Technical and Bibliographic Notes / Notes techniques et bibliographiques

The Institute has attempted to obtain the best original copy available for scanning. Features of this copy which may be bibliographically unique, which may alter any of the images in the reproduction, or which may significantly change the usual method of scanning are checked below.

L'Institut a numérisé le meilleur exemplaire qu'il lui a été possible de se procurer. Les détails de cet exemplaire qui sont peut-être uniques du point de vue bibliographique, qui peuvent modifier une image reproduite, ou qui peuvent exiger une modification dans la méthode normale de numérisation sont indiqués ci-dessous.

- [ ] Coloured covers / Couverture de couleur
- [ ] Covers damaged / Couverture endommagée
- [ ] Covers restored and/or laminated / Couverture restaurée et/ou pelliculée
- [ ] Cover title missing / Le titre de couverture manque
- [ ] Coloured maps / Cartes géographiques en couleur
- [ ] Coloured ink (i.e. other than blue or black) / Encre de couleur (i.e. autre que bleue ou noire)
- [ ] Coloured plates and/or illustrations / Planches et/ou illustrations en couleur
- [x] Bound with other material / Relié avec d'autres documents
- [ ] Only edition available / Seule édition disponible
- [x] Tight binding may cause shadows or distortion along interior margin / La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure.
- [ ] Coloured pages / Pages de couleur
- [ ] Pages damaged / Pages endommagées
- [ ] Pages restored and/or laminated / Pages restaurées et/ou pelliculées
- [x] Pages discoloured, stained or foxed/ Pages décolorées, tachetées ou piquées
- [ ] Pages detached / Pages détachées
- [x] Showthrough / Transparence
- [x] Quality of print varies / Qualité inégale de l'impression
- [ ] Includes supplementary materials / Comprend du matériel supplémentaire
- [ ] Blank leaves added during restorations may appear within the text. Whenever possible, these have been omitted from scanning / Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été numérisées.

- [x] Additional comments / Commentaires supplémentaires: Continuous pagination.

SCIENTIFIC CANADIAN
MECHANICS' MAGAZINE AND PATENT OFFICE RECORD

Vol. 10. JUNE, 1882. No. 6.

NOTE AND COMMENT.

SINCE the completion of KNIGHT'S AMERICAN MECHANICAL DICTIONARY, in 1877, the progress made in the development of the mechanic arts is unprecedented in the history of the world. Not only in such striking and wonderful achievements as relate to the telephone, phonograph, and electric light, toward which popular attention is naturally drawn, but in every department of applied mechanics, there has been developed a fertility of resource in the adaptation of means to ends quite as marvelous and equally important in practical results. Achievement has outrun the most sanguine expectation, and with such rapidity that even the most recent records are found to be very deficient in supplying the special information most desired.

The hearty approval which KNIGHT'S AMERICAN MECHANICAL DICTIONARY has received in all parts of the world has encouraged the Publishers to issue an entirely new volume, thus continuing the record from the date at which the former work went to press, but carefully avoiding repetition, and aiming to furnish not only a satisfactory supplement to the original work, but a book which shall have an individual and separate value as a complete record of half a decade in the history of invention. From this fact it is evident that this volume forms an indispensable supplement to all works of reference upon mechanics now extant, as none of them cover the period mentioned.

The same method has been adopted in dealing with the subject matter in both works. First, each article appears in its proper alphabetical place, thus fulfilling the function of a Dictionary, in affording direct response to inquiry. Second, the items of information thus distributed throughout the work are classified in Special Indexes of the Art, Profession, or Manufacture to which they pertain. The book thus fulfills the function of a Cyclopædia, which is a collection of treatises.

The value of a work of reference depends largely upon its Index. When one has a question to ask of an ordinary Cyclopædia it is frequently very difficult to deterime under which title or heading to look.

The author has invented a system of what he terms "Specific Indexes" by the use of which the inquirer is guided straight to the information he is in quest of, even though he is entirely ignorant of the name of a thing, and have but the most vague and general notion of its use. This is accomplished by grouping under the general title of each Science, Art, Trade, or Profession a list or "Special Index" of every article in the book bearing any relation to the subject in question. The titles of these Indexes are in turn grouped at the beginning of the book, so that by a glance one map determine which clew to follow.

Besides the use above mentioned, these Specific Indexes afford the reader an excellent opportunity for investigating thoroughly all that pertains directly or indirectly to any special subject, by using the Index under the title of that subject as a sort of head-center, and following out its various branches through all their ramifications.

Special attention is called to a new and valuable feature in the work, by means of which exhaustive information on any subject is placed within easy reach. The author has made a complete Index to technical literature, covering a period of five years, and embracing all English and American technical journals published from 1876 to 1880 inclusive. Under title of each subject may be found a complete list of every article which has appeared, during this period, in the columns of these periodicals and as every subject of importance has been thoroughly discussed therein, it is evident that the whole range of recent investigation is thus placed at easy command. This Index cannot fail to meet with the heartiest appreciation among those who have experienced the labor and difficulty attending an exhaustive search upon any line of inquiry.

"Index-learning turns no student pale,
Yet holds the eel of science by the tail,"

The work treats of many thousand subjects and is illustrated with over 2,500 carefully prepared engravings and numurous full-page plates, and for general typographical excellence, quality of paper, and printing it is unsurpassed. HOUGHTON, MIFFLIN & Co., Boston, Mass.

VIVISECTION AND MORTISECTION.

The pursuit of knowledge under difficulties has, from time immemorial, furnished a fruitful subject for the moralist, the philosopher, and the humorist. Perhaps danger gives zest to certain pursuits which would otherwise want for disciples. The cold and privation which constitute the risks to be incurred in Arctic exploration have, for certain people, the same irresistible power of attraction that lend a charm to the dangers of tropical Africa, and lead thither those brave men who take a real pleasure in advancing the boundaries of knowledge.

The difficulties encountered by explorers in barbarous countries are scarcely less than those to be overcome in civilized communities, owing to the prejudice of the populace and ignorance of the law givers. As man himself stands at the head of animate creation the last and crowning glory of the Creator's handiwork, the study of man becomes the noblest of studies. A selfish spirit prompts us to seek our own physical welfare, and, admitting of self-defense as the first law of our nature, no branch of science deserves greater attention nor should excite greater interests among all men then anatomy. A knowledge of the machine is absolutely essential to those who would repair it.

In early times when life was held in small regard it was not considered so very wrong to sacrifice a human being to appease some angry god or ward off a threatened plague or pestilence. To carve a lifeless corpse in order to prepare it for the roasting spit, or to obtain the entrails for the altar, was no uncommon deed, and yet up to the beginning of the fourteenth century we read of no case where a dead body was publicly dissected for the purpose of learning how it was made, its parts and their offices. The Mohammedan religion still forbids the dissection of a human body, and the people of to-day, nine-tenths of them at least, are Mohammedans at heart and would forbid dissection if they could.

The recent shooting case in a graveyard has called attention to this subject, and the question is asked afresh: Why must men risk their lives and incur the wrath of the community and the scorn of their fellows to obtain the only means whereby the surgeon and the physician shall learn his duty? Is it because the dead are more sacred than the living? The Jewish law required that he who shed the blood of another should suffer a like fate; but modern Christian people have decreed that those who touch the dead shall suffer swifter vengeance than those who destroy the living. Those who desecrate a grave in hope of extorting from the bereaved relatives an exorbitant ransom deserve severe penalties; but another law should apply to the man of science, who, actuated by his love of truth, and a desire to benefit mankid and to relieve suffering humanity, goes forth at the grim hour of midnight upon an errand most repulsive to his soul, and with trembling hand disturbs the sacred soil of "God's acre." Why does he brave cold and wet, even the danger of shot gun or pistol, and, at a loss of time and sleep, disturb the ashes of the dead? Certainly not for the fun of it; but because in many sections of the country law and custom make this his only resource. The same legislator that would make a dissection a *sine qua non* for the degree of doctor, would render dissection impossible by giving him no subjects except those obtained from graveyards, and then making body snatching a capital offense.

