Monday evening last. We need, therefore, only here state that in this furnace the ash-pit is dispensed with, and only a shallow curved passage for air left under the firebars. The mouth of the furnace is closed by a hanging door or apron placed within a box entrance and having perforations near its lower edge for the admission of air to the fuel. The furnace is fitted under a double-flued or Lancashire boiler eighteen feet long and seven feet diameter, at Mr. Engert's works, and it has a grate area of seven square feet only, the two flues forming returns for the products of combustion. At the end of the fire grate, which inclines towards the doors, is a firebrick wall three feet six inches thick, and which is carried up to within eight inches of the under side of the boiler at the front and seven inches at the back. Then comes a chamber or pocket three feet long for dust to settle in, and then the bridge proper, which, like the wall or embankment, follows the contour of the boiler and has a space of seven inches between its top and the bottom of the boiler. By keeping a comparatively thin fire, and, above all, by properly disposing and proportioning the air entrances, Mr. Engert is enabled to obtain a transparent flame having a pale greenish tint, as we have, in fact, seen for ourselves. As is well known, this flame gives the greatest intensity of heat, which, however, would be worse than useless if concentrated within a small area, as it would burn the plates of the boiler. In the Engert furnace, however, by means of the brick embankment, the flame is drawn out and distributed over a large surface of the plates, and, penetrating through them to the water, is fully utilized in producing steam. In a word, it is claimed—and the claim is substantiated in practice—that not an atom of oxygen entering the furnace, either from below or from the front, escapes to the flues without having done its work by coming in contact with the fuel and producing almost perfect combustion.

As the worth of a tree is determined by its fruits, so is the value of an invention gauged by its results. In the present instance, we have some remarkably advanced results which, although considerably in excess of ordinary practice, have yet been obtained from actual working, and which thus afford prima facie evidence that Mr. Engert has succeeded in effecting a practical and a practicable departure in steam engineering. The furnace and boiler have been tested by two professional experts independently of each other, namely, Mr. D. K. Clark and Mr. W. Schonheyder. Mr. Clark's test extended over nearly seven hours, during which he consumed 721.5 pounds of coal, and evaporated 150.8 cubic feet of water from a temperature of 70° F. We thus get an evaporation of 13.02 pounds of water per pound of coal from the temperature just stated. The steam is reported to have been dry, and there appears to have been no evidence of priming. The test was made under conditions of slow combustion, only a small proportion of steam being used during the trial for driving the machinery in Mr. Enert's works, as most of the hands were absent on holiday, the day having been Nov. 10 last. Mr. Schonheyder's test was made on Nov. 20, and extended over nearly eight and a half hours. He used 12,857 pounds of water, and consumed 1120 pounds of coal, the mean temperature of the water being 74° F. The evaporation was therefore 11.48 pounds of water per pound of coal from 74°, and 35 pounds boiler pressure. This test was made under the conditions of quick combustion—that is, when the boiler was fully at work supplying steam for driving the whole of the machinery in the factory. Both Mr. Clark and Mr. Schonheyder agree that the combination of the furnace arrangements cause an in-



DESIGN FOR SUBURBAN RESIDENCE, COSTING ABOUT $4,000.



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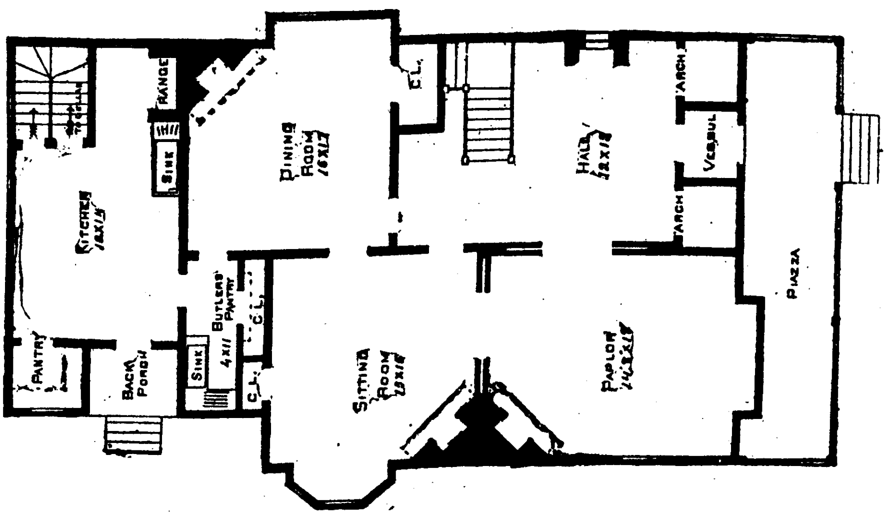


First Floor.

tense heat to be developed, and consequently produce very perfect combustion, as evidenced by the absence of smoke from the top of the chimney. The results of these tests, coupled with our own observations, lead us to the conclusion that Mr. Engert has so far, established a claim to having advanced the question of steam boiler efficiency in a very important degree. —*Iron.*

THE FIRST STEAMBOAT.

A telegram from Trenton, New Jersey, announces the important fact that a search among the old State records shows that Robert Fulton was not the inventor of the first steamboat, and that John Fitch was the inventor, having run a steamboat on the Delaware river some twenty years before the launching of Fulton's steamboat on the Hudson. It will now be settled in the minds of those who read the article from Trenton that Fitch invented the steamboat, and for generations this fiction will become an accepted fact, and be believed by vast numbers of people. It will be accepted for the reason that it appeared in a newspaper as from the State records of New Jersey, and for the further reason that it ascribes the invention to an American. There is in every country an intensely patriotic desire to retain the credit for all inventions—as, for instance, Holland and Germany both claim to have invented the process of using movable types for printing; England, America, France, and one or two other countries claim the discovery of appliances for the employment of steam. The same three countries insist, each for itself, that it was the inventor of the processes of using electricity as a means of communication between distant points, and what is true of steam is also true of the telephone.

The steamboat is not the invention of Robert Fulton, John Fitch, or any other man. It is a development of many centuries, having been the result of a slow evolution. The paddle-wheel was known to, and was in use among the Romans; and this mechanical appliance constituted the essential difference between the steamboat built by Fulton and that of Fitch and others. The Spaniards claim a long priority in the use of steam for the propulsion of water craft. Our late minister to Spain, Hon. Geo. Marsh, has translated a document found in the national archives, in which there is an official account of an experimental trial of a vessel constructed by Blasco de Garay, a sea captain, which moved in all directions without sails or oars, and whose machinery "consisted of a large caldron of boiling water, and wheels of propulsion attached to the side of the ship." The experiment was witnessed by several of the highest dignitaries of the empire, by whom the account is furnished, and who made a highly complimentary report to the emperor, Charles V. The sole exception was Treasurer Renargo, who, for some reason, was unfriendly, and condemned the invention as being dangerous from the liability of the caldron to explode, and the complicated and expensive character of the machinery. This was in 1543 just two centuries before the birth of Fitch. Papin, a well-known Frenchman, published a work in 1690, in which he describes a steamer to be moved by paddles and built one in which a steam-pump was used to raise water to a certain height, which then was poured on the paddles of the vessels, as is done in the case of an overshot wheel. His boat was destroyed by a mob of watermen, under the impression that his invention would take the bread out of their mouths.

In 1736, Jonathan Hull, of England, described a method of propelling a vessel by steam, in which he placed the paddle at the stern. From this period to 1760 there were plans submitted for the propulsion of vessels by steam by Bernouilli, a Frenchman, Genevoise, a Swiss clergyman, and Abbe Gauthier, of France. At the close of this period, the United States appear on the field. William Henry, a Pennsylvanian, went to England, where he inspected Watt's invention, and on his return constructed an engine and placed it on a boat fitted with paddle-wheels. He ran it for a time on the Conestoga river, when by accident it was sunk. There is no doubt as to Henry's being the first to "bring out" a steamboat in this country.

In 1781, the Marquis Jouffroy constructed and ran a steamboat on the Seine; but, as the government declined to extend its aid, he dropped the steamboat and returned to the army. Three years later, James Rumsey, of Virginia, constructed a boat which was propelled by using steam to draw water in at bow and force it out at the stern. So convinced was the State of Kentucky that Rumsey invented the steamboat that it gave a gold watch to his son for the sake of his father, who had "give the world the benefit of the steamboat." A year before Rumsey's experiment, Dr. Franklin and Oliver Evans suggested a method of propulsion precisely similarly to that used by Rumsey. In 1786 John Fitch came to the front with his steamboat, which he declared he invented without the knowledge that steam was being used as a motor. His first model has floats on an endless chain as the propelling mechanism; then he substituted oars operated by steam, and succeeded in navigating the Delaware at the rate of six miles an hour. He and Rumsey had some fierce quarrels as to priority in the use of steam; lawsuits were instituted, and Fitch was ruined.

From the time of Fitch there were steamboats without end, none of which, however, were permanent. In 1788, Symmington, of England, built a steamboat which ran five miles an hour. A year later, the famous Oliver Evans built a dredging-machine which he propelled over land and through the water by steam. In 1801, the Englishman Symmington, built the Charlotte Dundas for Lord Dundas, with a paddle-wheel at the stern, and which was a complete success. Robert Fulton saw this steamer, and all the other models in Europe and in this country, and in 1807 he launched the Clermont in the Hudson river. Since the launch of that vessel the use of the steamboat has been unbroken.

If anyone from the reading of these facts is prepared to say who is the inventor of the steamboat, he must be the possessor of more than human sagacity. If the Spanish accounts of the experiment of Garay were less remote as to time, the credit would rest, so far as the records cover the ground, with this Spanish adventurer. It is, however, agreed to regard the paper taken from the national archives as being apochryphal in its assertions. In fine, the facts show that the steamboat was not invented by any one man, but was gradually evolved during the last 150 years.—*Chicago Times.*

ELECTRIC LIGHTING IN AMERICA.

At a recent meeting of the Society of Arts held at London, the chair was taken by Sir F. Bramwell, and a paper was read by Mr. W. H. Preece, F.R.S., who described electric lighting as he saw it during his late visit to the United States. Electric lighting, he said, was flourishing in America much more than at home. There were probably 90,000 arc lamps alight every night in the States, and there were many central stations working regularly, both with arc and with glow lamps. Contrasting the brilliantly illuminated avenues of New York with the dull and dark streets of London, he stated that on the evening of October 21 he drove from the Windsor Hotel, New York, to the Cunard Wharf, a distance of about four miles, through streets entirely lighted by electricity. On the 30th of October, he drove from Euston to Waterloo, without seeing a single electric light. He visited Montreal, Philadelphia, Buffalo, Cleveland, Chicago, St. Louis, Indianapolis, Boston, and New York, and found in each city the principal streets and warehouses, as well as stores and places of public resort, lighted by arc lamps. It was with arc lighting that the greatest advances had been made in the States. One manufacturer told him that he was turning out 800,000 carbons for arc lamps per month; another said that his output of plant was 50 arc lamps and three dynamos per day; and while he was present at a third factory an order was received for an electric lighting plant of 330 arc lamps requiring 14 24-light dynamo machines, intended for an installation to light up a park in the environs of Chicago.

In that city the number of arc lamps installed had doubled, increasing from 1000 to 2000 during the past 12 months. More than one electric light company paid dividends to its shareholders, and all the manufacturers as well as the lighting companies seemed to be full of work. The principal system in use there, for arc lamps, the Brush, the Weston, and the Thomson-Houston; but they were other arc systems, not so well known on this side of the Atlantic, such as the Hochhausen, the Van de Poel, the Western Electric, the Fuller, the Sperry, etc.; for glow lamps, the Edison and the Weston. Mentioning a considerable improvement which had been made in the Brush dynamo machine, he gave some account of the Western system, which, looked at from a mechanical point of view, struck him as being probably the best in use in the States. Of the Thomson-Houston system, unknown at present in England, and containing some considerable and ingenious novelties, he gave a more detailed account. The Hochhausen system was known in this country from its recent use at the Health Exhibition.

