STRENGTHENING THE ABUTMENT OF A GREAT BRIDGE.

Across the Schuylkill River at Chestnut Street, Philadelphia, is a two span bridge, begun in 1861 and completed five years later. It has two segmental arches supported by an abutment on either bank and a central pier in the river. At each side is a masonry approach. The spans are 185 feet each, and the total length of the bridge, including approaches, is 1,528½ feet. The carriage way is 26 feet wide, and the foot ways 8 feet. The western abutment is situated upon what was the river flat, there being, at the time of construction, 27 feet of mud, under which was a stratum of about 5 feet of gravel and bowlders, below which was bed rock. White oak piles were driven to a firm bed, and the heads of these, after leveling, were embedded in beton to a depth of 2½ feet; upon this foundation of piles and beton was laid a platform on which the masonry was erected.

Since completion this foundation has maintained its vertical position, but the thrust from the long flat arch, exerting a pressure of some 2,000 tons, in a few years forced the western abutment through the yielding material in which it rested. A certain amount of this thrust was communicated to the approach through the two small arches, the effect of which was to compress the joints until, with the accompanying bulging of the masonry at points, the limit of movement was reached in the approach masonry, after which it continued in a rise of the two arches. It became evident that unless this movement was arrested the span would fall into the river. The fact that the space beneath the arches was used for traffic which could not be interrupted for any length of time led to the placing of wooden struts, at water line, from the abutment to the arch pier and from the pier to the base of approach, the effect of this being to transfer the thrust, through the struts, to the solid approach. This served the purpose so well that the wonder now is that the bases were not so constructed of solid masonry at first. The struts are shown in the large view in the accompanying engraving, and were each composed of four 12 by 12 inch timbers bolted and tied to one another. By this time the abutment had moved 8 inches and the central pier had moved half that distance.

The city now sought for something more permanent to save the bridge than timber struts. Several plans were received, but those proposed by Messrs. Anderson & Barr, of Room 12, Tribune Building, New York city, were adopted. The reasons governing this decision were that they were the only plans which would not interrupt travel on the railroad using one of the arches, thereby saving the city, in damages, about $40,000; the risk of lessening the stability of the abutment during the operation would be avoided, since the space made by the removal of material would be immediately refilled with the cylinder and concrete filling; and that by these plans the work would be so completed as to need no further attention in the future.

In brief, this plan was to build four iron cylinders of one-half inch iron, 8 feet in diameter, stepped into the base of the abutment and extended downward to bed rock at such an angle (about 45 degrees) as to embrace the line of thrust of the arch, and fill them with concrete. By this plan the weight of the arch is transferred to a solid foundation through four stone columns 8 feet in diameter. In carrying out this method no further disturbance of the ground was necessary than to start the cylinder. The concrete was made of 1 cement, 2 sharp sand, and 4 broken stone. Two of these stone struts have now been completed—one 65 feet long and the other 62 feet. Work was begun Oct. 21, 1884, and the first was finished Nov. 26 and the second Dec. 16.

The plan of projecting this class of work, below tide water, is by the aid of compressed air, similar in every respect to the plan so successfully used in the Hudson River Tunnel, and which we have frequently described and fully illustrated. At the upper end of the cylinder is a vertical stem 4 feet in diameter, across the top of which extends an air lock 5 feet in width and 14 feet long. This lock is divided into three compartments by four doors. The advantage of this construction is that while one compartment is being filled with material from the outside, the other is open to the interior; all waiting is done away with, and both the passage of supplies to the lower end of the cylinder and the removal of excavated material are greatly facilitated.

In building the cylinder, a space large enough to admit an iron plate is dug out, when the plate is inserted and bolted to those already in position, adjoining spaces are then excavated and other plates put in, and in this way the cylinder is formed—plate by plate, and ring by ring, until bed rock is reached. When completed, it is cleaned out and the concrete laid.

The plant for carrying on the work consists of a double air compressor—which may be quickly converted into a hoisting engine when necessary—a twenty-five light dynamo for illuminating the interior engines, etc.

With regard to the cost of work of this nature, we are assured by the contractors that similar cylinders can be sunk to any depth up to 500 feet for less than one hundred dollars per foot.