A false sentimentality makes us unwilling to see the remains of our relatives mutilated, yet many of our leading men confess themselves more than willing to submit to cremation. Here the question of premature burial naturally presents itself, and many persons say they should prefer to be burned alive than buried alive. It seems rather a sad choice! Well authenticated cases of burial alive are known; and with the general introduction of cremation cases of burning alive will probably take place, although then there will be no means of proving it, for the involuntary motion of the limbs in the furnace is no proof of life. While burning and burying alive are both possible, it is safe to say that no one ever has been, or ever will be, dissected alive, for the first stroke of the scalpel would detect the faintest spark of lingering life. In fact, cases are reported where this has happened, while in other cases body snatchers have proved rescuing angels who have saved human life. From a consideration of these facts the unprejudiced mind would acknowledge the dissecting room to be a safer refuge than the grave or the cremation furnace.

In the meantime this does not settle the question as to how material is to be obtained for dissecting-rooms without robbing graveyards. Cremation would put a stop to this, and thus seriously interfere with medical instruction. It is not enough that some States give their dead paupers and criminals to the colleges, for the number of medical colleges is greater than the number of the subjects thus obtainable. But there is one way, at least, out of the difficulty. Let every medical student solemnly swear, as he stands with uplifted scalpel before his first subject, that in return for the privilege of dissecting others he agrees to give up his own body after death for a like purpose. The medical fraternity owe it to their successors to form a mutual dissecting league, and thus render themselves independent of the general public, and at the same time win the respect of those who now blame them for encouraging grave robbing, an offense that none of them defend except when absolutely necessary.

Equally detrimental to the cause of science and the interests of humanity is the foolish attempt to prohibit vivisection. Theology, jurisprudence, and art have, in times passed, subjected human beings to torture worse than any vivisector ever inflicts upon numb animals. In the name of religion, of justice, and of art, vivisection has been practiced on man, but it is now denied to the student of anatomy, of physiology, and of pathology. Is "the true" of less consequence than "the good," "the right," and "the beautiful?" Trade and commerce, fashion and dress, epicureanism and gormandism, as well as art and industry, inflict upon our harmless neighbors of fur and feather woes greater in number, more severe in character, than the scientific investigator visits upon the animals subjected to his knife. The huntsman that leaves his dying prey in the bush, the taxidermist that flays a trembling bird for my lady's bonnet, the purveyor who stuffs the Strassburg goose until his liver is hypertrophied, and mutilates animals of all kinds to tickle my lord's palate — are they not guilty of acts as cruel and less defensible than the vivisector's? But we forbear to multiply examples. The case of the Dutch society for the prevention of cruelty to animals, which secured the passage of an act prohibiting the harnessing of dogs and compelled the women to drag their canal boats alone, is but an example of the way these self-styled humanitarians work.—*Sci. American.*

CREMATION.

BY DR. SAMUEL KNEELAND.

The four principal ways of disposing of the dead have been: First, mummification; second, burning; third, interment: fourth, aerial exposure; Of the first, practised chiefly by the ancient Egyptians, and of the fourth, by many savage nations, I need say nothing at this time.

In most nations, savage and civilized, from time immemorial, it has been the custom to inter the bodies of the dead in the ground, or to seal them up more or less tightly in tombs. Though these may answer all sanitary purposes, and fulfil all the sacred obligations of the living to the departed, in scattered populations, they are attended with danger, always increasing in populous communities.

This danger has practically been recognized by the fact that cemeteries have generally been placed without the limits of thickly inhabited districts. When persons, dead from infectious diseases, are buried in graves, they leave behind them to the public, as residuary legatees, a fearful amount of danger; and faithfully and impartially is the deadly legacy divided among all dwelling within a circle of one thousand to three thousand feet of such graves. Earth will, to a certain extent, deodorize, but cannot destroy or impede the escape of minute poisonous germs.

The danger from this source has never been fully appreciated by the public, entirely ignorant of the process of decomposition, and the products thereof. Of course the decay of the body committed to the grave depends as to rapidity entirely on the soil and temperature. In the Arctic regions decomposition is imperceptibly slow; in dry, torrid sands desiccation takes the place of putrefaction, and a kind of natural mummification takes place. In low, damp, or wet soils, in temperate zones, decay may be complete in one to one and a half years, giving off deleterious gases for that length of time, with perhaps the seeds of contagious disease. In dry, high, and airy soils the process is much slower and less dangerous.

What is decomposition of the human body? What are its products? What its dangers?

An English writer has defined the human body, chemically, as 45 pounds of carbon and nitrogen dissolved in 5½ pailfuls of water. Oxygen, though the principal of life, is also the great destroyer; the moment life ceases, our carbon by its agency is converted into carbonic acid, which escapes into the air, or is taken up by the roots of plants, according to the mode of sepulture; our nitrogen combines with some of the hydrogen of decomposition, forming ammonia, which escapes in a similar way; the water which forms about two-thirds of our weight is lost by evaporation. We are resolved, therefore, into gases, and the only dust which remains behind is the four or five pounds of lime salts which constitue our bones and hard parts. Nature provides sufficient animate and inanimate agents for the removal of decaying animal substances in the air, on the ground, or just beneath its surface, and the more speedy in the hot and damp climates where the results of decomposition are the most deleterious, provided man in his folly does not interfere with her processes. Man, by his mode of interring human bodies, contrives to prolong as much as possible the decay of his deceased brethren, thereby increasing to the utmost the possibility of poisoning the air, infecting the earth, and contaminating the water in the neighborhood of living beings. Air and surface burial permit free access to the myriads of minute living creatures whose office it is to convert into their own harmless substance the bodies of dead animals and men.

In the grave of six feet or more in depth, light and air are in a great measure excluded, and there is no access to the insects from whose eggs emerge the grubs or worms, from whose jaws popular belief expects the rapid and total destruction of the body. The truth is that the devouring worm is a myth, as much without foundation as the "dust" into which we are supposed to be resolved, and the results of decomposition are horrible enough in reality without adding any imaginary sensational acessories.

The modern process of cremation is performed as follows: The crematory at Washington, Pa., is a brick structure one story high, thirty feet long, twenty feet wide, divided into two rooms, a reception room twenty feet square, including walls, and a furnace room twenty feet by ten including walls. Cremation is performed in a fire clay retort, such as is used in the manufacture of illuminating gas, but of a somewhat different shape, heated to a red heat before the body is introduced, which work requires about twenty-four hours. The body is placed in an iron crib made in the shape of a coffin, with small round rods with feet three or four inches long to keep it up off the bottom of the retort. These feet are inserted into a flat strip of iron two inches wide and a quarter inch thick, turned up at the ends so that the crib with the body will slide into the retort easily. In addition to the ordinary burial garments, the body is covered with a cloth wet with a saturated solution of sulphate of aluminium (common alum) which, even when burned, retains its form, and prevents any part of the corpse from being seen until the bony skeleton begins to crumble down. During the cremation there is no odor or smoke from the consuming body, as the furnace is a self-consumer of smoke and other vaporable matter. The time required to complete the operation is about two hours, but improvements in the process will doubtless shorten the time. A very small portion of the remains is ashes, but the mass is in the form of calcined bones in small fragments, very white, odorless, deprived of animal matter, and may be preserved any length of time without change.

There are four to seven pounds of these remains from various sized adult bodies; they can be placed, for preservation, in a one-gallon druggist's bottle, with large ground stopper, into which a photograph of the deceased, with appropriate record, can be placed before introducing the remains. This bottle can be placed in the *columbarium* of the crematory, kept among the cherished memorial of the family of the deceased, or placed beside other remains previously buried in cemeteries or grave-yards.

This building, with its appliances, cost about $1,500. A plainer one, equally efficient, could now, at the reduced cost of labor and materials, be built for $1,000. An impression prevails that this crematory was erected for public accommodation, and that the owner of it follows cremation as a business for fees. This is a mistake. It was built for the use of its present proprietor and friends in the vicinity who concur with him in this reform. No fees have been charged, nor ever will be while in his possession.

A not unimportant item in this process is the great diminution in the expense of funerals. The average expenditure for each body buried is $100, the average cost by cremation is $20; the aggregate saving in the United States, from the adoption of this system would annually amount to millions of dollars. The expense of cremation is less than that of an ordinary burial case.

Cremation certainly is not barbarous, for it never entered, nor could it enter into the heads of barbarous people. It is not burning; there is no pile of wood or other combustibles, no visible flame, no sickening odor; it is a process of great scientific skill, the reduction of the body to ashes by the application of intense heat, 1,000° to 2,000° Fahr., by which it is resolved into its chemical elements at once, and without the flame coming into contact with the body.