Visiting central stations in various towns, he found 164 Thomson-Houston arc lamps alight in the public streets and shops in Montreal. The rate was 50 cents per lamp per night from dark to midnight, or over £35 per lamp per annum. At Philadelphia the Brush system, employing 1,200 horse-power, supplied electricity for nearly 1,000 lamps, for which £60 per lamp per annum was the charge. The Brush people had also two central stations at Boston, lighting up 816 arc lamps; in fact, there are few towns of any consequence in the States that did not possess central stations worked by the Brush Company, and probably there were 25,000 Brush arc lamps in use in the United States. At Chicago all the drives in the Lincoln Park were lighted by arc lamps with very good effect, especially on the unique drive skirting the shore of Lake Michigan. Other companies also had central stations in Chicago. He did not see in the States one single instance of street lighting by glow lamps. In every case arc lamps were used for this purpose, and they were usually fixed on much taller posts than in England. Although brilliant, the effect was by no means perfect, and no effort seemed to be made to distribute the light uniformly, as had been done in England by Mr. Trotter. The price paid in New York was 70 cents per night, or £50 per annum, for each arc lamp; a fine of about 6s. for each time any lamp was reported out was inflicted.

Turning then to methods of incandescent lighting, he remarked that these did not seem to have flourished so much as arc lighting, nor indeed had they been applied to private houses to the same extent as in England. The principal system in practical use was that of Edison. House lighting had been attacked principally by the Edison Company. They had a central station in New York, which was opened on the 3rd Sept., 1882, and from that date to the time of Mr. Preece's visit there had been only two hours and a half stoppage, and that due solely to carelessness. There were 587 subscribers, using altogether 12,764 lamps served day and night. The price charged was the same as that which would be paid if gas were supplied at 7s. 6d. per 1,000 cubic feet, the price of gas having now been reduced to 5s. 9d. The use of secondary batteries had not received so much attention as on this side of the water. No difficulty was found in determining by the Edison meters the charge to be made, the subscribers paying for the light they received and not for the current they used. These bottle measurements were unquestionably accurate within one per cent.

At present the electric light in England must be regarded as a luxury, and must be paid for as a luxury, but there was no reason why it should remain a luxury. Pointing out improvements in dynamos and lamps which had already effected a reduction of cost, he observed that there was still vast room for economy, and it was clear that the prices now required to make electric lighting pay would be brought down. Even now it was possible in England to make a system pay at the rate of a half penny per glow lamp per hour. In conclusion, he spoke of the influence of electric street lighting upon the morality and safety of the public. The Chief of Police of New York had gone so far as to say that "every electric light erected means a policeman removed."

In a discussion which followed, Mr. Crompton gave reasons for believing that with regard to steam engines, dynamos, and lamps, and consequent economy and efficiency, we had little to learn from the United States. Professor G. Forbes spoke of the important element in the question of the experience gained in the United States in the supply of the current from central stations. Mr. Hammond, agreeing that in point of quality arc lighting was better done in England on the whole than in the United States, said the love of the electric light there was to be measured by the commercial instinct of the consumer.

Tho chairman, in closing the proceedings, pointed to the unfair conditions of an Act of Parliament as the true reason why electric lighting from a central source had not been developed in this country. The thing had been done with the express purpose of stopping the introduction of electric lighting from a central source, and only a strong expression of public opinion would remove this unreasonable obstacle to a great improvement.

TANNEKAYA bark, a new agent used in tanning leather is, to some extent, imported from New Zealand, the cost of the bark there and the freight bringing the price up to about $80 per ton. It is thought that this tree would grow in the Southern States if transplanted. It is a beautiful tree of the fir species, and its timber is said to be valuable.

ROLLING MILL ENGINES.

Our double-page illustration this month illustrates two pairs of engines constructed by Messrs. Davey Brothers, Limited, of the Park Iron Works, Sheffield, for the rail mill of the Tredegar Bessemer Works. Fig. 1 shows the reversing cogging mill engines and Fig. 2 the rail mill engines. In the former the cylinders, which are overhung, are 40 in. in diameter and 5 ft. stroke, and are fitted with balanced slide valves worked, through reversing links of the Allan type, by eccentrics fitted to separate shafts and driven by drag links from the main cranks. The reversing is effected by a steam cylinder fitted with suitable controlling gear, so arranged as to dispense with the usual oil cataract. All the starting handles are brought to an elevated platform erected over the centre of the engine, so that the man in charge has a complete view both of the engine and of the rolls.

The cranks are of cast steel and have the counter-weights cast on. The crankshaft is of best wrought scrap iron, 16 in. in diameter in the journals and 20 in. in the middle. The second motion shaft is also best wrought scrap iron, 20 in. in diameter in the bearings and 24 in. in the middle. The spur gearing has a ratio of about 2 to 1; it is 8 in. pitch and 24 in. wide at the points of the teeth. The total weight of the engines is about 140 tons.

The engines designed for driving the finishing rolls have cylinders 48 in. in diameter, and 4 ft. 6 in. stroke. They are overhung and fitted with balanced slide valves driven by eccentrics through reversing links of the Allan type. The reversing is effected, as in the previous case, by a steam cylinder fitted with suitable controlling gear, so arranged as to dispense with the usual oil cataract.

The crankshaft is 18 in. in diameter in the journals; its extreme length is 20 ft., and its weight upwards of 13 tons. It is made in halves, bolted together in the centre, the flanges being used for carrying the balance disc. The height from the foundation to the centre of the crankshaft is 4 ft., and the total weight of the engines about 150 tons.

Messrs. Davey Brothers supplied the first set of their rolling mill engines about five years ago to Messrs. Wilson, Cammell, and Co., of the Dronfield Works, and these are now being removed to Workington. They have since their erection rolled about 2,500 tons of finished rails per week on the average, without any stoppage for repairs. The other engines and rail plant in connection with these works were also constructed by the same makers, who have supplied similar engines to Messrs. Bolckow, Vaughan, and Co., Messrs. Steel, Tozer, and Hampton, the Tredegar Iron and Coal Company, the Barrow Hematite Steel Company (two pairs), also the Swanton Steel Company in America, and they are now building another pair for a Middlesbrough firm for rolling large angles and tees.

We may state that a modern rail plant, consisting of cogging, roughing. and finishing engines and mills, will turn out 3000 tons of rails per week with ease, whilst formerly 700 to 800 tons was considered a splendid week's work.—*Eng.*

THE WORLD'S TELEGRAPH.

The telegraph appears to have made more progress in the United States than in any other country. The number of American telegraph offices in 1882 was 12,917, and the number of telegrams forwarded during the year was 40,581,177. The number of telegraph offices in Great Britan and Ireland in 1882 was 5747, the number of telegrams forwarded being 32,-965,029. Germany had 10,803 offices, the number of telegrams farwarded being18,363,173. France had 6319 offices, the number of telegrams forwarded being 26,270,202. Russia had 2819 offices, the number of telegrams forwarded being 9,800,201. Belgium had 835 offices, the number of telegrams forwarded being 2,830,186. British India had 1025 offices, the number of telegrams forwarded being 4,066,843. Spain had 647 offices, the number of telegrams forwarded being 2,032,603. Switzerland had 1160 offices, Italy 2500, and Austria 2696. The number of telegrams forwarded in these three last-mentioned countries was 3,046,182, 7,062,287, and 6,626,203 respectively.—*Ex.*

THE manufacture of needles and pins is one of the most flourishing industries in Germany. The eight manufactories of the Iserlohn consumned in twelve months 600 tons of wire, employing 800 male and 700 female operatives, besides seven steam engines and four water wheels of 230 horse power.

ROLLING MILL ENGINES.

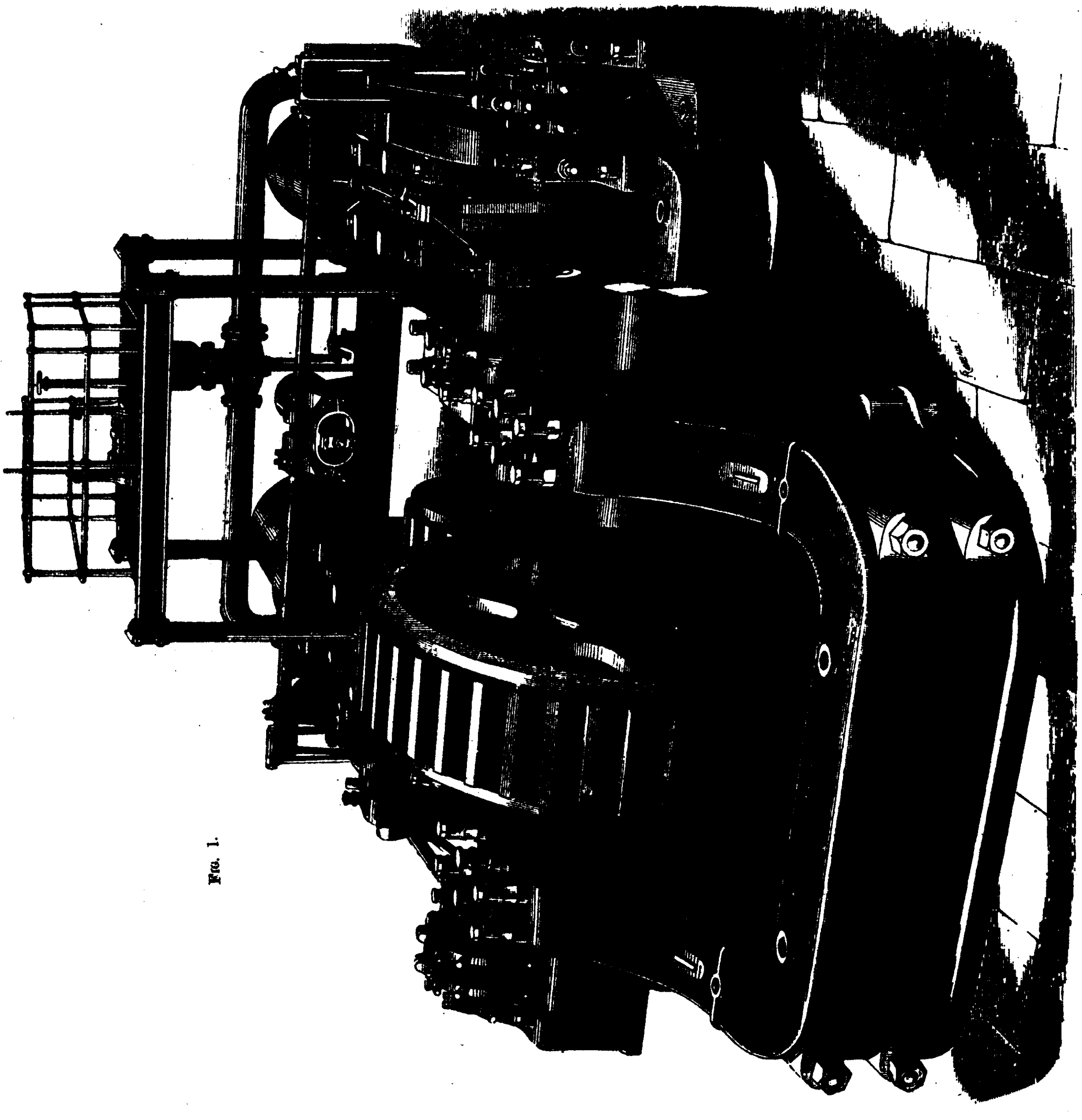


Fig. 1.

