of the world, may do so by passing through the building lengthwise, keeping in the zone devoted to the particular department; and any one desiring to examine only the products exhibited by any particular county or State may do so by passing through the building crosswise, in the zone devoted to the particular country or State.

THE ART GALLERY

is of a highly ornate design, and is intended to be the best and handsomest building yet erected on this continent for the purpose. It is to be constructed of granite, glass, and iron, and will be thoroughly fireproof. Its dimensions are 365 feet long, 210 feet broad, and 72 feet high, with a dome, surmounted by a figure of Columbia, rising to 150 feet from the ground.

The Central Hall will be 95 feet long, and the Pavilions, one at each end of the building, will be 45 feet. The Pavilions will be connected to the Central Hall by arcades, each 90 feet long by 40 feet high.

The lighting arrangement, the most important point in the construction of an art gallery, appears to be thoroughly efficient. From the east and west sides of the Central Hall extend the galleries, each 98 feet long, 48 feet wide, and 35 feet in hight. These galleries admit of temporary divisions for the display of paintings. The center hall and galleries will altogether, form one grand hall 287 feet long and 85 feet wide, capable of holding eight thousand persons, nearly twice the dimensions of the largest hall in the country. From the two galleries, doorways open into two smaller galleries, 28 feet wide and 89 feet long. These open north and south into private apartments which connect with the pavilion rooms, forming two side galleries 210 feet long. A corridor 14 feet wide opens into a series of private rooms. Mr. H. J. Schwarzman is the architect, and Mr. R. J. Dobbins the contractor.

It will be seen that the Commissioners have duly appreciated the magnitude of their undertaking, as well as the advisability of appealing to modern taste, culture, and refinement. If these two structures, the erection of which is being vigorously prosecuted, are finished as they are represented in our engravings, and the other three are equally worthy of their noble purpose, we shall as a nation have something to be proud of in our Centennial Exhibition, and among our best exhibits will be the buildings themselves.

THE FRANKLIN INSTITUTE EXHIBITION.

No. II.

PUMPS.

The huge water tank in the southeastern corner of the building attracts crowds of visitors. Clustered around it is to be found almost every variety of steam and hand pump. All the steam pumps are in operation, and together discharge immense quantities of water. Among the exhibitors we notice Potter & Hoffman, C. A. Conde & Co., William Cramp & Sons, Henry C Hall & Co (pulsometer pumps), Cooper,Jones & Cadbury, J H Billington & Co., and last, but not least, Thomas Shaw. The pump shown by this gentleman is one of the largest ever exhibited, and deserves especial notice. He calls it a compound propeller pump, and he claims for it especially simplicity of construction: it contains no valves, and consists essentially of but three pieces, namely, the column pipe, shaft, and propeller; therefore it is economical, costing much less than any other equally powerful pump. Its enormous power is a feature peculiar to it. The one exhibited is a 20 inch pump, and lifts 10,000 gallons per minute; with a greater speed it can lift 14,000 per minute. A 7 inch pump yields 1,000 gallons, and an 8 inch pump, 1,200 gallons, per minute. It can be used either as a force or a lift pump; can be placed at any angle; will lift sand, mud, sticks, and dirt off sunken lands without serious hurt. The hight to which the water can be lifted depends only upon the power employed. A serious difficulty was at first experienced in obtaining a bearing suitable to sustain without injury the enormous weight of the column of water, together with the shafts and propellers. This has, however, now been successfully met by Mr. Shaw's effective water bearing, which consists essentially of a cast iron beam resting on the top elbow of the pump, upon which pillars are secured, supporting a stationary disk carrying an ordinary stuffing box, penetrated by the propeller shaft. A dome rises from the stationary disk, and inside of this a second disk is attached to the propeller shaft and revolves with it. Water is forced below these two disks, under a pressure equal to the weight sustained. In this way the entire weight of the revolving machinery and the greater part of the water column is supported on a film of water on which the revolving disk floats. When too much water is forced between the disks, the revolving disk is raised and the surplus allowed to escape. The water is raised into a large tank 16 feet long, from which the water falls 10 feet to the tank below. The pump is driven by a beautiful engine built by Neafie & Levy, of Philadelphia.