We are all, more or less, carried away by our emotions and sensibilities, especially in the matter of the treatment of the bodies of our dear ones. As rational beings we must not allow our instincts and emotions to run away with our reason, especially in a matter as important as this.

The history of cremation in the United States is very brief, as the progress of such a radical change in long established customs must, of necessity, be slow. The earliest known instance was of Colonel Henry Laurens, in South Carolina, in 1796. Including that, to the present time not more than eight, or possibly ten, cases have occurred, the last in the current year and three or four in the crematory at Washington, Pa. Among those who left instructions for the disposal of their remains by cremation was Dr. Charles F. Winslow, of California, a former member of the Society of Arts, whose body was cremated about five years ago, in Salt Lake City, in a temporary furnace erected by his command, by the administrators of his estate. The Washington, Pa. crematory has had nearly one hundred applications, which have been declined, as the trustees do not intend to follow it as a business. They will permit only an occasional cremation for the purpose of keeping the subject before the public, and of hastening the disappearance of the prejudice which exists against this mode of disposing of the dead. It is believed by them that similar structures will be built at other places, and they will furnish for such laudable purpose any information which their experience enables them to give.

Leaving out of the question, then, all but sanitary reasons, cremation is far preferrable to earth burial: and we cannot but think that by degrees this reform will supplant prejudiced superstition, the pomp and profits of undertakers, and give to the living that immunity from many diseases, arising from foul air, impure water, and poisoned earth, which they are entitled to receive from the progress of sanitary science.—*Proc. Soc. Arts, Boston.*

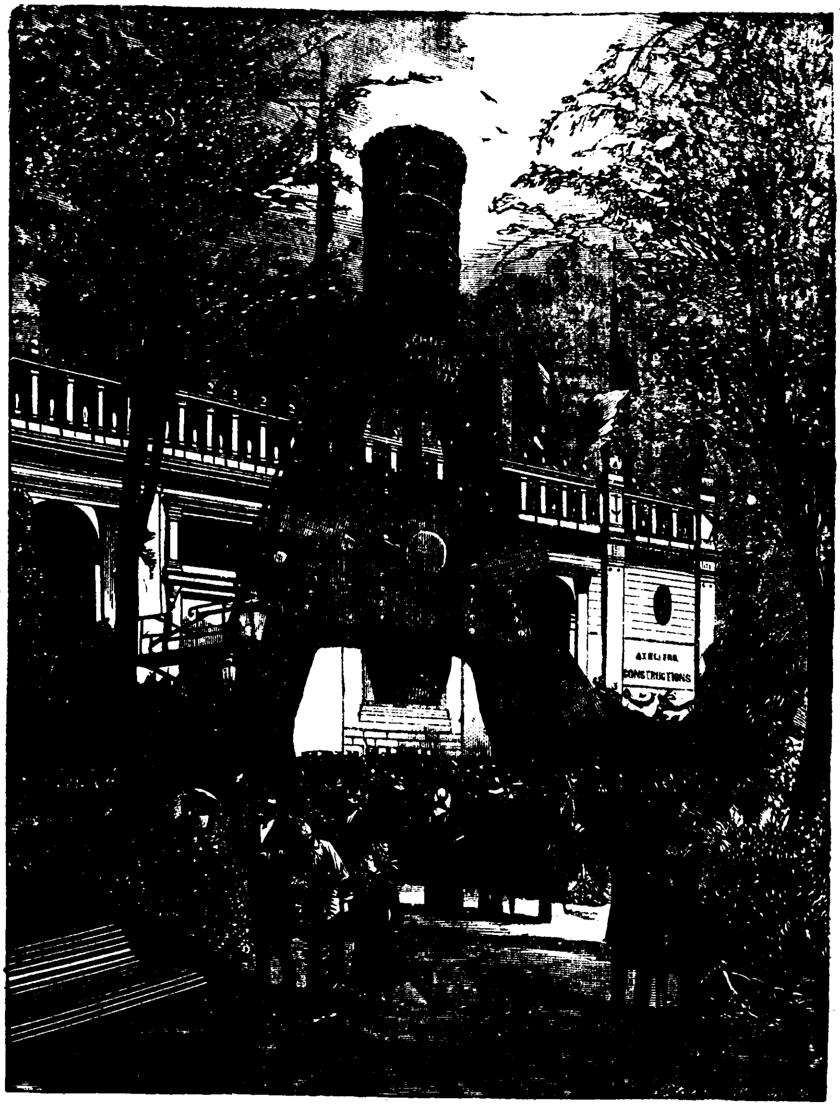
A KING'S OUTFIT.

The orders from the King of Siam for the furnishing of the new royal palace at Bangkok have created a pleasant sensation in Spitalfieds, where silk has been specially manufactured to supply the largest demand for any one order since the furnishing of the palace of the late Viceroy of Egypt. The furniture for which this London silk has been required made a pretty show in the establishment of the London manufactures who were intrusted with the execution of the order, and who show also the plan of the new palace for which the furniture has been designed.

Popular interest seems to center in the wonderful royal bedstead, quite an edifice in itself. It is fourteen feet wide and twenty feet high, and has a dome-like canopy, lined with rose-colored silk. It has the appearance of three European beds joined in one, the center part of the bed being about a foot higher than the sides. The material is walnut, elaborately carved and gilt. The chief decoration of the carver represents the triple-headed elephant, the imperial crown and the State umbrellas, which compose the royal arms. These arms are woven in, imprinted, or carved on the furniture and upholstery of all the different apartments.

For the Queen's drawing-room all the furniture is gilt even to the Erard piano; and chairs and couches are covered with rich fancy silks. For the dining room, the sideboard is of royal dimensions — eighteen feet wide and as many feet high. It is of solid mahogany, and is adorned with fine carving. There are furnishings also for the King's study and newsroom —including a writing desk, which is the envy of those who see it — for the council chamber, the audience chamber, the audience chamber, the aquarium, the smoking room and the various other apartments.

To execute this large order, several of the warerooms were for some months turned into workshops. The important business of packing took some time, and the shipment was at last made in the month of March.



THE CREUSOT EIGHTY-TON STEAM-HAMMER.—(SEE EDITORIAL.)

MACHINE RIVETING.

We select from the bulletin of the Hartford Steam Boiler Inspection and Insurance Co., the following article, which will be found to contain same pertinent comments on the merits of machine riveting.

There has been no little discussion among engineers as to the relative merits of hand and machine riveting. Those belonging to the old-school class of engineers have been slow to recognize any advantage in riveting by machinery, and in many boiler shops hand riveting is the practice to-day. Sir William Fairbairn advocated machine riveting more than twenty years ago. He says: "In hand riveting, it will be observed that the tightness of the joint and the soundness of the work depend upon the skill, and also upon the will, of the workmen, or those who undertake to form the joint and close the rivets. In machine riveting neither the will nor the hand of man has anything to do with it; the machine closes the joint and forms the rivet with an unerring precision, and in no instance can imperfect work be accomplished so long as the rivets are heated to the extent compressible by the machine. This property of unvarying soundness in the work constitutes the superiority of machine over hand riveting." Sir William says much more, and while in the main his statements are correct, there are certain important qualifications which will appear farther on. The machine which he used, and which is illustrated in one of the volumes of "Useful Information for Engineers," was driven by a belt, and far inferior to the steam and hydraulic riveting machines of to-day. Still, with this machine he accomplished some good work, as is shown by the experiments on the strength of joints riveted up with it. The steam and hydraulic machines, as first constructed, were too light to accomplish the best results; there was more or less vibration, and consequent imperfection in the joint. This difficulty has been mainly overcome by the additional strength and weight which has been given to the machines.

If, however, careful men and men of good judgment are not employed, very poor and inferior work may be done with the best machines. It is well known to those familiar with steam or hydraulic riveting machines, that there is a cup-shaped die on the end of the piston rod which presses against a fixed die. The work is brought into position for riveting by cranes. The rivet is placed in position by hand, the pressure is admitted to the cylinder and the die on the piston rod presses against the

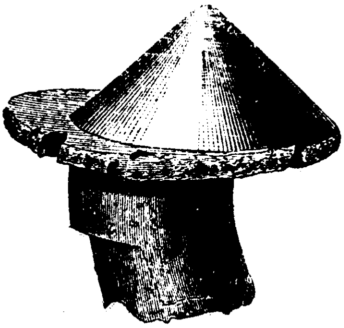


FIG. 2.