ROLLING MILL ENGINES.

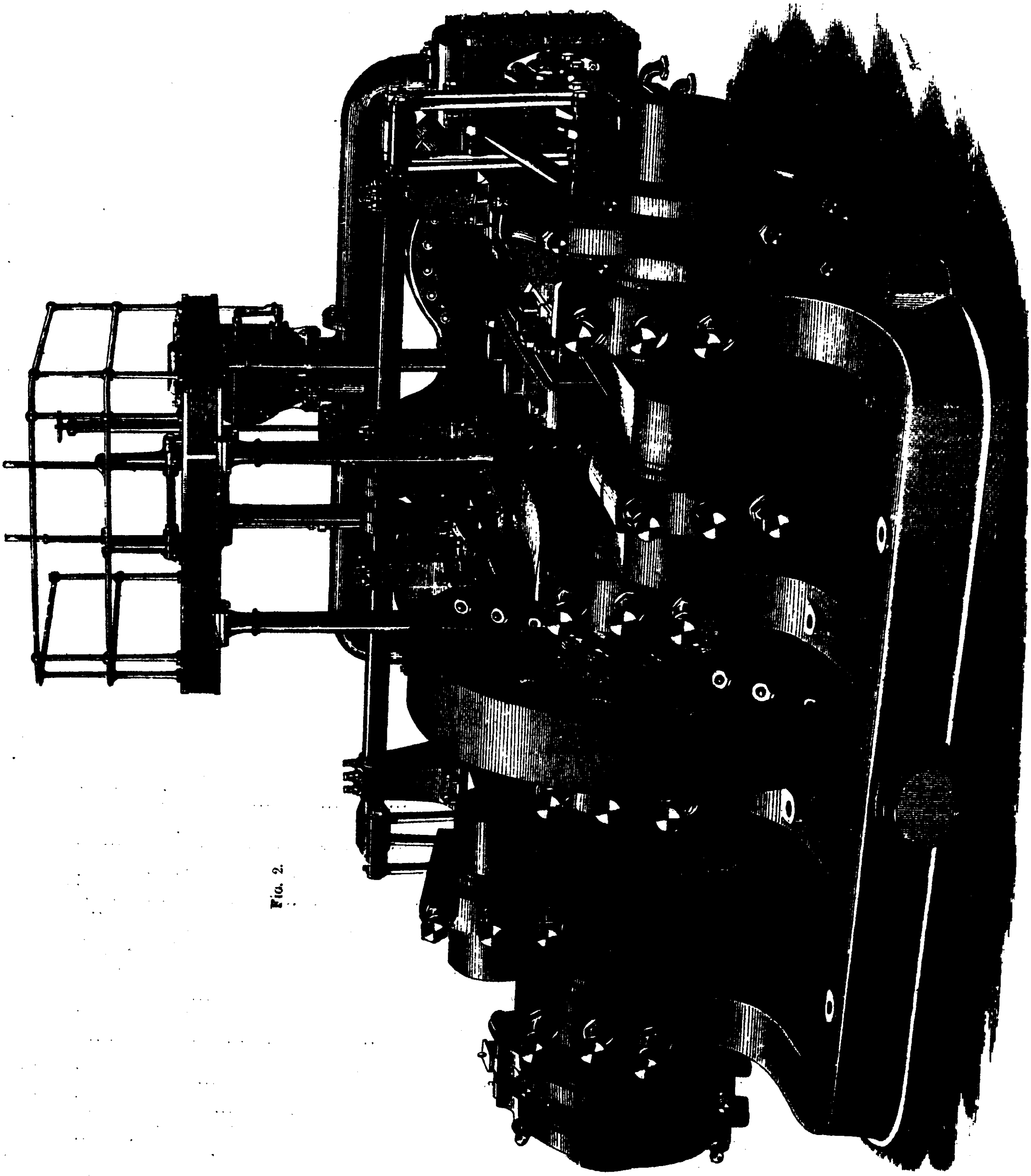


Fig. 2.

HABITS OF THE SCORPION.

A writer in *Land and Water* relates his experience with scorpions as follows:

A few years ago, while in the island of Jamaica, it was my fortunate chance to have an opportunity of observing some very curious facts in connection with that genus of the Arachnida class commonly known as the scorpion, and the curious traits of character in these insects. Turning over some old papers in my office one day, I suddenly came upon a large black scorpion, who promptly tried to beat a precipitate retreat. Having read or heard somewhere that if you blow on a scorpion he will not move, I tried the experiment, and was greatly astonished to find that it had the desired effect. The scorpion stopped instantly, flattened himself close to the paper on which he had been running, and had all the appearance of "holding on" for dear life. While I continued to blow even quite lightly he refused to move, though I pushed him with a pencil and shook the paper to which he clung so tenaciously. Directly I ceased blowing he advanced cautiously, only to stop again at the slightest breadth. I was thus able to secure him in a glass tumbler which happened to be within reach, and then I determined to try another experiment as to the suicidal tendencies which I had heard ran in the veins of the Pedipalpi family.

On the stone floor of the kitchen attached to my office I arranged a circle of burning sticks about three yards in circumference, the sticks being so placed that though there were no means of exit through the fire, it was not intense, but small and quite bearable, as regards heat within a few inches, so that the central part of the circle was perfectly cool. Into this center I accordingly dropped my scorpion, who, on touching *terra firma*, darted off in a great hurry, only to be quickly brought to a halt on reaching within a few inches of the periphery of the circle. After a short pause of reflection he deviated to the right, and ran once completely round the circle as near to the fire sticks as it was prudent to venture. This he did three times, often approaching the burning sticks quite closely in his anxious endeavors to escape. In about a quarter of an hour, finding that his efforts were useless, he retired almost into the exact center of the circle, and there in a tragic manner raised his tail till the sting or spur was close to his head, gave himself two deliberate prods in the back of the neck, and thus miserably perished by his own hand. As I placed the body of the suicide in a bottle of spirits, I almost regretted that I had not let him escape before he had resorted to such an extreme measure.

My last experience is even more curious than the preceding, as it shows a remarkable provision of nature that is almost incredible. All I have ever read on this point is contained in the following words.

"The young scorpions are produced at various intervals, and are carried by the parent for several days upon her back, during which time she never leaves her retreat."

I was playing a game of billiards in a small village in the Blue Mountains, there was no ceiling to the room, the roof being covered, as is the universal custom in Jamaica, with cedar wood shingles. My opponent was smoking a large pipe, and suddenly, just as I was about to play a stroke, what I thought was the contents of my friend's pipe fell on the table close to the ball at which I was aiming. Instinctively I was on the point of brushing it off with my hand, when, to my amazement, I saw it was a moving mass, which on closer inspection turned out to be a very large female specimen of a scorpion, from which ran away in every direction a number of perfectly formed little scorpions about a quarter of an inch in length. The mother scorpion lay dying upon the billiard cloth, and soon ended her feeble struggles, the whole of her back eaten out by her own offspring, of which, as they could not escape over the raised edge of the billiard table, we killed the astonishing number of thirty-eight. They had not only been "carried by their parent," but they had lived on her, cleaning out her body from the shell of her back, so that she looked like an inverted cooked crab from which the edible portions have been removed. She had clung to her retreat in the shingled roof until near the approach of death, when she had fallen and given us this curious spectacle. I was told by the attendant that the young scorpions always live thus at the expense of their mother's life, and that by the time her strength is exhausted the horrid offspring are ready to shift for themselves.—*Ex.*

THE metals which are found to longest retain heat are brass and copper; next iron, and lastly in order lead.

VENTILATION THOUGH WINDOWS.

Assuming that the most safe and effectual means of obtaining fresh air in the house is still by the way of the window, notwithstanding the variety of other device for the purposes, the *Lancet* says that the practice of window ventilation begun in warm weather, may be carried on with proper care through autumn and winter. The constantly accumulating impurities derived from the breath, from perspiration, from excreta of other kinds collected in sleeping rooms, from the use of gas or lamplight, and too often, even now, suction of sewer gas from waste-pipes by the heat of house fires, etc., render it as necessary for health as for comfort that these should have free egress and that they should be substituted by the pure outer air. Fresh air from without may very easily be had without draft and without risk of cold, even to delicate persons, if a few simple rules be observed. The cold air of winter, of course, enters with greater force and in greater proportional volume than the more equal summer air into a warm room. The aperture of egress must be correspondingly diminished. Air from a window is preferable to that from an open inner door, no matter how roomy the house, from its more reliable purity. If the window be the inlet—the fire, fire-place, or it may be the door of a room in summer acting as an outlet—it may be opened from the top, the extent being regulated according to the outer temperature. There is then a direct inward current at the upper part which follows the ceiling of the room, thus mingling with any heated waste products which require to be removed, and an uninterrupted current at the middle—the previous line of junction of the upper and lower sashes; both are broken and diffused by the blinds or curtains. Venetians for this purpose should be turned upward. A window should never be made to ventilate by opening it from below unless the open lower space befilled up in some and ventilation be carried on at the middle where the sashes join, otherwise draughts are unavoidable. The ventilating pane is a hardly less simple and equally efficient and safe method with either of the others. Window ventilation is especially useful in bedrooms, and its efficiency or otherwise cannot fail to affect the vital powers of the occupant, who, in his slumbers, must trust to other energies than his own for the removal of those impurities and morbific germs which his very breath multiplies around him.—*Ex.*

PATENTS INDUSTRIALLY CLASSIFIED.

Commissioner Butterworth shows that of the nearly 300,000 patents issued by the government, the various lines of machinery and industries have received the following number:

	No. of Patents.
Applications of electricity	5,872
Artesian wells	500
Beds	2,150
Boots and shoes	5,060
Bread and cracker machinery	440
Chairs	1,580
Corset patterns	969
Dairy utensils	2,429
Fences	2,888
Fire engines	567
Fire escapes	884
Harvesters	6,606
Lamps and gas fixtures	5,254
Laundry utensils	4,993
Machines for knitting	754
Metal working machines	10,203
Methods of tanning hides	1,219
Mills and threshing machines	6,740
Nut and bolt locks	734
Plows	6,889
Pumps	3,156
Railways	3,508
Railway cars	3,505
Seeders and planters	3,568
Steam engines	5,111
Stoves and furnaces	8,238
Vegetable cutters	450
Water distributors	3,719
Wearing apparel	2,417

These aggregate 100,403, or about one-third of the entire number of patents issued.—*Ex.*

THE largest room in the world, under one roof and unbroken by pillars, is at St. Petersburgh. It is 620 feet long by 150 in breadth. By daylight it is used for military displays, and a battallion can completely manœuvre in it. Twenty thousand wax tapers are required to light it. The roof of this structure is a single arch of iron, and it exhibits remarkable engineering skill in the architect.

A $4,500 COTTAGE.

The above cottage, which is illustrated in this number, is now building in the vicinity of Orange, N. J.

Examination of plans reveals fine parlour, large dinning-room with closet attached, convenient kitchen and roomy hall, with hall closets, together with attractive stairway to the floor above.

Up stairs there are two large chambers, one of which has dressing-room attached, two alcove bedrooms, plenty of closets and wardrobes, together with linen closets. Bath room is large and well-lighted by ornamental skylight. Full ventilation and light throughout the building. Cellar under all except extension. Servants staircase, dressers, pump, sink, etc., complete. The design is intended for a westerly exposure on the front, and a southerly exposure on the left side.—*Ex.*

EARLY COMPOUND ENGINES.