For engineering data connected with the bridge we are indebted to Chief Engineer S. L. Smedley, and First Assistant Engineer J. M. Titlow, of the Philadelphia City Engineering Department.

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 firebricks, 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 porcelain, 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 practiced 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.*

Balloons and Soap Bubbles.

Any photographer who may have had his stock of collodion rendered useless through the introduction of gelatine plates may find a pretty use for it during the winter season by converting it into balloons. We hasten to say not for outside use; we have no intention of endeavoring to rival our esteemed correspondent, Mr. Shadbolt—toy balloons for ascending indoors, we mean. Collodion is superior to all other substances for this purpose, and with care and a little dexterity a small quantity of collodion will furnish a good sized balloon. We have seen them from six inches to twenty-four inches in diameter.

The mode of manufacture, which is simple, is as follows: An ordinary glass flask—the shorter its neck the better—is carefully cleaned, rinsed out with distilled water, and perfectly dried. A quantity of collodion is then poured in, and the flask turned round in all directions until it is evenly coated, when the residue can be poured out, taking care to have the inside of the neck also covered with the collodion. The flask is then placed neck downward in a warm place till thoroughly dry; it will be well to give it two full days so as to insure the absence of all moisture. All that remains is to withdraw this coating of collodion without breaking it—a rather delicate operation, but one that can be performed by not being over-hasty, and carefully humoring the film. When it is quite withdrawn it can be easily filled with gas from a gas bracket, and will then, from the lightness of the material, ascend in any room. The larger sizes are made in glass carboys, and form very effective objects.

Those of our readers who do not care to go to this trouble, and yet would like to have some means of an unusual kind for amusing their juvenile sitters, should make a solution for soap bubbles, which can be inflated by hydrogen if preferred. With a properly made solution it is quite easy to produce bubbles close upon a foot in diameter, which can without bursting be rolled along the floor, played with like a shuttlecock—using the arm as a bat; or they can be placed upon a table to be admired, and many a happy, natural pose obtained when every other means have been employed. A solution of oleic acid is better than soap with glycerine and water.—*British Journal of Photography.*

THIRTY years ago an elm on the farm of P. Mariner, of Penn Yan, blew down, and the trunk, which remained in the soft ground and ran along fifty-eight feet, began to sprout. Now twenty-six trees, well grown, perfect, and some of them fifty feet high, are the result. They are not branches, but have roots, and are independent of the original trunk.

The Uruapan Ware.

Among the Mexican exhibits at New Orleans are specimens of the above ware, which are greatly admired. An interesting article from the pen of Mr. J. M. Franco, of Uruapan, is given in the *Mexican Financier*.

The articles which he describes comprise the wooden bowls, or *jicaras*, trays, center tables, and other objects made by the natives of that town, with no other instruction than that which has been handed down from their ancestors, as it has long been an industry peculiar to that locality. The wood used must be perfectly dry and of a porous nature so as to receive the first coat of sizing. The wood of the linden tree possesses good qualities, and is employed to a great extent. The sizing, which is applied first to the surface of the wood, is prepared by adding a fine powder of what the Indians call *tepushuta* to some drying oil, as *chia*, nut, or linseed, mixed with *axe*. It is spread over the wood and then rubbed in with the hand, an operation which requires considerable practice in order to obtain an even distribution and a thorough absorption into the wood. It is then ready for the reception of the different colors.

These colors are made, as a general thing, from the crude materials by the Indians, although a few are bought already manufactured. Burnt gypsum, white lead, and *ihuetacua*, reduced to a fine powder, are used in their preparation, and some of the colors are as follows, all of which are also pulverized except vermilion: Black earth, native ocher, Prussian blue, red lead, vermilion, commercial ocher, chrome yellow, and carmine. These colors are combined to form others as necessity or the taste of the painter requires, and all, excepting the black, may be mixed with white. With the vermilion and red lead, *ihuetacua* alone is mixed; with blue and orange, gypsum; and with all others, white lead. In the two latter cases a little of the *ihuetacua* is added, to insure a quick drying and a good polish. Vermilion cannot be applied directly upon the sizing, as it would soon discolor, therefore it is necessary to put on a ground of red lead before adding the vermilion.