FIG. 5.

FIG. 4.

FIG. 3.

FIG. 6.

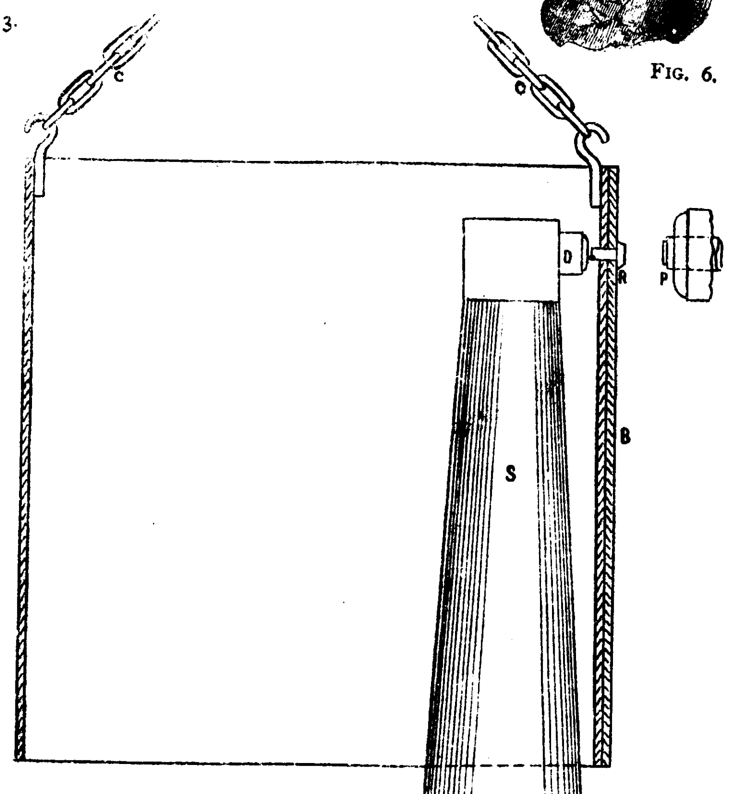


FIG. 1.

rivet head, which finds resistance against the fixed die and is pressed into shape. Fig. 1 will show the relative position of the several parts of a riveting machine ; S is the standard, on the top of which is the fixed die D ; the piston rod die is indicated at P ; the rivet R, and the section of the boiler to be riveted by B ; C C show the chains which support the section of boiler, which are attached to the crane above. Now, it will be seen that to do good work the axes of the two dies must be in exact line. If one is higher than the other, or if the piston varies to the right or left, the result will be an imperfect rivet. These errors we should not expect to find in a well made machine, under the supervision of a careful, intelligent man. But another difficulty, and one which even the best machine cannot overcome, is carelessness in the adjustment of the rivet holes in the plates to be riveted. If the axis of the rivet hole is not coincident with the axes of the dies, an imperfect rivet will be the result, and the imperfection will be increased in proportion to the variation. To make this plainer : If the man in charge is careless in adjusting his work to the machine — that is, if he elevates it too high or lowers it so that the rivet hole is a little below the dies, or if the materials swings or sways to the right or left, the result will be an imperfectly formed and weak rivet. This is a difficulty that is not confined to any one shop ; we have it in connection with the work of some of the best shops.

Fig. 2 to 6 are specimens of rivets which have been carelessly driven, and which we have selected from a collection of rivets that have been gathered up from different places.

From the foregoing it will be readily seen that this class of imperfect work is solely the result of carelessness on the part of the man in charge of the machine. When the boiler is all riveted up, it may be next to impossible to detect the true character of the work. But when leaks begin to appear and repairs become necessary, the defective workmanship becomes apparent. Boiler makers cannot be too careful in having competent workmen for such service, for in addition to the risk of impairing a well earned reputation, a very weak boiler may be unwittingly put to service.

EXTRACTION OF LEAD FROM ORE.

In the various lead-smelting districts of the world, it is strange to note the variety of methods of reduction in vogue, the various classes of furnaces employed, as well as the differences in fluxes and fuel, etc., employed in each district in the common object of separating the lead from the gangue. It is found, however, that each one of the various methods pursued and furnaces employed has usually special advantages to recommend it for adoption in that particular locality ; and that frequently a furnace or method which in one locality appears to work more satisfactorily and afford a better result than another working in a different locality, would, if transferred to the new district and worked under the altered conditions of ore, fuel and flux, prove an entire failure.

The considerations which thus determine the method of reduction to be pursued and the furnace to be employed in the smelting of the lead ore of any locality are : First, the nature and yield of the ore to be treated ; second, the character of the gangue or vein stuff ; third, the nature of the available fluxes ; fourth and most important, the nature and abundance of fuel in the district ; and fifth, the means of transportation of material.

The processes employed for the smelting of lead ores may be classed according to the type of furnace employed, as, according to Greenwood, first, the methods of smelting in England, France and Carinthia ; second, the methods in which cupola furnaces are employed, as practised in the Hartz, Silesia, etc. ; and third, the methods of reduction in open hearths, as in the ore furnace or Scotch hearth, and the American hearth. But Dr. Percy supersedes these classifications by grouping the various processes employed for the smelting of galena or other sulphur compounds of lead under three types, according to the agent employed to effect the decomposition of the ore and the separation of the lead, thus: First, "air reduction processes," in which atmospheric air, aided by heat, forms the reducing agent ; second, the "iron reduction or precipitation process," in which iron, or an oxidized compound of iron which, under the furnace conditions yields iron, is employed for the separation of lead ; third, the method of "roasting with subsequent deoxidation of the product by carbonaceous matters ;" while, fourth, for the smelting of ores of lead, such as carbonates, silicates and oxides in which the metal exists wholly in the oxidized state, it is necessary to reduce the metal either by carbon or iron, or both of these agents may be employed.—*Mining and Sci. Press.*

DEVELOPMENT OF THE PRACTICAL USES OF ELECTRICITY.

The popular existence of the electric light is due entirely to the application of steam, gas, or water power to the dynamo-electric machine. By this means electricity can be generated much more cheaply and effectively than by batteries. Before the dynamo machine existed the electric light was so expensive a scientific appliance that it could not even claim a place in the catalogue of luxuries. To whom the credit of the first complete dynamo machine is to be attributed, is doubtful, but its principle was undoubtedly embodied in one of the most important discoveries of Faraday, that of the mechanical production of electric currents. This germ idea is contained in the Gramme machine, in those of Siemens, Edison, and many other inventors. These all produce a strong electric current capable of giving a good light within about a mile radius. This current once obtained, the next step was its conversion into light. A sensation was created when, following Sir Humphrey Davy's idea, certain inventors exhibited carbon candles, into which the electric current was sent by steam power, and which that current consumed, giving forth at the same time a strong light. About this time, 1876, M. Jablochkoff applied the carbons in a way which rendered all mechanism for their regulation unnecessary. This light is now known technically as "arc" lights, from the arch of light produced, as the current leaps from the point of one carbon to that of another, and was called by Sir Humphrey Davy the voltaic arc. Of this class of lamps no less than fifteen collections are shown at the International Electric Exhibition now being held in London. These lights were impractical for domestic purposes, and the next problem to be solved was the domestic electric light. This has been accomplished by sending the electric current through a horseshoe-shaped carbon thread, formed of vegetable matter—bamboo and esparto grass—and placed within a pear-shaped glass globe, from which all air has been removed. This is called the incandescent light since it is given forth from the carbon film, when this is heated to an incandescent state by the electric current. There can be but little rivalry between the arc and this class of lights. Each has its peculiar advantages for particular purposes. The globe and the carbon film remain intact after burning from 600 to 1,000 hours, and when the film is burnt away both globe and carbon are readily replaced. Already the carbon light has won a position which ten years ago would have been regarded as fabulous. It is to be seen in all the important streets of the great cities of both hemispheres ; the largest houses are adopting it ; railway trains are lighted by it ; the piers in New York ; it is taken under ground and under water, and the boring operations of the tunnels under the English channel and the Hudson river are carried on with more than usual rapidity by its aid. At St. Etienne, in France, the Furens Falls have been utilized to supply the town with electricity.