From particulars furnished by a correspondent of the *Journal* of the Franklin Institute it would seem that the compound engine is not so recent an invention as many suppose. "The first composed engines (he writes) are said to have been built by Mr. I. P. Allaire. As early as 1830 and 1832 there were on Hudson River two steamboats with compound engines, the Swiftsure and Commerce. Their engines were of the upright square form, or cross-head pattern (very few of that form now in use, and none built), the high-pressure cylinder being forward and the low-pressure being shaft the paddle-wheel shaft, and both connected to it by cog-wheel gearing. About the same time the Post Boy, with similar machinery, built by Mr. Allaire, was sent to New Orleans. In the machinery of the above steamers the exhaust steam of the high-pressure cylinder passed directly to the low-pressure cylinder without the intervention of valves or receiver between the two cylinders. The Swiftsure and Commerce were in use for several years, and the machinery of the former was subsequently taken out and replaced by the ordinary beam engine. The compound engine, built by the late Erastus Smith, was of ordinary beam pattern, except that it had two steam cylinders, the high-pressure being within the low-pressure one. Their diameters were 37 and 80 inches, and stroke of piston 11 feet. This form has not been duplicated. The present compound engine has practically but little resemblance to those that preceded it, and is very much more economical."—*Ex.*

A SUBTERRANEAN RIVER IN AUSTRIA.

The river Reka, rising in the Schneeberg, in Carnialo, suddenly disappears in the so-called Karst caverns. At San Giovanni di Duino, 20 miles distant from the spot where the Reaka is lost, a river of corresponding magnitude is found issuing from the foot of a hill. This stream is known as the Timavo, which takes a westward course, and discharges its waters into the Bay of Monfalcone. As to the indentity of the Timavo with the Reka there has hardly been any doubt, although until last year no attempt has ever been made practically to demonstrate the fact. The members of the Austro-German Alpine Club last year made three attempts to explore this subterranean river.

Starting from the first great cavern, called Rudolph's Dome, the expedition, consisting of four persons in two boats, proceeded on their eventful voyage. From the cavern just mentioned the river flows for 200 feet through a narrow channel between the two perpendicular walls of rock, estimated to be upward of 100 yards in height. At the end of this channel the explorers, whose course throughout was illuminated by the magnesium light, found themselves in a vast cavern, where they were able to land. The explorers, proceeding, found seven waterfalls, the last one of which, at a distance of about a furlong from the entrance, they were unabie to pass, but will renew the attempt this year with more complete apparatus.

The cavern which was discovered is of far greater dimensions than the Rudolph's Dome or any of the other caves of the district. Its height is upward of 450 feet, so that it could easily contain the cathedral of St. Peter's at Rome.—*Ex.*

Fancy Articles of Cork.—A German inventor has utilized cork in the manufacture of fancy articles by a novel process. Powdered cork is mixed with starch and water, and the mass kneaded while boiling hot until thoroughly mixed. It is then poured into molds, and afterward dried at a very high temperature.

THE STEAM BOILER.

The question frequently arises: What is the proper way to regulate the draft of a steam boiler furnace by opening and closing the ash-pit and furnace doors, or by means of a damper, in the flue leading from boiler to chimney.

There is some difference of opinion and practice regarding this matter, which probably arises from differences or peculiarities in the constructive details of various boiler plants, which might make it desirablé, or even necessary to regulate one way in one case and the other way in another case.

Our own preference is decidedly in favor of regulating the draft by means of a damper placed in the uptake or pipe leading from one end of the boiler, smoke box, or front connection to the main flue. This uptake should be made of wrought iron, and riveted securely to the boiler shell, and the damper should be fitted as close to its lower end, or the tube openings as possible, and be provided with a convenient hand attachment whereby it may be set at any desired point and secured there.

There is much less liability of burning out the grates in a boiler furnace when the draft is regulated by a damper, than there is when it is regulated by the ash-pit door. For, let the ash-pit door be closed tightly, and all circulation of air in the ash-pit is stopped, there is nothing to prevent the heat from the layer of incandescent fuel being transmitted downward and overheating the grates, and overheating means warping, twisting and cracking of the bars, and we have known them to be melted from this cause.

When, on the contrary, the ash-pit doors are fully open there is nothing to prevent the free circulation of air throughout the pit, and the bars are kept cool. We recommend omitting altogether doors to the ash-pit, and make the opening through front nearly the full width of the grate, and making a water cavity or trough, at least six inches deep in the bottom of the ash-pit. This should be kept full of water, and it has a great effect upon the temperature below the grates.

For ease and certainty of regulation, a damper placed in the uptake as described above, possesses great and obvious advantages over any manipulation of ash-pit or furnace doors. Any one who has had charge of boilers fitted up in this manner can readily appreciate the truth of this statement.

There is, also, in our opinion, decidedly less loss of heat by infiltration of air through cracks in the settling walls when the draft is governed by a damper in flue than there is when the doors are used for same purpose; for, when ash-pit doors are tightly closed, the draught of the chimney will draw air in through every crack and crevice in the walls, and this air entering the furnace at all points has a cooling tendency which it is most desirable to avoid. If the ash-pit doors are open, however, any leakage past the damper will readily be supplied by air passing through the fire, which is always the way air should go into a boiler furnace.

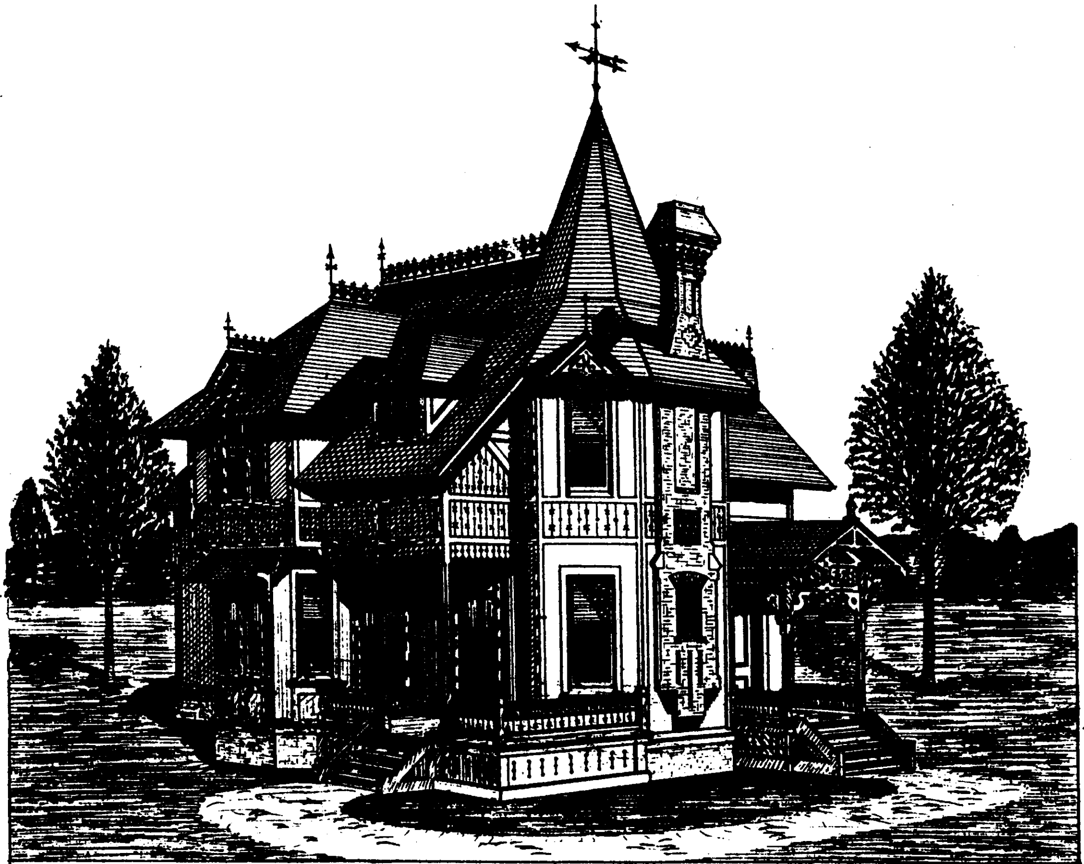
The damper should always be so fitted and adapted to the boiler, that, when it is tightly closed as far as it can be by the apparatus provided for operating it, it will allow sufficient draft to just keep the fires going, and carry off any coal gas which may be generated in the furnace.

The forgoing relates more particularly to boilers used for power purposes, and those plants of such size as to require the constant supervision of an engineer or fireman. With many of the small house-heating boilers where the draft is automatically regulated, it is deemed expedient by most steam fitters to regulate the draft by the ash-pit door. For boilers of this type, this is undoubted a good plan in many cases; with the attention this class of boilers receives, there is probably less danger of filling up a house with coal gas.—*Locomotive.*

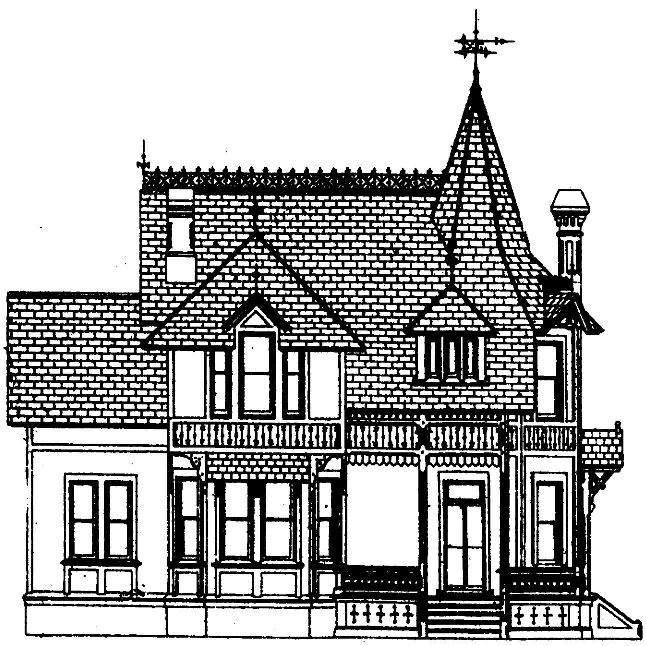
The leading pecularity of rice is the very large proportion of starch and the very small proportion of gluten which it contains, there being but one part of gluten to 13 parts of starch. In wheat there are two parts of gluten to every nine parts of starch.

To Temper Steel on One Edge.—Red hot Lead is an excellent thing to which to heat a long plate of steel that requires softening or tempering on one edge. The steel need only be heated at the part required, and there is little danger of the metal warping or springing, By giving sufficient time thick portions may be heated equally with thin parts. The ends of wire springs that are to be bent or riveted may be softened for that purpose by this process, after the springs have been hardened or tempered.

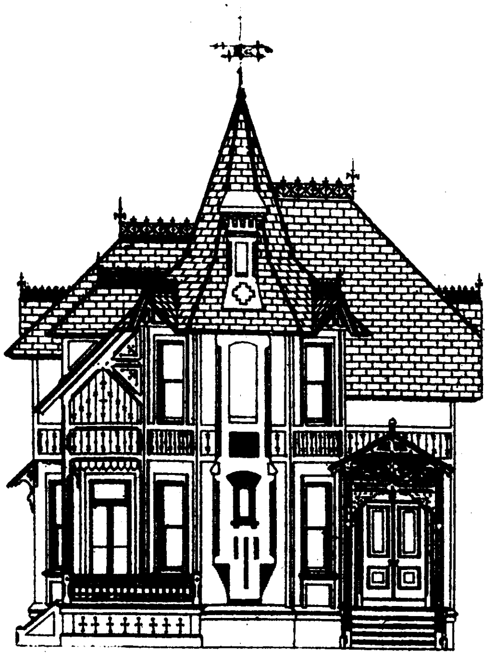
PLAN OF MODEL COTTAGE.