After the sizing has been put on, the color forming the groundwork is applied with a wad of cloth and rubbed in softly. As the color becomes incorporated in the sizing and at the same time is polished, powder is added until the coloring is perfectly uniform, except when the intention is to produce a mottled appearance, which gives a good effect, especially when the groundwork is dark blue. In order to save time it is customary to paint the ground color on several pieces at once, before proceeding to detail. When the primary color is dry, an outline of the drawing is made with a sharp point, commencing with the next principal color, which serves as a ground in its turn. For example, if a bunch of flowers is to be painted, the outline of the leaves is drawn, and inside of this outline the painter scrapes off everything which has been put on, down to the wood, applies a new coat of sizing and the green coloring matter, using the cloth and rubbing the color in with the same care and deliberation. This color then serves as a ground for drawing the structure of the leaves, and the same operation is carried out with the all the different colored flowers, each color being applied directly to fresh sizing on the wood, so that no color is added to another, thereby insuring permanence, so that the articles can be washed without fear of destroying the colors. It gives some idea of the care and the length of time bestowed on these works of art when it is considered that each color must dry thoroughly, although it takes two or three days, before a new one is applied, and each shadow, high light, or new combination of color requires a distinct operation. The only way of economizing time is to have a number of articles in the same stage of painting, so that while one is drying the same color may be applied to the next one.

After the pigments are rubbed in, they are polished with the palm of the hand, and the Indian women are also very expert in polishing them with the forearm when the form of the article permits.

Liquid Hydrocarbons as Fuel.

In the course of a recent address at the Society of Arts, Sir Frederick Abel, when dealing with the various industrial applications of science which have taken place in recent years, referred to the use of certain liquid hydrocarbons as fuel for engine purposes. His remarks on this subject were as follows:

It is many years since attention was first directed to the advantages indicated by theory, and which appeared practically realizable, from the application of certain liquid hydrocarbons as fuel for engine purposes; and before even chemists dreamt of the possible future value of coal tar as a source of brilliant dyes, attempts were made to apply crude coal tar naphtha as fuel for boilers. Later on crude petroleum, and the heavier and less readily inflammable liquid hydrocarbons remaining after extraction, from coal tar and petroleum, of the portions available for color-producing and illuminating purposes, have been applied experimentally in this direction from time to time, and with some success; the liquid being injected into the fireplace in the form of a spray, by means of ordinary or superheated steam. A successful experiment has quite recently been made at the Forth Bridge works, in working the furnace of one of the air-compressing engines with the residual product of the distillation of shale oil, obtained at one of the largest Scotch mineral oil works.

This butter-like material, liquefiable by heat, for which no use has been found, even for coarse lubricating purposes, and which cannot be ignited by the application of flame in the ordinary way, is allowed to flow through a superheating apparatus, and is thence carried into the furnace by a powerful jet of superheated steam. The force of the jet draws a powerful current of air into the center of the flame produced by burning the mixture of vapors and of minutely divided liquid; and the result is said to be an almost perfect combustion of the fuel, with total absence of smoke and of solid residue in the furnace. Even at the locality of this experiment, where coal is cheap, it is claimed that an ultimate economy will be effected by the use of this fuel; the cost of labor for stoking being much diminished. This experiment has been valuable as showing that the residual products of British mineral oil works may be utilized with advantage as substitutes for coal. But far more important results have been obtained in this direction in Southern Russia during the last few years. The value of the residual product of petroleum distillation, as an efficient and economical source of steam power, has been conclusively established in connection with the marvelous development, by the Brothers Nobel, of the petroleum industry at the Baku works, which are fed through pipe lines of an aggregate length of upward of 60 miles, by the apparently inexhaustible supplies of petroleum of the Aspheron Peninsula.

The residual or heavy oil, which remains after extraction of the illuminating and the lubricating oils from the petroleum, and of which Messrs. Nobel alone now produce 450,000 tons annually, is already used as fuel on upward of 300 steamers upon the Caspian Sea and the Volga, and by the locomotives on the Trans-Caucasian and Trans-Caspian railways. Its use is also extending to other railways in Southeast Russia and to manufactories in Moscow, where it is rapidly replacing English coal. In an instructive paper on the employment of refuse petroleum as fuel in locomotive engines, recently communicated to the Institution of Mechanical Engineers, Mr. Urquhart has shown that, weight for weight, it has 33 per cent higher evaporative value than anthracite, and that while 60 per cent of efficiency is realized with the latter, 75 per cent is obtained with petroleum refuse. The very rapidly continuous extension of the Russian petroleum industry appears to assure a most important future to liquid fuel; and though it is hardly likely to compete in this country with coal for locomotive purposes generally, the comparative ease with which its perfect combustion is now insured appears to render it especially suitable for employment in underground railways; while its use in steamers cannot fail to be attended with important advantage in many special services.