Not less rapid has been the growth of the telephone system as a means of communication, supplementing that of the telegraph. In the larger cities of America and Europe, and, it may soon be added, in those of India and Australia, telephonic exchanges have been established. In London, the Telephone Company, during October and November, 1881, sent 19,500 messages per day, containing, it is estimated, 1,950,000 words, while the General Post Office Telegraphs carried 35,000 messages per day during the same period, containing only 700,000 words. The cost of the telegrams to the public was $8,750 ; while the charge for the telephone messages was only $405 ! This is the practical result of the telephone, and it represents an amount of time, money, and trouble saved which mere figures are unable to express.

The miscellaneous uses to which electricity can be applied are discovered to be more and more numerous. In the wide field of railway signalling it will soon have a more prominent place than ever. As a locomotive agent it has entered upon a practical stage in a number of cities in Europe. In the domain of science it measures the speed and pressure of the wind, the velocity of a shot, and regulates clocks. In that of art it reproduces engravings, records music, and under its lights photographs can be taken. In that of industry and agriculture railways may be driven by it, land ploughed, fire damp detected, and plants grown. Indeed, it would be difficult to limit the sphere in which electricity may not shortly be applied. All prognostications heretofore made regarding its failure have proved baseless. It was said in 1869 that one telegraph wire could never take more than one message at a time, but now four, five, and even six messages can be transmitted and cross one another on the same wire. In 1870 it was declared before a Select Committee that the telephone would never come into general use. At the Paris Exhibition in 1878 a French scientific man called the electric light "an exhibition craze," and in the following year another man of science said that it would never be used in dwelling houses. But it should be remembered, in extenuation, that the telegraph shared similar neglect until a murderer happened to be captured by its agency.

One great problem is now awaiting solution, and is, perhaps, already solved. An arrangement is wanted in which large and powerful quantities of electricity may be stored and transported. By the use of such cells and accumulators the present light would at once obtain a more secure position, for the current generating them could then be drawn from the accumulator instead of directly from the machine, and thus the inequalities in the production of the latter would not be conveyed to the light. Accumulators are already made by M. Faure, but these, so far, have not found extended application. When a really strong and practicable storage apparatus has been invented, the last step in the triumph of electricity will have been made. Electric-power could then be brought to us from any part of the world.—*Industrial News.*

CHRONOGRAPH FOR ENGINEERING PURPOSES.

BY W. R. ECKART, C. E.

In the chronograph illustrated, the tracers, both for recording seconds as well as the velocity curve of the engine, are made of flat strips of spring steel, the axis of each being pivoted at the end on adjustable screw centers to prevent lost motion. By means of a small steel wire and weight extending to the opposite side, the tracers can be made to bear as lightly as desirable on the paper, and when properly adjusted the pressure is only sufficient to remove the lampblack with which the paper is coated without touching the paper, thereby leaving a fine white line on the dark background with the least possible interruption of motion. The whole is permanently set by dipping the face in shellac.

Instead of using a pendulum for producing (through an electro-magnet) the marks spacing seconds on the paper, some other method that would admit of compactness and portability was found necessary, as the chronograph was to be used not only on the surface where the pumping engines were situated, but had to be adapted to underground use.

After numerous experiments, the use of a chronoscope (or timer), such as is to be had for timing horse races, was made to give satisfactory results. (See Fig. 1, front page). A stand or base plate upon which the timer was placed had a brass stanchion suspending a fine platinum wire directly over the second hand; this wire, when at rest, bore on a piece of platinum inserted in a rubber insulator projecting from the stanchion, each of these wires being connected through the electro-magnet on the chronograph to a two-cell battery. A circuit was always formed, except when the hand of the timer, revolving once every second, swings the suspended wire free from its metal bearing at the apex of the triangular notch cut in the rubber guide piece; as contact was broken every revolution of the second hand, the armature of the electro-magnet recorded the same by a side movement of the steel tracer resting on the prepared paper of the drum. The suspending wire was made adjustable to suit the second hand, and the instrument was covered with a glass case.

Mr. Briggs states in a paper read before the Franklin Institute that Prof. Hilgard used a chronoscope for the Navy Ordnance Department, in which the second marks were 30 inches apart. I have found no trouble in speeding the revolving drum of 6" diameter, until the second marks were 20 inches apart, but for practical use, a length of three to ten inches (depending somewhat on the engine speed), was all that was desired, and by use of a standard steel scale with the inch divided into hundredths, changes of motion taking place in the one one-thousandth part of a second were easily read and recorded without trouble, and the crossing of lines due to the too frequent revolution of recording drum during one stroke of the engine was avoided. The use of the small electro-magnet, on the tracer carriage, to raise for an instant the tracing pointer off of the drum at any desired point, was found necessary in determining the effects of elasticity in the interruption and variation of motion, where a *long* line of pump rods was used, and was also found useful in fixing, positively, the exact point of closing or opening of the steam valves of the engine independent of all reference to the indicator cards taken.

Two drawings giving different views of the chronograph as constructed and used, are attached to this article, exhibiting details of construction to complete what otherwise might be considered a defective description of the instrument.

The instrument has been succesfully applied to several of the different types of large pumping engines found on the Comstock Lode, such as direct-acting flywheel engines, geared pumping engines, and the "Davy engines;" it has also been used to determine the motion and relative motion of pump rods, and pumps some 2,500 feet below the surface engine driving same, and at intermediate points. The results are exceedingly interesting and instructive, and as numerous indicator cards were taken from the engines and pumps simultaneously with the motion diagrams, nearly all conditions of motion and power, during the time under consideration, were definitely determined, and may hereafter form the subject of other papers when time will permit.

Some very important results of the elasticity of long pump rods are clearly set forth in one case: A rod at a point 1,800 feet below the surface showed a positive pause, while the engine driving it was nearly at its point of maximum motion, and pumps attached to the rods may have and do have strokes in excess of or deficient to the *stroke of engine driving same,* and to an *important extent.* Hence, I think, it can be definitely stated that any consideration of motion of pumps, or discharge capacity of same, driven by a long line of pump rods based upon the motion or stroke of a surface engine alone, will in no way be even approximate, unless the elasticity and effects of counter-balancing by balance bobs on that elasticity is also considered.

The effects of different degrees of compression upon the engines and motion of the pump rods in passing the centers have been considered, and the diagrams clearly show the importance of considering it in connection with the strength of the rods and balance bobs.

The latest use of the instrument in conjunction with an engine test has been to determine, if possible, the rate of condensation of steam per second, in the steam cylinders of a pumping engine, where the change of motion due to each fractional part of the stroke was determined. Also, a ten hour experiment trial, to show the economy of compression as compared with a ten hour trial of the same engine on the succeeding day where no compression was used (otherwise all conditions being similar), has been made, when changes of velocity of piston were determined by the chronograph.

While it is well known that a Committee of the British Association applied a chronograph of Morin's type in 1843-4, to the determination of the velocity of piston for a Cornish Pump Engine, I believe there was no application of the instrument to the rods below ground, and, from published records at my command, I am led to believe that this is the first application of a chronograph of sensitive construction ever made to pit work, and the other purposes so briefly mentioned.—*Scientific American.*

MAGNETIC PREPARATIONS OF STEEL AND IRON.

Many investigations upon the relation between the molecular conditions of iron and steel produced by heat, by torsion, and by annealing processes, and the resulting changes in magnetic conditions, have been made. It appears from the paper of Louis M. Cheesman that the effect of mechanical hardening has not been properly investigated, and this paper contains the results of his investigation upon this point. The method of research consisted simply in determining the magnetic moment of the magnetic bar after it had been subjected to well devised mechanical pressures. The result of his investigations is summed up as follows: Iron in a mechanically hard condition can receive more permanent magnetism than in a soft condition. The magnetic moment of a steel magnet in a mechanically hard condition is greater or smaller then in a soft condition, according as the ratio of its diameter to its length is less or greater than a certain limit.—*Ann. der Physik und Chemie.*

Sharp castings are obtained from cast iron holding too much phosphorus to be good for puddling or for castings requiring strength. Such metal is very good for ornaments having no strains to bear.