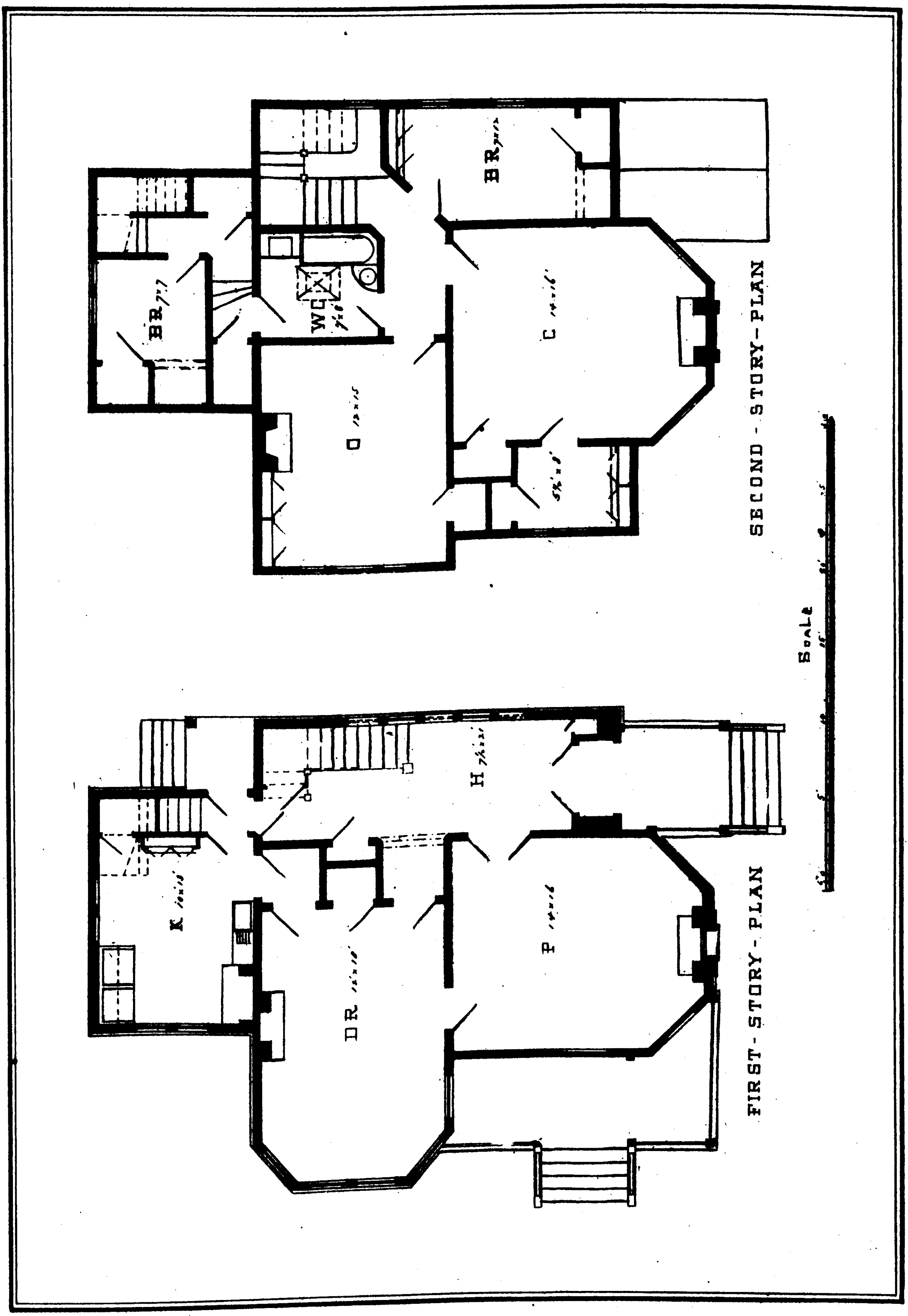
—PERSPECTIVE VIEW—



SIDE ELEVATION



FRONT ELEVATION


SECOND - STORY - PLAN
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LECTURE ON "FREE WILL."

(*Continued.*)

What is the connection if any between the objective and subjective, between molecular motions and states of consciousness? My answer is I know not, nor have I met anybody yet who does know. It is no explanation to say that the objective and subjective effects are two sides of the one and the same phenomena. In fact the very core of the difficulty is the phenomena having two sides. Here are plenty of molecular motions which do not exhibit this two-sidedness

Does water think or feel when it runs into beautiful crystals and frost ferns upon a window pane?

If not why should the molecular motion of the brain be yoked to the mysterious and miraculous companion Consciousness? We can present to our mind, a coherent picture of the physical processes—the stirring of the brain, the thrilling of the nerves, the discharging of the muscles, and all the subsequent mechanical motion of the organism. But we can present no picture of the process whereby consciousness emerges either as a necessary link or as an accidental bi-product of this series of actions. Yet it certainly to our mind does energy, so molecular motion produces consciousness, and when this, probably of the brain, is impared or destroyed, semi-consciousness or unconsciousness results.

The reverse process of the production of motion by consciousness is equally unpresentable to the mind.

We are here upon the boundary line of our present intellectual powers where the ordinary canons of science fail to extricate us from the difficulties.

We must hesitate at least to attribute if not even deny to subjective phenomena all influence on physical processes. Physical science offers no justification for the notion that molecules can be moved by states of Consciousness and it furnishes just as little countenance to the conclusion that states of consciousness can be generated by molecular motion.

The case of man in a newly born condition furnishes alone ample illustration for proof of the above assertion although consciousness in the babe looked at objectively, subjectively seems to be latent and grows apace as a natural result of an inherent property, unless in abnormal cases.

Frankly stated we have here to deal with facts almost as difficult to be seized mentally as the idea of a soul, and I for one in the absence of other revelation cling to the belief that the soul belongs to a phenomen on which refuses the yoke of ordinary mechanical laws.

Amid all our speculative uncertainty there is one practical point as clear as the day, viz., that the lightness and usefulness of life, as well as its darkness and disorder, depend to a very great extent upon our own use or abuse of this miraculous organ, I do not now inquire how some men seem to be predisposed to use and others to abuse but that such is the case few will deny,—and further this disposition is the natural result of forces acting on man's environments through successive otages of development, this is decidedly to my mind the rule which I would be bold to affirm has no exception.

We now stand face to face with the final problem. It is this. Are the brain and the moral and intellectual processes, subject to the laws we find paramount in physical nature?

Is the will of man in other words free? or are it and nature equally "bound fast in fate."

What is meant by "*free will.*" Does it employ the power of producing events without antecedents—of starting as it were upon a creative tour of occurrences without any impulse from within or without? Let us consider the point. If there be absolutely or relatively no reason why a tree should fall, it will not fall, and in the same way a man will not act unless there be a reason for it. It is true that united voices could not persuade me that I have not at this moment the power to speak, move my body, or walk across the floor if I will or wish to do so. Within this range the conscious freedom of my will cannot be questioned. But what about the origin of our wishes.

Are we, or are we not, complete masters of the circumstances which often lead up to and create our wishes, motions and tendencies to actions?

Adequate reflection will I think prove that we are not? What, for example have I had to do with the generation and development of that which some will consider my total being and others a most patent factor of my total being, the living, thinking and speaking organism which now addresses you.

As stated at the outset, our physical and intellectual textures were woven for us, not by us. Processes in the conduct of regulation, of which we have had no share, have made us all what we are. Here surely if anywhere we are as clay in the hands of the potter. It is certainly one of the greatest delusions to suppose that we come into the world like sheets of white paper, upon which the age can write anything it likes, making us good or bad, noble or mean, at pleasure. The age, with, all its surroundings and influences, can shunt, promote or pervert pre-existing capacities, but it cannot create them.

External circumstances are the great moulders of human character, and man himself one of the circumstances. In our courts of law, for example, whenever it is a question whether a crime has been committed under the influence of insanity, the best guidance the judge and jury can have is derived from the parental antecedents of the accused.

If among these insanity be exhibited in any marked degree, the presumption in the prisoner's favour is wondrously enhanced, because the experience of life has taught us all that insanity is frequently transmitted from parent to child.

Influences of which such people had no control brought them within the grasp of the law, and what happened to them might have happened to any of us.

There is a class, but happily not a large one, whom no kindness can conciliate and no discipline or punishment tame. They seem to be born into the world labelled "incorrigible," permanent wickedness being stamped upon them.

The largest class, perhaps, is formed of individuals pursuing no strong bias, moral or immoral; plastic to the touch of circumstances, which can mould them into good or bad members of society.

Here again we are confronted with responsibility. If, says the robber or murderer, I act because I must act, why should I be held responsible for my deeds? The reply is, the right of society to protect itself from forces no matter how and from what source they come. But the criminal says you punish me for what I cannot help. Granted, says society, but simply with a view to our own safety and purification, we are determined that you and such as you shall not enjoy liberty of evil action in our midst.

The public safety is a matter of more importance than the very limited chance of your growing better without such imposed restrictions. While the knowledge that you have been hanged for murder, may furnish to others about to do as you have done, the precise influence and motive which will hold them back. If the act be such as to invoke a minor penalty, then not only others, but yourself, may profit by the punishment we inflict.

Observe, finally, the consistency of all this. You offend—because you cannot help offending—to the public detriment. We punish—because we cannot help punishing—for the public good. There is, therefore, no equilibrium of forces here; motives and results can be discerned, if not calculated.

What, some may argue, is the use, then, of preaching about duty, if man's pre-determined position in the moral world renders him incapable of profiting by advice?

Who knows he is utterly incapable, or will deny that some very slight influence may not be instrumental in raising the lowest and debased mind a stage in advance towards a complete evolution to goodness?

The preacher's very last word enters as a factor into the man's conduct; and who knows but it may be a most important factor, unlocking moral energies, which might otherwise remain imprisoned and unused?

If our preachers only felt that words of enlightenment, courage, admonition, etc., enter into the list of forces employed by Nature's God for man's amelioration, they would suffer no paralysis to fall upon their tongues. Dung the fig tree hopefully, and not until its branches has been demonstrated beyond a doubt, let the sentence go forth, "Cut it down, why cumbereth it the ground!"

We must all surely be able to remember periods when listening to some lecture where the speaker's voice and earnestness soon rivetted our attention, where duty was spoken of with such kindling vigour as to strengthen the sense of duty in our own minds. No speculation regarding the freedom of will could alter the facts that the words did us good.

The power which has moulded us thus far has worked with stern tools upon a very firm and rigid material.

What it has done cannot be so readily undone; and it has endowed us with moral constitutions, which take pleasure in the noble, the beautiful and the true, just as surely as it has endowed us with organisms which find aloes bitter and sugar sweet. That power did not work with delusions nor will its hand be stayed when such are removed. Facts rather than dogmas have been its ministers, the interaction and adjustment of which during immeasurable ages of development wove the triplex web of man's physical, intellectual and moral nature, and such will be effectual to the end.

BOLTON FLAGGING.

Sixteen miles east of Hartford, Conn., in the town of Bolton, is a quarry of remarkable stone, not duplicated in its qualities by any other in this country. The stone is a micaceous slate, but is so thoroughly filled with mica that the slaty matrix is barely discernible by the eye. The best qualities of this stone are not affected by moisture and frosts, are not corroded by acrids nor stained by oils, and a slab of it will bend perceptibly before it breaks. As a pavement, its durable quality is also remarkable; there are flags of it on a busy street in Hartford that have been trodden for more than fifty years, and are in good condition now. This stone is in great demand for floors and tables for chemical factories and laboratories, for hospitals, and in public buildings where constant cleanliness is a requisite. The area of these flags is limited; very seldom is one quarried with a superfices of two hundred square feet.