IRON AND STEEL.

The Union Iron Company of Buffalo exhibit a heavy 15 inch beam weighing 66⅔ pounds per foot, 52 feet 6 inches long, rolled in one heat; and a light 15 inch beam, weighing 50 pounds to the foot, 60 feet 6 inches long, also rolled in a single heat.

The Midvale Steel Works, of Nicetown, Philadelphia, make a beautiful display of their manufactures of cast steel. Several cold twisted rails are exhibited, showing the excellent quality of the steel. Forgings of various forms are also to be seen. A steel axle made of Siemens Martin steel was submitted to the following tests: A weight of 1,640 pounds, falling 20 feet, was allowed to fall on the bar, placed on bearings three feet apart. The bar was reversed after each blow. The following deflections were observed: The first blow produced a deflection of 7 inches; the second, of ¼ inch in the opposite direction; the third, 6⅝ inches in the opposite direction; the fourth, $1\frac{3}{16}$ inches; the fifth, 5½ inches and the sixth, 2¼ inches, each in the opposite direction.

HEATERS AND STOVES.

In heaters and stoves a very large display is made. Liebrandt & McDowell exhibit, among other novelties, the Radiant Parlor Cook, Our Mutual Friend, and the Great Centennial Range. Samuel Kirby exhibits the Phœnix Double Heater, which he claims to be one of the most economical and powerful now in use. A small grate attachment serves as a consumer in cleaning clinkers from the fire. J. A. Lawson exhibits a combined self-feeding and surface burning furnace, called the Pearl. It is designed especially for the consumption of anthracite. Other firms are adapted to bituminous coal and wood. Fuller, Warren & Co. exhibit a very beautiful open front Franklin stove, which they call the Howard. The cheerful, open fire is combined with economy and cleanliness. The Pennsylvania Heating and Ventilating Warehouse and Blacksmithery Works, of Philadelphia, exhibit one of D. Mershon's Sons' wrought iron airtight furnaces, adapted for all kinds of fuel. A novel application of a regulator is made, by which the fire can be regulated without going into the cellar. This is effected by simple levers and pulleys. Reynolds & Son, of Philadelphia, exhibit their wrought iron airtight furnaces. Among a number of forms we note especially the Centennial Furnace, arranged expressly for burning bituminous coal or coke.

MACHINE TOOLS.

Unquestionably the most interesting feature of the Exhibition is the display of machine tools. Among the prominent exhibits we notice those of the following firms: William Sellers & Co., W. B. Bement & Son, Van Haagen, Shoper & Bro., Faris & Miles, E. Harrington & Son, and many others. As it will be impossible in the limited space of a single letter to do justice to all these exhibits, we therefore select one of the most prominent, namely, that of William Sellers & Co., of Philadelphia. Among the many ingenious tools exhibited by this firm none attract more attention, both from experts and non-experts, than their automatic gear cutting and wheel-dividing machine, and indeed justly so, for it is a marvel of ingenuity. Its movements are entirely automatic, no manual labor whatever being required on the part of the operator, save the oiling of the machine. It is impossible to convey a clear idea, in a brief description, of the number of beautiful motions of the machine. The gradual advance of the cutter, its quick return and final stop, the automatic starting of the dividing mechanism which brings the wheel around to the exact position for the next tooth, must be seen to be fully appreciated; and when once seen, there is a kind of fascination about it that makes a visitor spend a length of time in examining its beauties.

Alongside of the gear cutter is one of their self-acting slide lathes for turning and screw cutting, the arrangements of which secure great convenience for working. The top of the shears is a plane surface. The saddle carrying the slide rest is guided on the front edge, the heads moving between the parallels. The cone pulley is furnished with five steps, giving fifteen rates of speed, rising proportionally from the slowest to the most rapid. The feed movement is especially novel. By means of an ingenious combination of friction disks, invented and patented by Mr. C. Sellers, the rate of speed is altered by the simple turning of a milled screw, no stoppage or change being necessary. The importance of this feature will be instantly recognized.