Plumbing at the Time of Edward III.

The following is a full text of a remarkable ordinance existing more than 500 years ago relating to plumbers. The *Sanitary News* has unearthed the document, which we copy *verbatim*.

38 *Edward 3d*, A.D. 1365. *Letter Book E.* (*Norman French.*)

May it please the honorable men and wise, the Mayor, Recorder, and Aldermen of the City of London, to grant unto the Plumbers of the said City the points that here follow:

In the first place that no one of the trade of Plumbers shall meddle with the works touching such trade within the said City, or take house or apprentice, or other workmen, in the same, if he be not free of the City; and that, by assent of the best and most skilled men in the said trade, testifying that he knows how well and lawfully to work, and to do his work; that so the trade may not be scandalized, or the commonalty damaged and deceived, by folks who do not know their trade.

Also, that no one of the said Trade shall take an apprentice for less than seven years; and that he shall have him enrolled within the first year and at the end of his term shall make him take up his freedom, according to the usage of the said City.

Also, that every one of the Trade shall do his work well and lawfully, and shall use lawful weights, as well in selling as in buying, without any deceit or evil intent against any one; and that for working a clove of lead for gutters, or for roofs of houses, he shall only take one-half penny; and for working a clove for furnaces, *tappetroghes*, belfries, and conduit pipes, one penny; and for the waste of a wey of lead when newly molten [he shall have an allowance of two cloves], as has been the usage heretofore.

Also, that no one for singular profit shall engross lead coming to the said City for sale, to the damage of the commonalty; but that all persons of the said Trade, as well poor or rich, who may wish, shall be partners therein at their desire. And that no one, himself or by another, shall buy old lead that is on sale, or shall be, within the said City or without, to sell it again to the folks of the said trade, and enhance the price of lead, to the damage of all the commonalty.

Also, that no one of the said Trade shall buy stripped lead of the assistants to tilers, *laggers*, or masons, or of women who cannot find warranty for the same. And if any shall do so, himself or by his servants, or if any one be found stealing lead, tin, or nails, in the place where he works, he shall be ousted from the said Trade forever, at the will and ordinance of the good folks of such Trade.

Also, that no one of the said Trade shall oust another from his work undertaken or begun, or shall take away his customers or his employers to his damage, by enticement through carpenters, masons, tilers, or other persons, as he would answer for damage so inflicted, by good consideration of the masters of the Trade.

And if any one shall be found guilty under any one of the Articles aforesaid, let him pay to the Chamber of the Guildhall, in London, for the first offense 40 pence; for the second half a mark; for the third 20 shillings; and for the fourth, 10 pounds, or else forswear the Trade.

The Fire Waste of the Country.

Mr. C. J. Hexamer has been delivering a series of lectures before the Franklin Institute, of Philadelphia, on the fire waste of the country.

His lectures have received considerable attention, and the *Fireman's Journal*, of this city, from whose columns the following is extracted, considers Mr. Hexamer's lectures full of practical suggestions. His lecture last week was on "Fires in Textile Mills," the special feature of it being on the construction of such mills with a view to fire prevention. The lecturer said that one of the most important precautions to be observed in erecting mills was to insure the confining of a fire to the apartment in which it originates. All stairways and elevators should be built in a shaft beside the building proper, the openings between them being shut off at the different floors by iron doors. The next precaution to be observed is in the construction of the floors. The best form of fireproof floor is of brick arches built between iron girders placed at short distances. Floors of concrete or "terra cotta lumber," a porous clay material that can be readily cut and shaped with edge tools, rank next in security. If ceilings are of wood, they may be covered with fine wire netting and plastered over, or they may be rendered practically "fireproof" by coating with asbestos paint or by liberal and frequent applications of common lime whitewash. Additional loss is frequently caused by having floor beams so deeply embedded in the side walls that when they burn through in the middle the weight upon them causes the overthrow of the walls when the floors fall in. This can be easily avoided by placing the joists so that they fall out when burned through in the middle. Fire doors are best made of heavy wood, covered on both sides with sheet iron and fastened to the brick wall. Two fruitful causes of fires in mills are the lighting and heating arrangements. Hot water pipes are the safest, steam pipes ranking next. To avoid having combustibles placed in contact with them, they should be suspended from the ceiling, where they are out of the way and give the best heating results. The incandescent electric light is the safest, though there are many risks when improperly introduced. Mr. Hexamer explained how such risks might be avoided.