The quarries are in the mountains known locally as the "Bolton Range," and forming the eastern boundary of the Connecticut River valley. They are at an elevation of about 1,000 feet above the level of the Connecticut River, and are of considerable antiquity, having been worked continuously for more than sixty years. In 1820, flags of this stone were sent to Washington, Philadelphia, Baltimore, and to New Orleans. At the first, the quarrying was largely done by means of gunpowder; but this destroyed more than was gotten out in a marketable condition. Now gunpowder is used only to remove the superincumbent rock to make the ledge bare; all the slabs are taken out by the use of crowbar and wedge. The ledge has been traced for more than six miles, but much of it is valueless because of the cost of getting out the stone, the layers being at an angle, so that the surface rock may be reached in one place at a depth of less than six feet, but within one hundred feet surface distance it will be sixty feet below the soil. The rock is split into slabs only where natural divisions occur; some slabs may be only half an inch thick, while others are five inches, and as they are they must remain, for no chiseling can effect another division. Indeed, the only means of dressing the stone is by hammering, the edges being dressed in this way; the surfaces remain in their natural state, smooth and glistening. These natural divisions may be traced by the eye, sometimes entirely around a block, and where the minute crack appears, rows of thin iron wedges are inserted and gently forced in by hammers until one lamina can be lifted from the rest like the well-baked upper crust of a pie.—*Ex.*

A WORLD OF CAUTION ABOUT INK PENCILS.

We have to utter aword of caution about the ink pencils which have come so much into vogue lately, says the New York *Times*. A most useful implement to the business man, this innocent-looking pencil can be converted into a treacherous friend, and on no consideration should it be used to write the signature of any one. The composition of the pencil is a peculiar combination highly poisonous in itself, and--herein lies the danger to signature writers—competent to give off two or more impressions on damped paper—not tissue paper, be it understood, but ordinary writing paper. Our attention was first directed to this peculiarity by an astute official of the Bank of New Zealand; and subsequent experiments proved the easy practicability of making a clear copy of the check with this ink pencil. First the writing of the check is transfe red—upside-down of course, to a slip of damped paper, and from that transferred right side up—to another slip of damped paper. We tested this recently in the case of a check written with the ink pencil and sent in from the country, and by simple hand pressure obtained a very perfect copy of the transferable parts of the document.

A FRIEND at our elbow says he is tired of hearing the cry of *overproduction* so generally repeated as the cause of our hard times. He suggests, for a change, *lack of consumption* to be the cause.

GOUPIL'S AEROPLANE.

The accompanying figures give end and side views of an aeroplane devised by Mr. A. Goupil, and described by him in a recent work upon aerial navigation. The apparatus might be termed a sort of aerial velocipede. The man, in order to obtain speed, acts at one and the same time, though the pedals, *a a*, and the connecting rods *b b*, upon a wheel that moves over the ground, and through jointed arms, *c c*, upon the helix, *e*; and he likewise acts upon the rudder, *f*, and the tail lever, by means of cords. In measure, as the apparatus obtains velocity its weight diminishes on account of the increase of the vertical re-action of the current, and, finally, it ought to ascend and maintain itself aloft solely through the motion of the helix combined with the sustaining action of the wings and regulating and directing action of the rudder. Equilibrium must be maintained through the displacement of the man's center of gravity.

The construction of the apparatus (which is of thin strips of wood cross-braced by tough wood and covered with silk) is of the lightest character. The whole weighs 220 pounds.

Certain persons will smile, perhaps, upon first glancing at the figures of this new aerial velocipede: and others, upon reading the conditions of the apparatus' working and the hopes that are had of it, will be tempted to ask us if such apparatus have already operated—a question which we cannot answer affirmatively. However, if it is allowable to smile innocently at such claims, it is perhaps less allowable to have doubts. The rules of mechanics do not contradict the assertion that it will one day be possible for man to rise and direct himself in the air when the latter is undisturbed by storms.

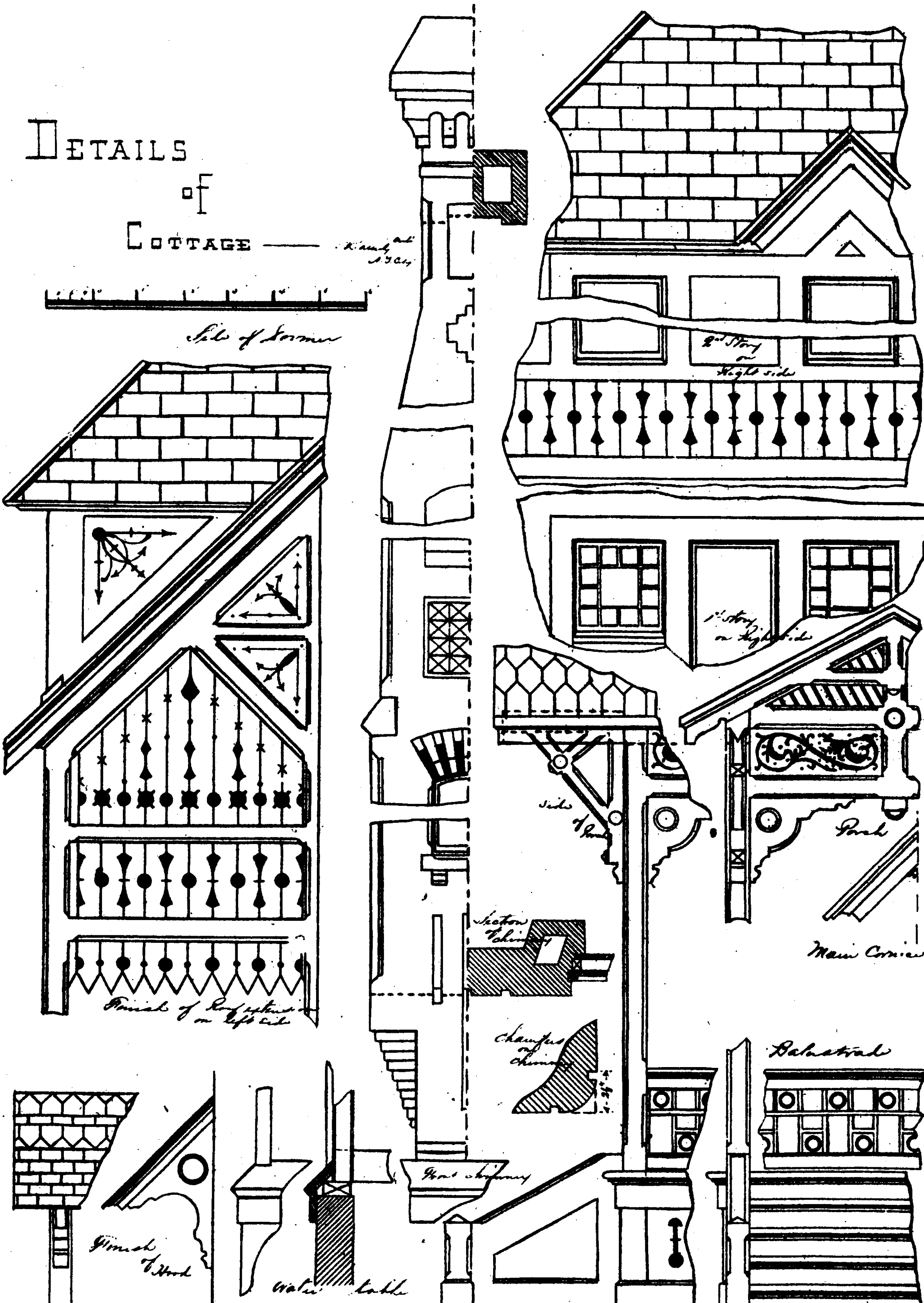
When aluminum and still lighter and more powerful motors shall intervene, the solution of the problem will not have to be long awaited. But what will prove more difficult yet, after this very solution, will be the practice of the thing. It is not everything to have a sure and well-rigged ship that fulfils all the conditions of good navigation, for a crew is likewise necessary. When, then (however distant the period) it shall be felt that the end has been about reached, it will be necessary to instruct the future fliers to preserve that coolness and precision of motion in the air that should contribute to secure the necessary conditions of precise maneuvering and perfect equilibrium.—*Chronique Industrielle.*

INFLUENCE OF THE MOON ON THE EARTH.

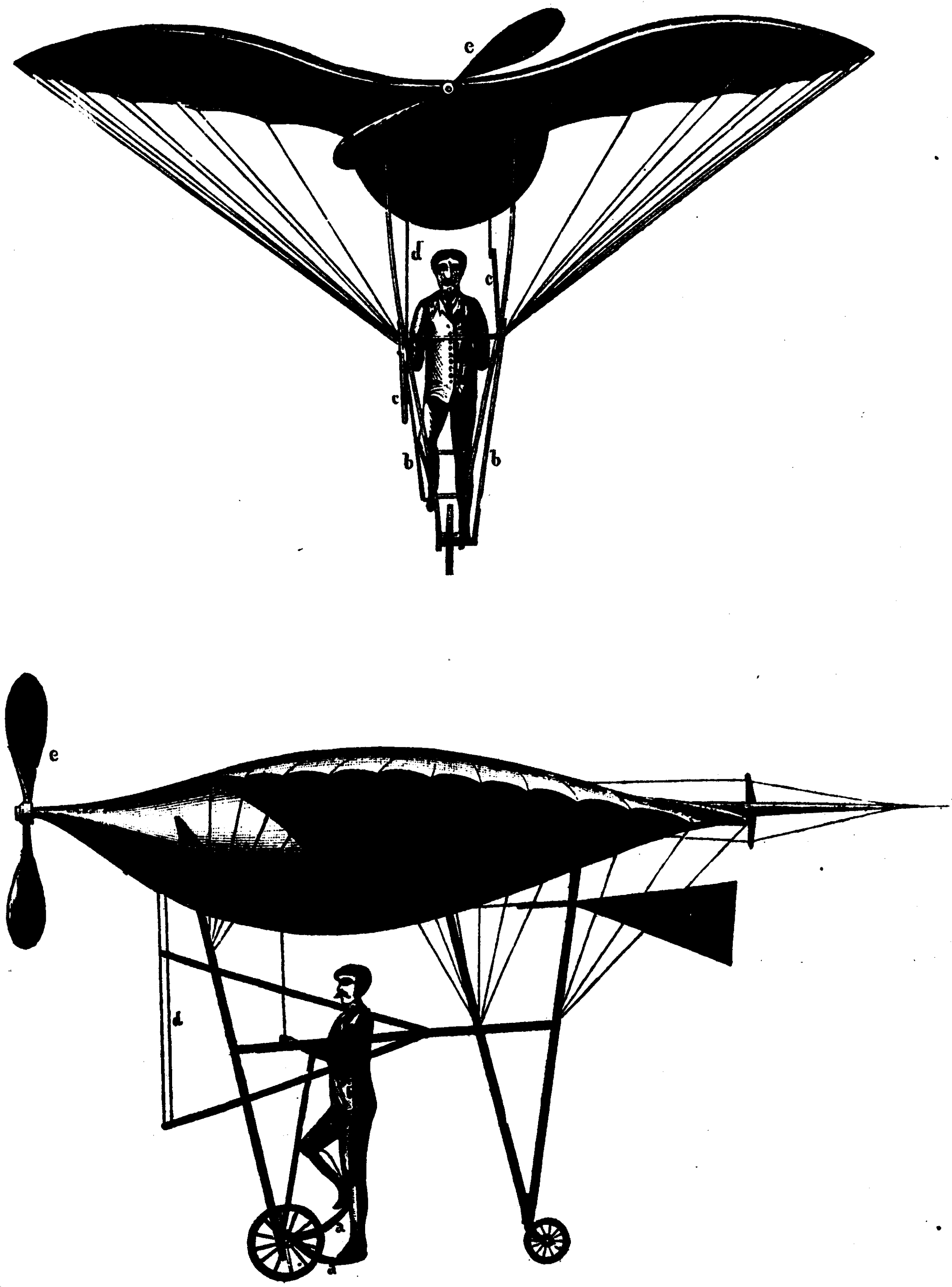
The tides are caused mainly by the moon, as it were, catching hold of the water as the earth revolves around on its axis. This must cause friction on the earth as it revolves, and friction, as every one knows, causes loss of power. Suppose a wheel, with hair round its rim, live circular brush, such as is used for hair brushing by machinery; if this brush be revolving rapidly, and we hold our hand ever so lightly on the hair, so that it is slightly rubbed backward as the wheel will be gradually diminished, until at last it will be brought to a standstill, provided there is no additional power communicated to the wheel by machinery or hand, beyond what was given to set it spinning round. Now, this is somewhat anagolous to what is happening to the earth in its rotation. There is reason to suppose that the action of the tides is slowly but surely lessening the speed of the earth's rotation, and consequently increasing the length of the day, and that this action will continue until the earth. Then the day, instead of being 24 hours, as now, will be about 28 days, and the earth will be exposed to the full blaze of the sun for about 14 days at a time. The change this will bring about on the face of the earth can hardly be exaggerated. All life, both animal and vegetable, will be destroyed; all water will be evaporated; the solid rocks will be scorched and cracked, and the whole world reduced to a dreary and barren wilderness. It is supposed by some that the moon has already passed through all this; hence, its shattered and bare looking surface. That the earth, being so much larger, has more quickly acted upon the oceans, which once were upon the moon's surface, and stopped almost entirely its revolution round its own axis, thus causing it to have a day equal to 28 of our days, and the heat of the sun has already done to it what in future ages it will do to the earth. —*Harper's Weekly.*