A nut shaper of entirely new design is also on exhibition. All six sides of the nut are finished at the same time, by means of a peculiar arrangement of cutters. A continuous stream of oil is supplied, to the surfaces cut, by a pump beneath, run by the machine. Nuts finished by this machine have a beautiful and characteristic appearance imparted to them. We also notice a radial drill, with adjustable arm capable of a five foot swing. The tool is so arranged that the spindle can be accurately adjusted to any point of the lathe, thus avoiding the moving of heavy work. A section of the latter is susceptible of vertical adjustment, thus adapting the machine to the performance of small work. The spindle is driven by a belt running horizontally, giving the remarkably smooth motion so characteristic of the Sellers' upright drills.

Another interesting feature of their exhibition is a lathe in which are two small grinding machines, one for drills and the other for straight edges and other hardened work requiring true surfaces. The drill grinder produces the required edge on the drill with no other labor than is needed to set it in the required position. Though a small tool, it deserves especial mention. The slotting machine is also remarkable for the originality and excellence of its construction. A vertical adjustment to the connection of the slotting bar enables it to be easily set for different hights of the work. The feed movements are readily controlled by the workman, without leaving a position favorable for watching his work. A number of other novelties are exhibited by this firm, among which might be mentioned their improved forms of Gifford injectors for feeding boilers, but want of space prevents any further notice.

Messrs. Riehle Brothers make a fine display of their scales and testing machines. They have on exhibition one of their 75 tuns upright testing machines for ascertaining the tensile strength of round, flat, or square specimens of any material from 18 to 32 inches long; also one of Professor Thurston's new testing machines.

Fairbanks & Ewing, of Philadelphia, have on exhibition a large number of their standard scales for different purposes, as well as scales graduated to the Russian, French, Chinese, Spanish, and other standard scales. Messrs. Howe, Fairbanks & Co. also make a fine display.

As an unusually fine specimen of wood work, we note the Union table, made by Samuel McCracken, of Philadelphia. It contains some 35,000 pieces of wood. Among the varieties employed are the following: oak, pine, walnut, coco, tulip, amboyna, lance, locust, mahogany, Hungarian and American ash, cedar, white holly, French walnut, satin, and rose. The American eagle is in the center, surrounded by thirteen stars, and in circles beyond this are stars and other devices. On the whole, the effect is a happy one.

A Bullock printing press and a machine for making envelopes, both in actual operation, draw large crowds of the curious. Working models of Chambers' and of the Excelsior brick machines are also exhibited.

The exhibition of drugs, dyestuffs, and chemicals is one of the most attractive features of that portion of the building on the left hand side of the main entrance. The Pennsylvania Salt Works, Powers & Weightman, Henry Bauer, John Lucas & Co., Harrison Brothers, and Rosengarten & Sons have exceedingly large displays.

Sheet Iron Gas Mains.

The Paris Gas Company have lately laid down a main 3·2 feet in diameter and 1,093 yards in length, from St. Maude to the Place du Trône. Hitherto sheet iron pipes covered with bitumen have not been applied to mains of that dimension, and it was important to ascertain how such pipes of a moderate thickness would answer beneath the public roads, where they would be submitted to the permanent and accidental pressure tending constantly to produce deformity.

The company had already adopted sheet iron pipes of 27 55 inches diameter, without any important deformity being produced, and it was only necessary to submit the 3·28 inches pipes to similar pressure to ascertain what effect it would produce, all theoretical calculation being deemed untrustworthy. A comparative trial was therefore made with the aid of an apparatus planned for the special purpose. A pipe of 27 55 inches diameter, of the ordinary thickness of 0·157 inch, and a pipe of 3 28 feet diameter, 0 197 inches thick, were laid in the ground in the mode adopted for the mains in Paris, the trenches having been dug in such a way that there was a space of 10 inches between each side of the tube and that of the trench, and that the filling-in above each pipe should be 3·28 feet in depth. The pipes in ordinary use are 13 12 feet in length; but in order to spread the weight over a large surface, pipes 19 68 feet long were adopted for the experiment, and one end of each was left open to allow of access to the interior.