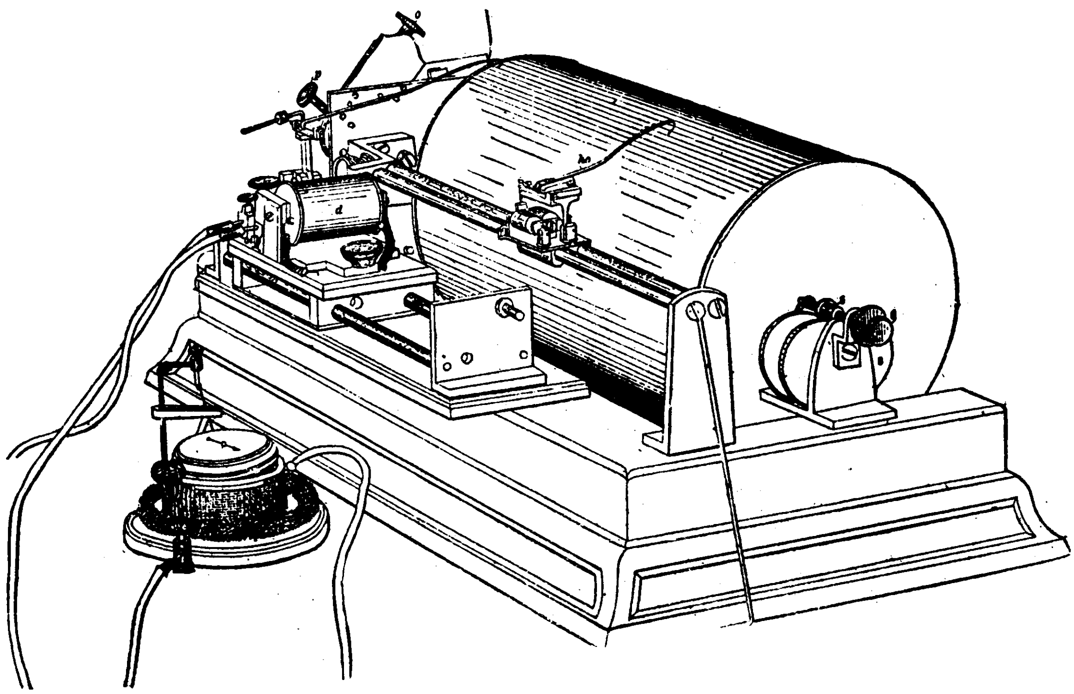


FIG. 2.—CHRONOGRAPH FOR ENGINEERING PURPOSES.

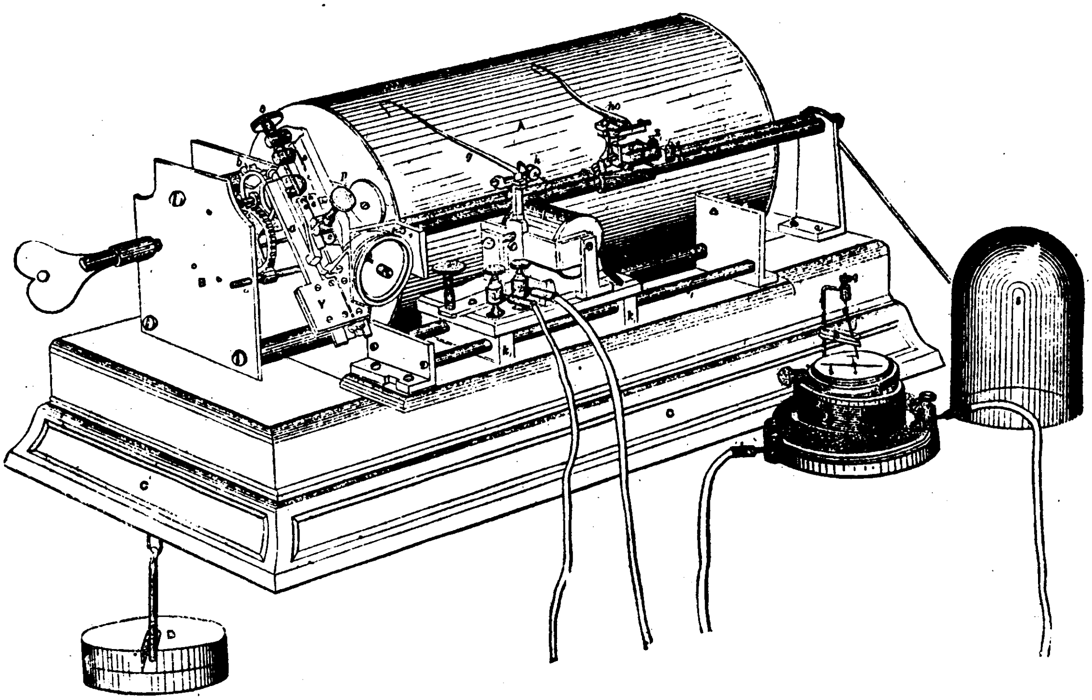


FIG. 1.—CHRONOGRAPH FOR ENGINEERING PURPOSES.

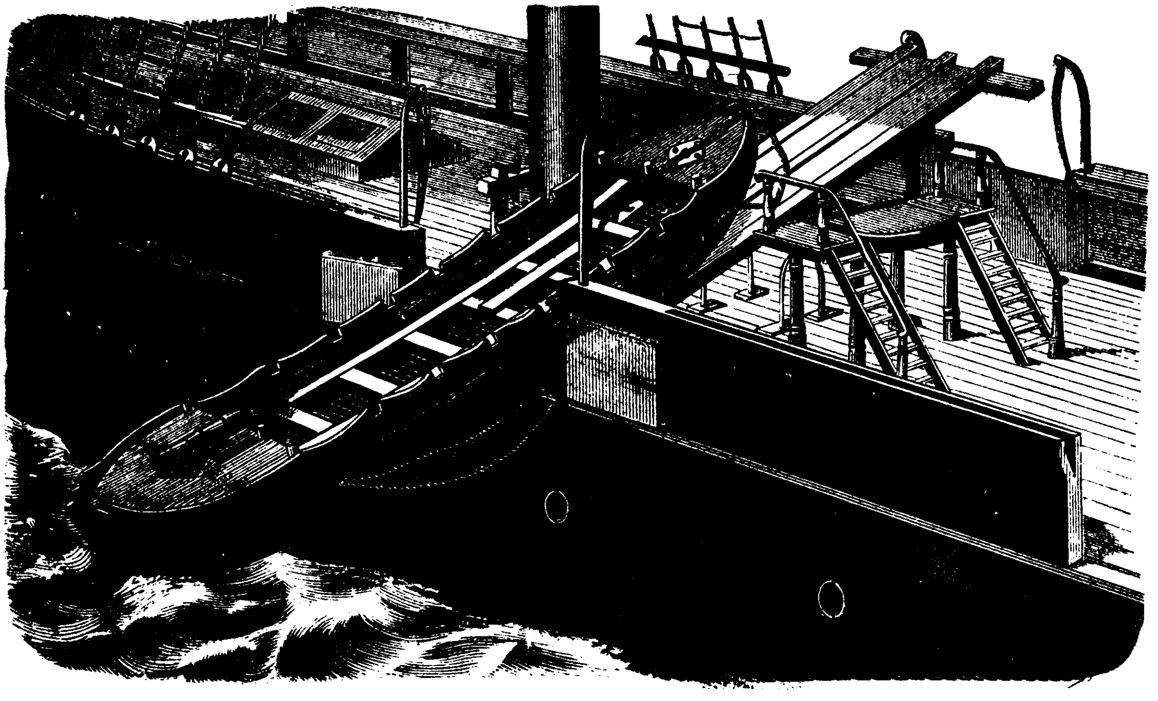


FIG. 1.—WHITE'S BRIDGE LIFE BOAT.

LIFE-SAVING APPARATUS AT THE RECENT NAVAL AND SUBMARINE EXHIBITION.

We give engravings (for which we are indebted to the *Engineer*,) of a variety of life-saving apparatus, shown at the recent Naval and Submarine Exhibition, London, England.

Fig. 1 shows a "bridge life-boat," by John White, Medina, Dock, Cowes. This life boat is held on the bridge athwart ship, which consists of a launching way pivoting horizontally at the centre so that either end can be tipped down to the gunwale on either side, when the dog shores being struck, the life-boat shoots into the water. Any water shipped is discharged through valves, and the boat is easily launched. The Orontes has long been fitted with this boat bridge which has been so highly approved of that the system has been now adopted for the Tamar and Himalaya. This boat carries from 150 to 200 men. Filled with water she would support 100.