The International Inventions Exhibition, London.

The applications for space have now all been examined by sub-committees of the Council, and a selection has been made of the most promising. The number of applications has been so great that it has been decided to limit very strictly the admissions in those classes which may be considered to have been fully represented in the exhibitions of the present and of the past year. The Council will, therefore, be obliged to refuse many valuable exhibits in such classes as those relating to food, clothing, and building construction. It will even be a difficult matter to accommodate those which have been selected, and it is feared that the list will have to be still further reduced. As soon as possible, information will be sent to those who have applied for space; but the enormous number of applications, far in excess of what was expected, has made it impossible to do this up to the present. The guarantee fund now amounts to £48,280, a sum considerably in excess of that subscribed for the Health Exhibition or for the Fisheries, the amount for the former being £26,518, and that for the latter, £26,656.—*Journal of the Society of Arts.*

THE *Buletin Commercial*, of Havana, gives an account of a perpetual motor invented in Barcelona, said to consist of a wheel with arms, which is furnished with weights, the power being developed by the movement of the weights from the extremities of the arms toward the center. The power of the motor, it is alleged, may vary from eight pounds up to thousands of H. P. We are sorry to be obliged to say that this is a very old form of perpetual motor, which up to the present time has stood still.

Electric Lighting in London.

At a recent meeting of the Society of Arts, London, Mr. W. H. Preece gave an interesting account of his observations in this country concerning the use of the electric light, after which the chairman, Sir Frederick Bramwall, spoke of the great obstacle to the progress of electric lighting in England, viz., that owing to the wires having to be put under the streets, the belief being entertained (though that was a moot point) that the local authorities had no power to grant permission for this, and that Parliament had to be applied to. Mr. Hammond had spoken as if the only objection to this was the delay and expense in obtaining the act, and why he and every other speaker had refrained from touching on what was the real obstacle he did not know; but it was a pity to close the discussion without reminding the meeting of what it was that really prevented electric lighting from central stations being carried out in England. It was not simply that an act of Parliament had to be obtained, but that when obtained it would be unfair, because it would have to be in accordance with a general act which must have been passed with the express intention of forbidding the progress of electric lighting.

Imagine a new steamboat company being started in Liverpool, which would have to use the docks, and assume that these docks belonged to the corporation, and that to be allowed to use them it was necessary to obtain an act of Parliament, and that the condition of its being allowed to use the docks was that at the end of twenty years, if the company paid a dividend, the corporation should be entitled to purchase the undertaking for the value of the old materials; but if the company did not pay, the corporation should not be obliged to purchase. He said that this appeared to his hearers to be ridiculous; but why was it more ridiculous in connection with a steamboat company than in connection with the distribution of electricity?

It was a mere accident that they had to go to Parliament; it was because they required to lay the wires under the streets in the same way as gas companies required to lay gas pipes. When the Electric Lighting Act was in the House of Commons, the Board of Trade tried to say that at the end of fifteen years the local authority in whose district the wires were laid should have the option of purchasing the undertaking, not for what it had cost, but on the then value of the material for their purpose. All apparatus put down in process of developing, which had been removed to make way for better, would not be reckoned as one shilling in the valuation.

When the bill got into the House of Lords, an effort was made to improve it, but the utmost concession obtained was to increase the fifteen years to twenty-one; and thus it stands that, at the end of that time the company, if the venture paid, must submit to be bought out at the value of the old materials. If it did not pay, no one would care to take it; but the company might go on until they had worked the affair up to a profit, not for their own benefit, but for that of the local authority, for after the first option of purchase, at the end of every five years in perpetuity the option rearose, and might be exercised to purchase the property for the value of the old materials.