The trial was made by placing on the soil above them pigs of lead, from four up to twenty tuns weight, which were supported on a platform composed of timber, and having a surface of 86 square feet. This platform was laid upon two pieces of timber, each 19 7 inches long and 9 85 inches wide, and placed 6 90 feet apart, which represented the tyres of the two wheels of one of the axles of a locomotive of forty tuns. The apparatus for the indication of the deformities produced consisted of a circular disk of sheet iron with nine radial rods, each supported by two small guides screwed to the disk, and provided with a spiral spring which kept its outer end pressed against the inner surface of the pipe. The guides of the rods were each provided with a set screw to hold the latter in place while the apparatus was being placed in the pipe. The only object of the rods at the lower part of the disk was to maintain the center of the latter in the axis of the pipe, and when the apparatus was in place both the guides of these lower rods were screwed firmly to the disk. Thus any alteration in the vertical diameter was measured from the center. In the center of the disk was an opening 7 87 inches in diameter, fitted with a piece of iron covered with leather, which carried a circular piece of paper. Each iron rod on the upper part of the disk was fitted with a pointer held in a small tube by a spring, and provided with a copper button. When the apparatus was in its place a finger was pressed on each button, and the position indicated by pricking through the paper, the leather behind preventing the point of the needle being turned. When a load was laid on the platform above, the position of the pointers was again pricked through the paper, and the difference between the two marks showed the amount of deformity produced. The results obtained were then transferred to a diagram of the same section as the pipe itself.

By comparison of the diagrams obtained, it was found that, with a load of twenty tuns pressing on the pipes for 130 hours the 3·28 feet pipe had given way vertically to the extent of 2·85 per cent, and the smaller pipe of 4 30 per cent. The conclusion was that a pipe 3 28 feet in diameter and 0 197 inches thick offered greater resistance than a pipe 27·55 inches in diameter and 0·157 inch in thickness, which had already proved itself satisfactory in practice. It was found by further experiments that, when a pipe had once been deformed by a heavy load, it only recovered itself to the extent of a fraction of an inch when the load was removed. After these experiments a main 3 28 feet in diameter was laid from the gas works at St. Maude to the Place du Trône, and as the joints were made they were tried with compressed air under a pressure of 2 755 inches of the mercury manometer, the pipes themselves having been previously tested under a pressure of 75 pounds to the square inch. These trials revealed a few defects which were easily repaired. Since that time the main in question has been in use constantly, without exhibiting anything contrary to the results of the several experiments which we have above recounted.—*The Engineer.*

Etching Iron.

Much time and attention has been devoted by Professor Kick, of Prague, to the subject of etching iron with acids. His method is not a new one for arriving at a knowledge of the quality of iron or steel, having been used with some success for a long time, but the care with which the professor has conducted his experiments makes them exceedingly valuable.

Some kinds of iron exhibit what is known as the passive state, and are unacted upon by acids until this state has been destroyed by heating. The surfaces thus prepared were inclined to rust very soon. After a series of experiments with nitric, sulphuric, and hydrochloric acids, and etching solutions of copper salts, Professor Kick found that a mixture of equal parts of hydrochloric acid and water, to which was added a trace of chloride of antimony, was the best etching solution. The chloride of antimony seems to render the iron less inclined to rust, so that, after washing thoroughly in warm water, and applying a coat of dammar varnish, the etched surface may be kept quite clean.

The smooth surface that is to be etched is surrounded with a ridge of wax an inch high, as is done in etching copper plates, and the acid is poured into the dish thus formed. At a temperature of 55° to 65° Fah., the action soon begins, as shown by the gas evolved; in winter the etching is poor. The time required is from one to two hours, but the etching should go on until the texture is visible. Every half hour the acid can be poured off without removing the wax, the carbon rinsed off, and the surface examined. If too much chloride of antimony is added to the acid, a black precipitate will soon form, which can easily be distinguished from the carbon. One drop of chloride of antimony to the quart of acid is sufficient. When the etching is finished, the wax rim is removed, the iron washed first in water containing a little alkali, then in clean water, brushed, dried, and varnished. If in a few hours it begins to rust, the varnish should be removed with turpentine, which will also take off the rust, and then varnish again.