A PIANOFORTE railroad car is being built in Birmigham, England, for the London and Northwestern Railway. "Appliances will be provided by which the sound of the carriage wheels will be deadened, so as to preserve the harmony of the music."

DETAILS OF COTTAGE.



GOUPIL'S FLYING MACHINE.



TENEMENT HOUSE REFORM.

The Tenement House Commission is preparing its reportof the Legislature on radical lines. The recommendations of the sub-committee, which have received the approval of the commission, are of a sweeping character. Among other suggestions are those providing for water-tight concrete cellar bottoms, the removal of vaults in yards, an adequate water supply on each floor, unoccupied space amounting to 35 per cent. of each city lot taken for the building, the ventilation of air-shafts at top and bottom, and enlarged hallways connecting with the open air. The commission must include a number of idealists, if recommendations such as these are to be embodied in an official report with any serious expectation that there will be any practical legislation based upon them. There are other suggestions designed to secure a more thorough inspection of tenement houses and more efficient control over the owners of this class of property. These will be of great practical benefit, if sanctioned by the Legislature, especially the rule making the posting of an order in a tenement house and the mailing of a copy to the owner a legal notice from the Board of Health.

The report of the commission will be awaited with great interest by all who are concerned in the important question of tenement house reform. Much valuable testimony has been collected, and the conclusions of the commission will have unusual weight. There ought, however, to be moderation in zeal for practical reform. Let the idealists exercise self-restraint and not confuse the judgment of the Legislature by making recommendations that cannot be practically carried into effect. The present building law and the requirements of the sanitary code are inadequate in some respects ; but while amendments will strengthen the statutes, the pressing need is not so much for more legal authority, as for a more efficient exercise of such powers as been already conferred. A new tenement house built in conformity with the present law will be a safe and wholesome home for working people. It is more important to provide for an adequate inspection of tenements before and after completion than it is to change that law in minor details. The statutes regulating the reconstruction of old tenement houses are not so stringent as they ought to be ; but greater benefit will be derived from a more thorough and rigorous application of such legal authority as there is than from finical attempts to revise the statutes.—*N. Y. Tribune.*

DARKNESS OF HELL GATE.

The electric light at Hell gate went out on Saturday morning Jan. 3, at 4 o'clock, and the brilliant illumination was with-held until Tuesday evening. The stoppage of the electrict light was caused by the fact that a part of the screws attaching the armature to the shaft gave signs of being loose. The attendant engineer noting this, decided that it would be advisible to cut of the light. Owing to the circumstance that there was a lack of proper tools, such as those which are in use at the Cleveland factory, the repairs occupied the time from Saturday until Tuesday.

"Since the light was first placed at Hell Gate last November," said Mr. C. P. Whitney, secretary of the Brush Swan Electric Light Company, to a reporter, "there have been no mishaps worth calling by the name. Once a couple of globes were broken by a bird and the lights went out. Of course the weather has once or twice occasioned annoyance. One night the lights went out owing to the presence of sleet on the elevator, which kept the attendant from going up. The government is perfectly satisfied with the apparatus and its workings, and the plant has been fully settled for."

Mr. Whitney stated that a duplicate apparatus had already been ordered, so that such a delay in electric lighting of Hell Gate could never occur again. "The original objections of the pilots," he said, "which was not very general, is, we are assured by the government officers, entirely removed. During the nights in which the lights were out there were many complaints from parties using the water about Hell Gate. Great regrets were expressed at the absence of the lights. Some of the captains of the Sound boats, I have been told, have concluded that it was a very great advantage to have the Hell Gate electric illumination, and that it was materially useful in navigation. It certainly is," concluded Mr. Whitney, "a permanentin stitution, and is now generally understood to be such."—*Ex.*

THE BENEFITS OF UNDERDRAINAGE.

The subject of underdraining has, of late, been receiving a great deal of attention in the agricultural press. Much that is written on it is scarcely to the point, and grave errors are given expression to by some writers. Whether to drain or not, and how to drain, are questions which each farmer must decide for himself according to the nature of his land. The depth of the hard pan, where such exists, is an important factor. Sandy lands in general need but little, though there are instances in this Province of sandy land underlaid by clay, in which tile-draining has been decidedly beneficial. As to clays there is room for much experiment as to the best depth : while three feet is properly accepted as about the right depth for most clay soils, there are clays so tenacious as to warrant a much smaller depth. The progress made in draining in Ontario in late years has been great, but not one per cent. of the land which requires draining has yet been drained. With the growing competition in grain, our farmers need to resort to every economical method of increasing their crops, and tile draining is certainly one of the very best. Regarding its cost the greatest misapprehension exists in some quarters. The New York *Times*, for instance, estimates the cost at $50 per acre. This is obviously far too high even for close draining by manual labour. Most lands, tolerably free from boulders, can be drained with three-inch tiles laid not over two rods apart for $20 per acre ; we know of not a few instances of it costing several dollars less. In these cases, however, the ditching machine is used. An increase of only two bushels of wheat per acre amply pays the interest on the cost of drainage ; but as on an average clays yield five to ten bushels more where drained and properly farmed, than where undrained, though carefully managed in other respets, the advantage of tile-draining is very obvious. It must always be borne in mind that every bushel over the number necessary to pay cost of cultivation is almost clear profit. If the margin over be five bushels per acre, an increased yield of only five bushels means double the profit in grain growing.

"MYSTERIOUS ILLNESS."

A discussion has taken place in the *Times* this week on the subject of Mysterious Illnesses," which are attributed to arsenical wall paper. Attention was first called to the effects of arsenical papers many years ago, we believe by the late Dr. Taylor, sometime Professor of Jurisprudence at Guy's Hospital, who collected together a large number of striking examples, in some of which fatal consequences had been produced, while in others the timely removal of the paper had been followed by the disappearance of the symptoms which its presence had occasioned. At that time (as the *Times* remarks), the arsenical salt of copper, known as Scheele's green, was largely used as a pigment to produce green colours on paper, and especially for the leaves of the running patterns of flowers and foliage which were then in vogue. In papers of a cheap description, it was not uncommon for the leaves to be absolute' masses of a dried arsenical paste, and the effects produced were often correspondingly severe. Arsenical fumes were liberated by the action of lamps or gas flames, and arsenical powdered was detached by all occasions of friction. The dust which floated in the atmosphere of the rooms, or which settled on cornices or furniture, was often very highly charged with arsenical particles, and cases were not wanting in which the disturbance of this dust by housemaids had manifestly been followed by increased derangement of health. The evil, when once attention had been directed to it, was gross and palpable, and the public mind became possessed by a very general distrust of green as a colour for decorative purposes. Since then the conditions have totally changed. The coarse and abundant presence of arsenic is no longer to be feared, and green colours no longer enjoy a monopoly of its presence. Arsenic is employed in the preparation of use of many of the aniline colours, and is often imperfectly removed from them. There is scarcely any colour from which it will certainly be absent, and while it is seldom sufficiently abundant to produce violent illness, its more gradual effects may be no less prejudicial in the long run.—*Ex.*

A BAVARIAN chemist is reported to have invented an enameling liquid which renders any species of stone or cement harder than granite, and gives it the undeliable appearance of any mineral that may be desired.

TALL CHIMNEY CLIMBING.

There are several agencies at work upon tall chimney shafts tending to deteriorate them, and necessitating an occasional inspection of the condition of the upper portions of the brick work of these structures. The material used is of a perishable nature, and, as a matter of course, in time the bricks and mortar or cement crumble away under the insidious attacks of wind and rain. Not uncommonly the interior of the chimney is full of highly-heated vapors, which exert a powerful disintegrating action. The top of the chimney is also exposed to strokes of lightening, which, under the system of imperfect protection often adopted, contributes in a material degree to the gradual loosening of the brickwork. Hence the necessity for occasional inspection. But the difficulty and also the expense of such examinations have probably been at the root of a neglect which in some cases has led to the fall of the structure. A notable instance of this occurred two years since at a mill in a suburb of Bradford, England, where a chimney 240 feet high fell, killing 30 of the workpeople and injuring about 40 more who were engaged in the spinning and drawing sheds beneath. The chimney had been built about twenty years, and was known to be out of repair; in fact, it was under repair at the time of its fall. The plan adopted in the earlier days of tall chimneys for gaining access to their tops for the purposes of examination and repair is deserving of some praise on account of its ingenuity. A kite was flown by a trained and skillful hand over the top of the chimney until its string was placed obliquely across the orifice of the shaft, and the kite was then pulled down to the ground by a second string attached to the one which was used in managing and controlling the flight, leaving in this way the string looped over the top. The kite being then removed, a stout cord was attached in its place and drawn over the top of the chimney until the cord had taken the place of the string, rising from the ground, crossing over the mouth of the chimney, and descending to the ground on the other side. This process was then repeated, stouter and stouter cordage being used each time, and finally a strong iron chain, until at length a tackle was raised and fixed, from which an adventurous workman, generally known as a steeple jack, could be pulled up to complete the adjustments and attachments of more reliable machinery above. In most of the large chimneys of this earlier date upwardly-curved hooks of iron were left fixed at the rim in a position conveniently arrranged for catching the kite string.