Subterranean Woods.

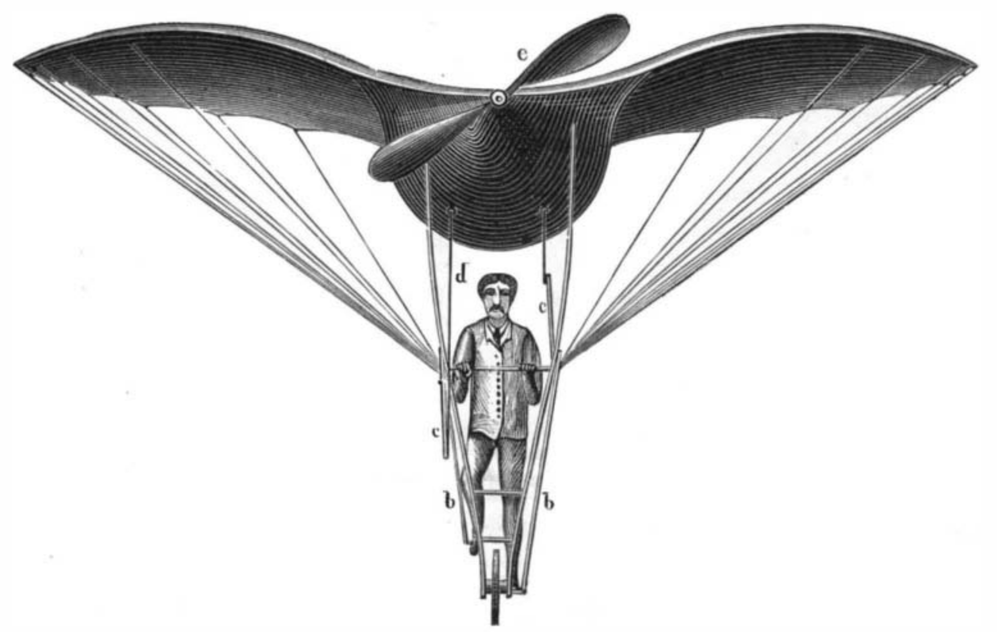
Clarence Deming, in his "By-ways of Nature and Life," says of the swampy region of southern New Jersey:

"The huge trees which lie under the swamp to unknown depths are of the white cedar variety, an evergreen, known scientifically as the Cupresses Thyoides. They grew years ago in the fresh water, which is necessary for their sustenance, and when in time, either by a subsidence of the land or a rise of the seas, the salt water reached them, they died in numbers. But many of them ere they died fell over as living trees, and were covered slowly by the deposits of muck and peat which fill the swamp. Those trees that fell over by the roots, and known as 'windfalls,' to distinguish them from the 'breakdowns,' are the ones most sought for commercial uses, and they are found and worked as follows: The log digger enters the swamp with a sharpened iron rod. He probes in the soft soil until he strikes a tree, probably two or three feet below the surface. In a few minutes he finds the length of the trunk, how much still remains firm wood, and at what place the first knots, which will stop the straight 'split' necessary for shingles, begin. Still using his prod, like the divining rod of a magician, he manages to secure a chip, and by the smell knows whether the tree is a windfall or breakdown. Then he inserts in the mud a saw like that used by ice cutters, and saws through the roots and muck until the log is reached. The top and roots are thus sawed off, a ditch dug over the tree, the trunk loosened, and soon the great stick, sometimes five or six feet thick, rises and floats on the water, which quickly fills the ditch almost to the surface.

The log is now sawed into lengths two feet long, which are split by hand and worked into shingles, as well as into staves used for pails and tubs. The wood has a coarse grain which splits as straight as an arrow. The shingles made from it last sixty or seventy years, are eagerly sought by builders in southern New Jersey, and command in the market a much higher price than ordinary shingles made of pine or chestnut, which last for roofing usually not more than twenty or twenty-five years. In color the wood of the white cedar is a delicate pink, and it has a strong flavor, resembling that of the red cedar used in making lead pencils. The trees, once fairly buried in the swamp, never become waterlogged, as is shown by their floating in the ditches as soon as they are pried up, and what is more singular, as soon as they rise they turn invariably with their under sides uppermost. These two facts are mysteries which science has thus far left so. The men who dig the logs up and split them earn their money. The work, according to the *Industrial World*, is hard, requiring, besides lusty manual labor, skill and experience; the swamps are soft and treacherous, no machinery can be used, and long stretches with mud and water must be covered with boughs or bark before the shingles can reach the village and civilization.