The appearance of different kinds of iron when etched is essentially as follows: Soft or sinewy wrought iron of excellent quality is attacked so equally by the acid, and so little carbon is separated, even after several hours' action, that the surface remains bright and smooth. Fine grained iron acts the same; the surface is still smoother, but a little darker. Coarse grained and cold short iron is attacked much more violently by acid than the above. In ten minutes, especially with the latter, the surface is black. After thirty minutes a black slime can be washed off and the surface will remain black in spite of repeated washings, and exhibits numerous little holes. Certain parts of the iron are usually eaten deeper, while others, although black and porous, offer more resistance. By allowing the acid to act for an hour or so, then washing, drying, and polishing with a file, a distinct picture is obtained. Malleable cast iron, we know, rusts more easily than wrought iron, and it is interesting to know that the action of acids is also violent, the surface being attacked very violently. Gray pig iron acts like steel; the etched surfaces have quite a uniform gray color. In puddled steel, the color, after etching and washing, is gray, with quite a uniform shade, and the lines are scarcely visible. Cement steel has a very similar appearance, the lines being very weak. In Bessemer and cast steel the etched surfaces are of a perfectly uniform gray color, with few, if any, uneven places. The softer the steel, the lighter the color.

On etching, the finest hair-like fractures are rendered prominent. A piece of steel, which looked perfect before etching, afterwards exhibited a hair-like fracture through out its whole length. When different kinds of iron are mixed, the acid attacks that for which it has the greater affinity, while the other is less acted upon than if it were alone. Etching is exceedingly valuable to all who deal largely in iron, as it enables them to determine with comparative accuracy the method of preparing the iron, as in the case of rails, etc., as well as the kinds employed.

New Phosphor Bronzes.

Dr. Kunzel, whose name will be recalled as the joint discoverer, with M. Montefiore-Levy, of the well known phosphor bronze, now announces the additional discovery that when phosphor bronze is combined with a certain fixed proportion of lead, the phosphorised triple alloy, when cast into a bar or bearing, segregates into two distinct alloys, one of which is hard and tough phosphor bronze, containing but little lead, and the other a much softer alloy, consisting chiefly of lead, with a small proportion of tin and traces of copper. The latter alloy is almost white, and, when the casting is fractured, it will be found nearly equally diffused through it; the phosphor bronze alloy forming, as it were, a species of metallic sponge, all of whose cavities are occupied by the soft metal alloy segregated from it. This phenomenon of the segregation into two or more alloys of combinations of copper with tin and zinc has long been known; and from the fact that such separation is generally massive, and not equable throughout the mass, it has been a source of great annoyance to the founder. Dr. Kunzel, however, seems to have succeeded in causing the segregation to take place in uniform distribution throughout the casting, and has taken advantage of the properties of the product, which he obtains in this manner, to construct therefrom bearings of railway and other machinery.

In heavy bearings, such as those for marine engines, the valuable properties of Babbitt metal, and similar anti-friction alloys, are well recognized; but these, being generally soft, are open to the grave objection that, where they are subjected to considerable pressure, or even moderate pressure accompanied by continued vibration, they become distorted in form, and then fail to sustain the journals in their proper places. The device is, therefore, resorted to by the machinist of casting a hollow cage of hard metal, of proper form for the intended bearing, the cavities of which he then fills up by casting into them the soft metal alloy, which thus forms the actual rubbing surface of the bearing. The hard metal cage thus supports the soft metal within, and prevents its distortion or escape, save by surface abrasion. Dr. Kunzel claims to effect the same result by the peculiar constitution of his new phosphorised alloy for bearings. This forms its own supporting cage for the soft bearing metal, which, as alluded to at the outset, separates from it in the process of cooling. He claims that these bearings combine the very small friction and non-abrasion of the journals with the firm resistance to pressure and stability of form of bearings of hard metals. The test of practice, however, alone can decide the value of these claims, though they seem very plausible.—*Iron.*

The Waste of Power in Cotton Mills.