Fig. 2 is Roper's life raft, forming a captain's bridge. Its weight is given as 5¼ tons, floating power 80 tons. It is intended to be self-launching on its fastenings being released. Mr. Roper has also self-floating raft decks for river boats. These simply rest by their weight in their place. If a vessel settled down in smooth water they are designed to float of with the passengers. A model of the ill-fated Princess Alice is fitted with decks which are calculated to support 900 passengers. The decks proposed are fore and main and fore and aft saloon decks, and sponson house tops. The design took a first prize at the aquarium. Fig. 2 and 3 show the raft on deck and afloat. This raft took the 100 guinea prize at Islington.

Rose's life-buoy seat, shown in fig. 3, consists of two thin iron buckets screwed together at the bottom, with tops closed. They may be used as buckets, or a buoy, or to render a hencoop seat buoyant—*vide* Figs, 4, 5, and 6. The cushions of the hencoop seats are life belts. A specimen made for Sir T Brassey's yacht, the Sunbeam, was shown.

Copeman, of Downham Market, exhibited a raft constructed of seats by means of connecting rods, spars, and grating seats. This was put together by two men in less than two minutes repeatedly at the exhibition (see Fig. 7). It is a very serviceable, strong, and simple arrangement. The inventor claims that the expense is small—about $25 extra on each seat; that the space occupied is no more than that of ordinary seats; that it is always ready for use, and when in the water cannot be upset. Masts and oars are carried. The strength and simplicity of this will probably commend it. It is to be tried shortly for the Prince of Wales.

The wreck escape, shown in figs. 8, 9, and 10, is the work of Mr. Hodgson, another practical man eminently qualified to judge as to what may be done in a moment of danger, having earned eight or nine medals for saving life himself, and also so ready to point out anything good in designs of others, that one must respect the honesty of his opinions. Two wreck escapes, one of wood tubes and cells, the other steel, weight 7 to 17 cwt., supporting twenty to seventy five men; rope bottom reversible; may be used as an ordinary boat, the resistance being brought down to much less than is usual in bottomless boats. It is stated that it has been actually tried and obtained good speed. The form appears to be a very good one for a bottomless boat. It was tried with success before Admiral Mends in 1869. It is, we believe, the first and also the best reversible boat. It is possible for a man under it to pull the ropes asunder and creep through the bottom.

(*For balance of Cuts, see page 172.*)

Educational.

EGYPTIAN ANTIQUITIES.

The year 1881 has added considerably to our knowledge of Egyptian antiquity, partly owing to the discovery of inscriptions in the pyramids, and partly owing to the finding of many antiquities of the time of the Theban dynasty in Upper Egypt. Although the value of the inscriptions above-mentioned was at first overrated, and that of the antiquities considerably diminished by the chaotic condition in which they were found, they yet yield a rich field for the further development of Egyptological science. It is extremely interesting, therefore, to listen to what one of the most celebrated Egyptologists says about the value and kind of those antiquities, and the hopes for science which are derived therefrom. Dr. Brugsch-Pascha recently gave a lecture on this subject in Vienna, and we believe we shall benefit our readers and all friends of science by reporting the most important parts of Dr. Brugsch's address. Through all antiquity there can be traced a spirit of reverence towards the dead. This trait is seen not only in the more civilized, but in all ancient peoples. It is proved by their manner of burial, for their tombs were constructed to endure for ages, and within them was laid everything that had become dear to the departed during their lifetime. From such sepulchres and their contents we draw conclusions very important to the knowledge of the history and culture of ancient nations, and it may be rightly said, "When men are silent, stones will speak." Among the nations whose ruined tombs provide us with such a rich fund of antiquities the ancient Egyptians rank first. The laws of their religion were: First, to praise and thank the gods; second, to love all mankind: and third, to honour the dead. Their dead, therefore, were buried with great solemnity and ceremony. Most of the ancient tombs are ruined, but even the ruins tell their own tale. The Egyptians laid little value on their dwelling-houses considering them to be merely temporary resting places—ante-rooms to the long period after death—and spent very little trouble on their arrangement or construction. All travellers in Egypt will have been struck by the entire absence of human dwellings, contrasted with the number of ruins of tombs and temples. There is nowhere to be found the ruins of a regal palace. Here and there are seen monumental remains of large brick edifices, but nothing betrays by whom they were inhabited. The tombs, on the contrary, are built of lasting materials, and the interiors richly decorated. On enquiring into the condition of the people it is necessary to fix on great periods. We distinguish two of these periods; the first and most ancient is the Memphis period, until about 250 B.C., the second and youngest was the Theban dynasty. The first of these periods is characterized by the building of the pyramids, which stretch for miles along the edge of the desert. The ancients were aware that the more ancient pyramids were the graves of Egyptian kings. The size and height of the different pyramids vary greatly. The discoveries of the past year have for the first time shown, beyond all doubt, the disposition and construction of the interior of these immense masses of stone. The first of these discoveries was that of the pyramid of King Cheops. The centre of this and all other pyramids consists in a sepulchre hewn in a gigantic granite monolith, with a roof of the same material, upon which rests the whole weight of the pyramid. On the north side a slanting passage leads into the tomb; this passage is divided by two or three falling blocks—the first of which closes the opening on the exterior of the pyramid—into so many chambers. When first built a pyramid was not higher than from 80 to 100 ft.; but if the king for whom it was built lived long, he caused other stone coatings to be built over it. There have been found in some cases five repetitions of such a casing, and the length of a king's reign can be deduced from their number. The local sequence of the pyramids from north to south corresponds with the sequence of the dynasties; a proof of the civilization of all Egypt, which progressed also from north to south. About 1830 to 1840 great interest was taken in the pyramids but as the inscriptions in the interiors were not then discovered scientific research remained without any great result, a few stones with the names of kings being all that was found. Dr. Brugsch has counted four or five. But a step has been made by last year's discoveries. In February some arabs who had sunk a kind of shaft into a ruin from above, found all the inside walls covered with inscriptions. But the hope raised of discoveries of historic value was not realized. Here, too, nothing was found but the names and titles of several kings, and some copies of the course of life of the soul, which, in ancient Egyptian conception, wanders like the sun, from east to west. Still, the inscriptions were of value, for they taught us the most ancient language in the world, as it was spoken 3,300 years ago. Brugsch, when he visited the spot, found that the pyramid had already been robbed. The corpse of King Cheops was gone. Brugsch only found one hand, and a great quantity of linen, so fine that the Arabs burst out into the exclamation, "Silk!" In another pyramid examined by Brugsch he found the body of the king therein buried lying on the earth, but perfectly preserved. It was that of a young black-haired man, apparently about 26 to 30 years of age. It is yet hoped that some pyramid may be found, the contents of which have not been disturbed, and one which seems untouched is now being opened. The operation will take same time, and a year may elapse before it is accomplished, for the immense number of stones which a pyramid contains is incredible. If the pyramid of Cheops were coated with lead, that lead would be sufficient to entirely cover the tower of St. Stephen, in Vienna, and if the stones of the pyramid were placed side by side, they would be sufficient to surround the whole of France. The lower classes of Egyptians were not entombed in pyramids. For them vertical shafts were dug in the rocks, with a second shaft at right angles, at the head of which the dead were deposited. The vertical shaft was then filled with sand, and a hall for prayer built above it. When the Memphis dynasty, from what cause we know not, was at an end, that of Thebes arose. Then the building of pyramids ceased, for the very nature of the mountainous country, with its narrow valleys forbade such a proceeding. The tombs were now made in the rocks of the mountains, into the bosom of which deep shafts were dug. An interesting discovery has been made of a well preserved roll of papyrus, containing a finished plan of a rock tomb by the hand of the architect. The shafts leading into the Royal tomb are slanting, and each of them is always divided into four successive corridors. Then comes a fifth chamber, the so-called "waiting room"; then a sixth, and chief room, the "golden hall," in the centre of which stands the sarcophagus; and behind this the seventh and eighth rooms — the "statue-hall" and "treasure-chamber." In the golden hall was placed everything that had belonged and was dear to the king; his arms, his whip, and his eating and drinking vessels, &c. The statue-hall contained a number of statues of Osiris, with the head of the king. There still exist twenty-five such tombs. But everything they contained has long since been removed, not only by the Romans and Arabs, but also by the Egyptian themselves—either robbed or removed by order of the Egyptian Government. There have been robbers in all times, also among the Egyptians. A document exists relating to the most ancient theft of which we have any knowledge, in the year 1100 B.C. This document is in Vienna. It contains the process against the thieves, the conduct of the case before the justices, and the Royal verdict. After the Egyptian came the foreign thieves; who they were we do not know. When Strabo went to Egypt, a century after Christ, he visited forty open tombs on the walls of which he found, not Egyptian but Greek inscriptions; then, as now, travellers used to immortalize themselves by writings on walls. Now only twenty-five of these Royal tombs are known to exist, so the rest must have been completely ruined and erased.