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 reaction 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.

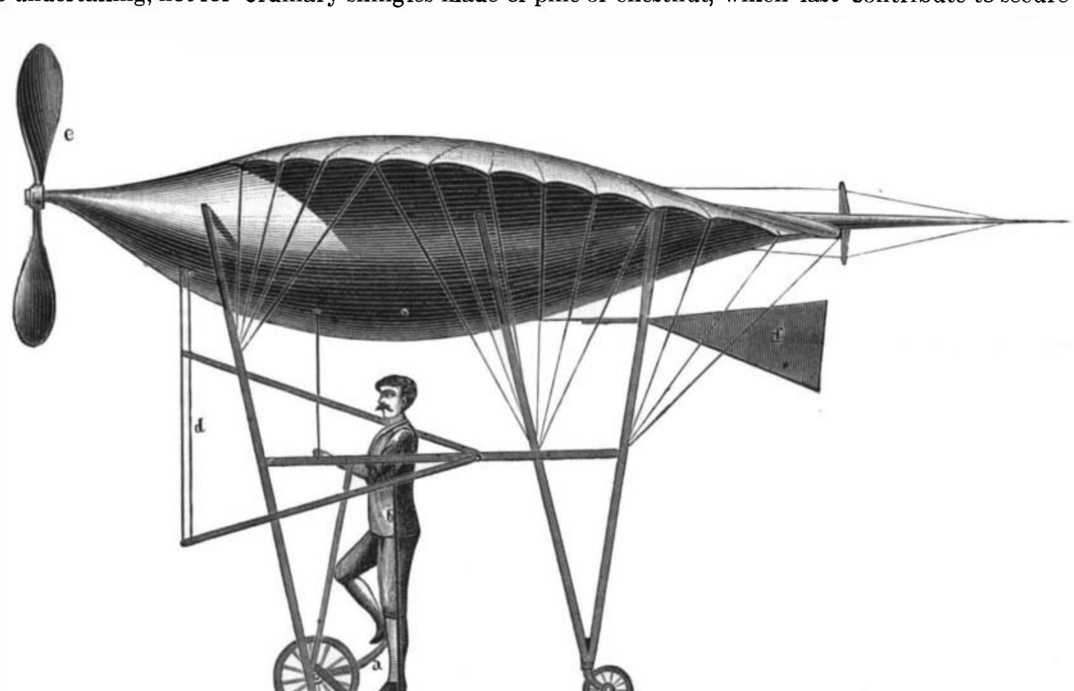


GOUPIL'S FLYING MACHINE.

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 fulfills 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.*



GOUPIL'S FLYING MACHINE.

Mechanical Toys.

The recent holiday season is said to have afforded a particularly active business in mechanical toys. A dealer says: "The run on them has been something wonderful. The baby doll that walks and squeaks, says mamma and papa at each mechanical theatrical stride, sold like hot cakes. They have simply been improved upon very much, but not recently invented. The mechanical smoking man is a late patent. It is a comical figure of a man eleven inches high, seated on a black walnut box and a small keg at his elbow, with the historical long pipe and mug of beer in his hand. Place a cigarette in his pipe, and, when wound up and the cigarette lighted, the figure will draw and puff the smoke in a perfectly natural manner. The motions of the head and arm and the action while smoking are perfect. These have sold rapidly to the small boys, ambitious to learn how to smoke and use tobacco.

"But one of our latest hits is the stump orator. It is a negro with a carpet bag in one hand and an umbrella in the other. He makes motions, pounds the desk in front of him with the umbrella, and assumes positions of appeal, entreaty, fierceness, and humor such as the orators of the day do when speaking. The dog cart with the dude in it driving a prancing horse is put in the show window for the first time this season.

By winding it up, away it goes until it runs down. The bear that walks about snapping his jaws cost a lot of time and money to perfect."