We need hardly observe that some skill is required for the attainment of distinction in the art of kyte-flying for getting at the tops of tall chimneys. Some years ago Mr. Solomon Sanderson, of Huddersfield, England, acquired a high reputation for his successful practice of this craft. He contrived the means which have now practically superseded the use of the kyte. One great disadvantage of the kyte-flying process was the delay that continually occurred in getting the tackle attached to the top of the chimney by its instrumentality. A firm who had undertaken a work of reconstruction or repair very naturally hesitated to send a staff of workmen to any distant place until there was good assurance that they could at once enter upon their task. A kyte-flyer was therefore dispatched as a preliminary measure, to establish a practical connection with the chimney top. But when this *avant courier* was once well away from the superintending eye, it seldom happened that a favorable wind could be secured. The public-houses of the place, which naturally became the refuge of the kyte-bearing artist and messenger, appear to have exerted some very curious meteorological influence upon the direction and force of the currents of the air. Weeks, and in some special instances months, would slip by before a favorable and manageable breeze would present itself for the raising of the kite. It was in these embarrassing circumstances that Mr. Sanderson determined to contrive some upward path that would be independent alike of the caprices of the wind and the seductions of the drinking shops. He succeeded in his design, and about 17 years ago he introduced the ingenious method of getting at the tops of tall chimneys which is now largely adopted.

The method devised by Mr. Sanderson consists in pushing length after length of short segments of a ladder, as it were telescopically, up against the perpendicular face of the shaft of the chimney, and of climbing simultaneously upon the lengthening-out ladder as it goes. This would appear to be a somewhat formidable proceeding when employed upon a chimney 250 or 300 feet high. It is one, however, which has been so perfected by the inventor and his successors that it is now employed, in the hands of good climbers, with an almost complete immunity from dangerous risk. The ladders used in the process are 15 feet in length, and they are so made that the bottom of any one ladder can be dropped into sockets provided at the top of any of the rest. Pegs about 8 inches long, which project out from one face of each segment of ladder, serve the purpose of keeping it that distance from the brickwork when it is fixed, and of providing a secure foothold and handhold. The first step consists in placing one section of the ladder, standing perpendicularly upon the ground, against the base of the chimney. An iron holdfast is then driven into the brickwork 1 foot up from the bottom of the ladder, and 1 foot down from its top. These holdfasts are of a hooked form, so that they can each be made to clamp one of the rungs of the ladder when they are driven home upon it into the brickwork. When one segment of the ladder has been thus firmly attached to the shaft of the chimney, a free ladder is sloped against it, and the climber then ascends upon this until he can reach about 1 foot above the top of the fixed segment. He there drives a holdfast and attaches to it a pulley and block, so that one end of the rope reeved into the pulley can be brought half down a a second loose section of the ladder, placed perpendicularly and side by side with the first. The rope is there fastened at midway height, and by means of the block the second section of the ladder is hauled up by men standing upon the ground until it projects half-ladder height above the section No. 1. In this position it is temporarily lashed to the fixed section, rung to rung, so that the climber can mount to its top and drive a holdfast into the brickwork a foot above its upper extremity. He then shifts the pulley and block to this upper holdfast, and descends to the ground. Section 2, still attached to the rope at its middle part, is then hoisted up to its full height above Section 1. The climber, following its ascent, next inserts the bottom of its sides into the sockets at the top of Section No. 1, mounts upon its steps as, still held by the pulley, it leans against the chimney, drives home two hooked holdfasts, clamping its rungs to the chimney, near the bottom and near the top; and, this having been done, the second section remains fixed in continuation of the first, and the ladder attached to the brickwork, and affording a practical way to the climber, has thus grown from 15 to 30 feet of continuous height. The process is then repeated with succeeding sections of the ladder until a perpendicular path has been construed from the bottom to the top of the chimney.

There are three essential points in this ingenious process which furnish a ready explanation to its success. The first of these is the temporary lashing of each section of the ladder when it is half way up, so that the climber can get safely to the top, as it is held still attached to the pulley, and fix a fresh block above its upper extremity for the accomplishment of the second half of the hoist. The second point is the joining of the sections by sockets as each one is placed in position upon the one beneath; and the third, the fixing of each section, when it is once lifted into its place, by holdfasts driven into the brickwork of the chimney. The ladder virtually creeps up to the top of the chimney, joint above joint, and fixes its tenacious fangs into the brickwork as it goes. The process is so so easily performed by practiced hands that the highest chimneys are scaled in very brief spaces of time. As an example of the rapidity with which the work can be performed, we find it stated that the chimney at the Abbey Mills pumping station of the Metropolitan Sewage Works, London, England, some 230 feet high, was laddered from the ground to the summit in three hours and a half, about a year ago, when some repairs were being carried out.—*Ex.*

LARGEST OF THEIR KIND.

The largest ocean in the world is the Pacific; river, the Amazon; gulf, Mexico; cape, Horn; lake, Superior; bay, Bengal; island, Australia; city, London; public building, St. Peter's, Rome; hotel, Palace, San Francisco; steamship, "Great Eastern;" desert, Sahara; theater, Grand Opera House, Paris; state, Texas; highest mountain, Mt. Everest, Hindostan, Asia; sound, Long Island; railroad, Union Pacific and Central Pacific; canal, Grand Canal, China; bridge, that over the Tay at Dundee, Scotland; railroad depot, St. Pancras, London; largest room in the world under single roof, on militarye, St. Petersburg.—*Ex.*

WATER filtered through charcoal becomes perfectly pure, the charcoal absorbing all disagreeable tastes and smells, whether they arise from animal or vegetable impurities.

STEAM ENGINES AT THE NEW ORLEANS EXHIBITION.

Probably few things at the New Orleans show will be found more generally interesting than the machinery department. Entirely bisecting it, says a local newspaper, is a space 100 feet wide and 300 feet long, devoted to the steam engines, while the immense battery of 66 boilers is accommodated outside of the main building in a structure especially built for the machinery department, but separated from it by an alley or street. This enormous range of boilers presents a front of 400 feet, and they are all connected by a great steam drum which traverses the battery its entire length. The steam, being gathered in this drum, is supplied to the engines through a riveted main-pipe 26 inches in diameter. This main has out-valves at various points connected with small pipes which feed steam to the several engines. Another, but smaller, pipe leads from this main to the right and left—that to the left carrying steam to the cold-storage engine and pumping machinery, while the pipe to the right, after traversing the southern half of mine building, crosses Magazine street and gives steam to machinery in the iron cotton-mill building and the sawmill annex. There is fully ½ mile of this steam-pipe, and is all supported on roller brackets, so that it may have full play to move forward or to retract when expanded or contracted. The boilers have a steaming capacity equal to about 6000 horse-power, which is supplied to 20 engines of various sizes. It is pecular fact that all the engines thus far erected, and some of them are very large, are of the horizontal type.—*Ex*

Engineering Notes.

Horse-Power of Niagara Falls.—The falls of Niagara are, say, 150 feet high, and each hour on a rough estimate, 1,165,000,000 cubic, feet of water fall over. The power of the falls, then, exclusive of the velocity with which the water arrives at the brink, is about 5,000,000 horse power, or about one-fourth of the entire steam power of the earth. For such falls as Niagara, working day and night, would be required to replace the work now done for man by the steam engine.

There is likely to be a revival in the copper trade, and Swansea is excited thereat. The introduction of iron and steel ships paralysed the industry, but it is now proposed to put a layer of gutta-percha upon the plates, and fasten copper sheating thereto with a patent composition. The copper plates will thereby be fixed with a tenacity which will resist wear and tear. The Admiralty is investigating the matter, and the seat of the copper trade of the world is likely to become once more very prosperous.—*Liverpool Journal of Commerce.*

English iron and steel makers thought they saw in the agitation in that country for an increase of the Navy some hopes of improving their business, which is in a very unsatisfactory condition. To this end they are said to have encouraged the agitation by all legitimate means. Now that enormous appropriations have been made for the purpose named, it has been discovered that the officials have been in negotiation with leading French and German steel makers, on the ground that they manufactured a better quality of steel than was made in England.

Formerly the Lake Superior Mines controlled the copper trade of this country, but the discovery of great deposits of copper in Arizona within the past few years has changed all this and the stocks of the Lake companies have been seriously if not permanently affected thereby. The attempts on the part of the latter to discourage western production by deliberately knocking down the price of copper have utterly failed and their own shareholders have been the principal losers. It is known that the Arizona ores contain a percentage of copper so much greater than those of the Lake Superior mines that the western producer, though a greater distance from market, is able to compete successfully with his rival of the Lake region.

The Brooklyn Bridge has disappointed its friends. It does not do anything like the business that was expected of it, and the running expenses are much greater than was expected. For the year ending Nov. 30, 1884, the figures on the maintenance account show as follows: Total receipts, $533,993,00; total expenditures, $440,036,00; net earnings, $93,955,00.

Further experiments have recently been made at Sandy Hook with the Haskell multi-charge gun. In one of the rounds fired nineteen pounds of powder were used in the breech, and one hundred pounds distributed in the four pockets. The result was that a shot weighing 111 pounds was projected with an initial velocity of 2004 feet per second, and, with an elevation of 8½ degrees, to a distance of 6753 yards. This, it is claimed, is the greatest distance ever attained at that elevation.

The Vanne Aqueduct, in France, which is some 37 miles long is said to be the most important and costly work that has ever been constructed of artificial stone. This aqueduct, which supplies the city of Paris with water, traversing the forests of Fontainebleau its entire length, comprises 2½ to 3 miles of arches, some of them as much as 50 feet in height, 11 miles of tunnels, and eight or ten bridges of from 75 to 125 feet span, for the bridging of rivers, canals and highways. The smaller arches are half-circles, and are generally of a uniform span of about 39 feet, with a thickness at the crown of some 16 inches; their construction was carried on without interruption through Winter and Summer, and the character of the work was not at all affected by either extreme of temperature. The spandrels were carried up in openwork to the level of the crown, and upon the arcade thus prepared the aqueduct-pipe was molded of the same material, the whole becoming firmly knit together into a perfect monolith. The construction of the arches was carried on about two weeks in advance of work on the pipe, and the centers struck about a week later.—*Ex.*

Pyronaphtha.—According to the Organ fur Oelhandel, an interesting trial was lately made in St. Petersburg with a new illuminating material which is destined, it is considered, to take the place of kerosene. This is a new illuminating oil, absolutely free from danger of fire. An experiment was made as to the power which pyronaphtha has of extinguishing fire, and it was found that burning kerosene was easily put out by it. Pyronaphtha can itself be extinguished by water Pyronaphtha is a product of the distillation of naphtha residue, of which large quantities remain from the Baku distillation of petroleum. From these, illuminating gas is produced, and likewise pyronaphtha. The idea would seem to have hitherto been carried out only by Ragosin and Co., of Baku. A celebrated Russian chemist, Professor Beilstein, has examined pyronaphtha, and has expressed his conviction that it has a brilliant future before it, and that it must eventually replace American and Russian kerosene. The specific gravity of pyronaphtha is 0.864, and it ignites only at 230 deg. Fahrenheit. It burns without smoke and vapour at 257 deg., gives a brighter light than kerosene, and is consumed less rapidly, while its prime cost in less. At St. Petersburg it is being adopted for domestic use, and Messrs. Romberg have constructed a special burner for that purpose.—*Ex.*

Miscellaneous Notes.

A Technical School.—Mr. William Mather, in 1873, established a school in connection with the iron works of Messrs. Mather & Platt, at Salford, England. This school has developed into the most complete technical school in the kingdom. Everything required in the way of illustration and example is provided by the firm on the most liberal scale.

The British National Association for Promoting Technical Education has appointed a deputation to visit the continent of Europe, for the purpose of reporting upon the technical instruction given to the industrial classes in Germany, France, Switzerland, and elsewhere, and the influence of such instruction upon manufacturing and other industries at home and abroad.

The Arlberg tunnel, on the railway from Innspruck to Bregenz, on Lake Constance, was recently formally opened by the Emperor of Austria. It is the third longest tunnel in the world, being about six and a half miles in length, while the Mont Cenis is about eight and a half, and the St. Gothard and and a third. The Arlberg is the first bore through the Alps from east to west.