The winter session in connection with the Manchester, Eng., Scientific and Mechanical Society was lately opened by a paper by Mr. Evan Leigh, C E., on the waste of power in cotton mills.

During the course of his paper, Mr. Leigh said that it might naturally be thought that England would not allow herself to be surpassed by any foreign country on any point relating to her principal and favorite manufactures. On one or two points, however, England has been most decidedly excelled by inventions originating in America. He alluded to ring spinning and belt driving, both of which were eminently calculated to save power, and consequent waste of fuel. Referring to ring spinning, he said that it had been introduced into England as an American invention more than forty years ago, but for some reason it was not generally adopted by the English spinners. Perhaps that was owing to the recent failure of the Danforth throstle, another American invention of great promise, that had been adopted by several spinners. Although the principle of the two frames was totally different, the English spinner was not to be caught again, so he fought shy of the ring frame, and it was believed that for more than thirty years not one frame on that principle was used in Great Britain. The solid advantages of this method of spinning were, however, duly appreciated in America, and the system was cultivated until the difficulties and exact mechanical requirements attending its construction were thoroughly mastered, and the result was the production of a frame that took only half the power of an ordinary flyer throstle, besides being capable of working practically at a much higher speed. At the Laconia Mill, Biddeford, Me., Mr. Leigh saw, last year, a girl minding, apparently with ease, 1,344 spindles of these frames, with the front rollers running seventy revolutions per minute, spinning No. 26 yarn, and found it quite common for such piecers to run 1,100 or 1,200 spindles with so little hurry that they had plenty of time to avail themselves of a seat which was provided for each spinner, on which she sat and leisurely watched the frames spin. He (Mr. Leigh) did not think that this arose from superior ability in the American, but simply that in foreign countries spinners are less jealous of one another, and band themselves together to discuss and test scientifically all alleged improvements.

In Boston, Mass., the Cotton Manufacturers' Association had a semi-annual meeting, at which papers were read relating to new inventions in cotton spinning and manufacturing, and a discussion followed, in which each related the results of his own experience in testing any invention in question. In that manner, every particular subject was thoroughly ventilated, and the truth arrived at, establishing a safer basis for the investment of capital than would otherwise be the case. Should opinions be divided as to the merits or demerits of a new thing, the question was adjourned to the next meeting, and, if need be, a number of experts went round to the different mills and tested the machine in question impartially, by the results produced and power consumed, which were carefully measured by the dynamometer. A report followed, and another meeting generally settled the point.

Going on to speak of the comparative advantages of belts and gearing, Mr. Leigh said that the proper application of driving belts to the machinery was a most important question. To be rightly applied, a main driving belt should move through 4,000 or 5,000 feet of space per minute, and be sufficiently wide to drive all the machinery and shafting quite easily when running in a slack state. After a new belt had been once tightened up, it should work many years without wanting any further tightening, and would do so if made of good material and properly applied, saving in the meantime a large amount of power and all the grease and labor of putting it on, to say nothing of the noise heavy gearing makes. The speaker then adduced some practical instances of the extent to which belt power might be used in connection with machinery, giving examples from the various mills he had visited in America, showing the durability and ease with which large belts did their work. The lesson taught by the big belt was imperative, namely, that there should be very light shafting run at a very high speed, with larger drums and pulleys; then very little would be heard of strap-piecing, or wear and tear of belts, working with less power and steadier production all the while. The simplest and best, and also the cheapest and most durable, method of driving by belt was to convey the power from the main driving shaft direct to each room by a separate strap, and, if more than one shaft was wanted in any room, to drive it from the other direct by a separate strap, apportioning the width of each strap to the power it was required to drive, and, whenever a belt was necessarily short, allowing a little extra width.

Schools for Engineers.

Within the past ten years, schools for engineers have increased rapidly in this country. They are, to speak exactly, eclectic schools, where most of the positive and some of the abstract sciences are made a part of the regular course. They are not purely theoretical in their instruction, but have workshops attached, wherein the usual tools of a modern machine shop are found, and where substantial work is undertaken and subsequently sold in open market in competition with that of the trade. These schools or colleges have teachers thoroughly skilled in their professions, many of them being themselves graduates of machine shops in the most honorable and praiseworthy sense, who have from humble beginnings raised themselves to posts of importance and responsibility. Associated with these men are others of special prominence in the sciences they preside over, so that, by the union of practical example and pure theory, a student may graduate from any branch of science he selects.

It is scarcely necessary to say that such schools are of the very greatest importance to the country; and in view of this fact, it is proper to remind young men that engineering, which is largely and carefully taught there, is a profession which greatly needs thoroughly educated men. There cannot be too many in it, for the future of this country is so vast, its resources so utterly undeveloped, that there will be need of all who have fitness for engineering pursuits. Civil, mechanical, mining, hydraulic, and architectural engineers will be in demand in the future, and will find ample room for the exercise of their professions without interfering with one another. Nowhere can they find better facilities to become acquainted with the best modern practice of their callings than in these industrial schools. The ordinary colleges afford no such advantages as can be obtained at Cornell University and the Stevens Institute of Technology at Hoboken, and some others. These are well appointed establishments, with complete workshops, where Science and the practical development of it go hand in hand; where the natures, peculiar qualities, and modes of working various metals are shown in processes carried on by the student himself: not with a view of dabbling in the pursuit as a sort of experiment or recreation from dryer studies, but to produce works which are valuable.

Professor Sweet, of Cornell University, for example, sent out at one time circulars of face plates, straight edges, and angle plates of guaranteed excellence and accuracy, all of which were offered at low prices and made at the University workshops. It is notable also that, in the Stevens Institute of Technology, for example, the terms for a course of any branch are so low as to be almost nominal. By the munificence of Edwin A. Stevens, who left a large sum of money to found the Institute, residents of New Jersey are received as pupils at $75 per year for instruction only, and non residents at $150. With such facilities, it is to be hoped that the rule-of-thumb engineers will gradually become extinct, and their places supplied by men who have a reason to give for their opinions, and can tell why they make a piston rod six inches in diameter, or why they sink shafts where there are no surface indications to warrant them in the outlay.

The men who practised their calling without a thorough education in it were pioneers in the profession, and are entitled to respect and consideration for their eminent services. Where there was no thoroughfare, they boldly made one; where there were no precedents, they made precedents; they were a law unto themselves, and by their native talent and sagacity established works which more timid men would never have undertaken. They made few costly mistakes; and though they may have used a few tuns too much of iron or other material, it was cheap in the end, and experience has to be bought in some shape. Now, however, that a more perfect and direct road to the acquisition of professional knowledge is open through these industrial colleges, it will be the fault of parents and guardians if the coming generation does not reap the benefits of them.—*New York Sun.*

Effect of Ammonia Fumes on Flowers.

Professor Gabba has been examining the effects of ammonia on the color of flowers. It is well known that the smoke of tobacco will, when applied in sufficient quantity, change the tint of flowers; but Professor Gabba experiments by pouring a little ammonia liquor into a saucer and inverting a funnel over it. Placing the flowers in the tube of the latter, he finds that blue, violet, and purple colored blossoms become of a fine green; carmine and crimson become black; white, yellow; while particolored flowers such as red and white are changed to green and yellow. If the flowers are immersed in water, the natural color will return in a few hours. Professor Gabba also found that asters acquire a pleasing odor when submitted to the fumes of ammonia.

A NEW potato, known as the white queen (*reine blanche*) is being cultivated in France. In good soil, from ten to fifteen tubercles are formed, many of which attain or exceed the weight of 2·2 pounds. The flavor is said to be very fine. Planted in February or March, it becomes ripe in July.

Engineering learns that a rolling mill at Columbus, O., has recently contracted to furnish a large quantity of rails to a railroad company at $52 per tun. This is said to be $3 per tun less than the price at which the same quantity of rails could be delivered from England to the same part of the United States.