The emptying of the Royal tombs by order of the ancient Egyptian Government has been found out as follows: About six or seven years ago some travellers, among whom was Dr. Brugsch, saw in Thebes some remarkable Egyptian antiquities, small statuettes, which had evidently been brought from Royal tombs. They belonged to the twenty-first priest dynasty. In spite of the deep interest Dr. Brugsch took in the matter, he was unable to make further researches, for he was accompanying a high personage. Last July the origin of these antiquities was ascertained. Two Arab brothers quarrelled, and their dispute revealed the fact that in a certain ravine, which was not a Royal tomb, there was hidden a mass of mummies with everything belonging to them. One of the brothers, being promised immunity, offered to show the way to the ravine. It was a deep chasm in the rocks, ending in a cavern full of coffins, mummies, and the objects generally found in tombs. There were so many that they filled a large Nile steamer to such an extent as scarcely to leave room for the crew. On examination it was found that the brothers had not themselves heaped up these antiquities, but that the Royal tombs had been emptied by order of the Egyptian Government about 1000 B. C., in Salomo's time, and their contents taken to the cavern in question, no doubt, with the intention of preserving them from robbery and profanation by an approaching army (Assyrians?) An examination of the objects found has been commenced. There are thirty-nine mummies, among which are nine kings, seven queens, six princes, and four princesses. Among the first is a king who reigned in the year 1000 B.C., and who was a great conqueror in the style of Alexander the Great. But his mummy is scarcely more than 3 ft. 3 in. long, therefore this great hero must have been of exceedingly small physical dimensions. The objects found near the mummies are so numerous that it will take years to examine them thoroughly. If the Arabs had left what they found in the order in which they had been laid, everything could have been historically fixed and arranged. But Arabs are restless, curious, and disorderly, and the antiquities have been thrown about in indescribable confusion. It is known that one of the mummies must be that of Rhamses II., but it is not certain. Amongst the remains are traces of indications of the wandering of the soul from east to west. Copies of many objects are also met with, for it was the custom to lay beside the mummies, even of the lower order, the favourite objects they had used during their lifetime; but it seems that their survivors did not always like to part with such useful and beautiful objects, and so substituted for them copies in miniature. The ancient Egyptians, who are usually represented as a grave and gloomy people, were, on the contrary, exceedingly cheerful and fond of enjoyment. Dr. Brugsch found proof of this view in the conclusion of an inscription on the tomb of an Egyptian woman who died in the year 25 B.C., in which the deceased is represented as saying, "Oh, my brothers, my spouse, my friends! drink, love, and be joyful, for the dead are dead, and for them there is no return nor union with the living."

WALL DECORATION.

A writer in the *Chronique des Arts*, after referring to the wonderful work in glass which has been done on the island of Murano, says:

"This art could not escape the decadence, and about the end of the last century its vaunted products had lost their high renown. It remained for our century to bring fourth one who, by his studies, researches, observations, and marvellous work, has recovered the art and surpassed all his competitors. Though the Murano Company has produced some very beautiful things, the work of Dr. Antonio Salviati has proved that nothing is impossible for it. At the Milan Exposition we admired some objects which are unique of their kind. There were some vases of extraordinary grandeur, some cups with flowers in relief, daisies and roses of incontestable naturalness, one might imagine that the artist's caprice had sprinkled these objects with freshly gathered flowers.

"Salviati has also recovered the secret of the myrrhine glass, which was so precious to the ancient Romans, and of the 'Christian' glass, with its golden decorations placed between two layers of glass. He exhibited a large glass plate of fifty-eight centimeters diameter, upon which was a painting in enamel representing a Venetian regatta, copied from a picture by Canaletto.

"Another admirable plate was of smoky 'Christian' glass. Its diameter was fifty-four centimeters, and it represented Christ surrounded by the Twelve Apostles. Not less beautiful were the myrrhine plates, sprinkled with lilies of the valley of charming grace. . . . .

"In 1859, Salviati first took up mosaics in enamel, which was suggested to him by seeing the forlorn and dilapidated state of the ancient mosaics in the Basilica of St. Mark at Venice. . . . I have visited his factory, and was astonished at the order and precision which reigns there. After passing through the rooms where the materials are deposited after they come from the furnace, and where they are cut into fragments, and finally into little blocks, with surprising exactness, one reaches the room where the mosaics are put together. At the further end is the picture to be reproduced, and a half score of artists are seated at little tables each with his design, a part of that to be copied, before him. It is incredible how they can make the shades to reproduce the color of the flesh.

"According to the ancient method and that now in use at Rome, the wall to be decorated is covered with a layer of cement, and the little blocks of enamel are forced into it. This takes infinite time unless two or three workmen can work at once; but according to Salviati's method of constructing the mosaic upside down and stuck upon paper, the work is easier and more divisible. He is also able to send his mosaics, entirely finished, to the most distant countries and to put them in place without difficulty. Stuck upon paper, the bits of mosaic are pressed upon the wall, which has been covered with fresh cement; and the paper is then torn off. It makes no difference whether the wall be vaulted, horizontal, or vertical."

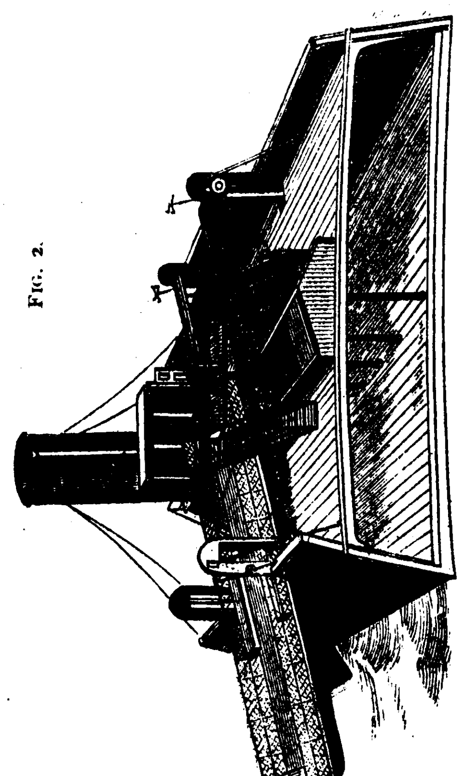
EMBOSSING AND GILDING ON GLASS.

There are two ways of embossing glass: by means of hydrofluoric acid and by the sand-blast. The second method being rather beyond the power of amateurs, I shall not describe it here. In the hydrofluoric acid process, the glass is first coated with some protecting substance, and upon this the design is drawn with a sharp instrument, so as to expose the glass below. The acid is then applied, when the exposed portion of the glass becomes corroded. The wax can be afterwards removed. In practice, the glass should be warmed and coated with molten bees-wax (not parafin, which is too brittle). Superfluous wax should be drained off, so as to leave as thin a coating as possible. Or a composition may be used, formed by melting together two parts of beeswax, two of asphalte, one of black pitch, and one of Burgundy pitch, and heating them together until a drop placed upon a cool surface gets hard and tough. Whatever the protecting substance used, it should be permitted to set, and the design should then be traced with some pointed instrument, care being taken to cut right down to the glass. If the design is complicated, it will be found better to trace it first on paper, and then to go over the lines with a pricker. The paper can then be placed upon the wax, and some dark-colored powder dusted over the holes. On removing the paper, the outline of the design will be found marked on the surface of the wax. It will then be easy to cut away the wax at the desired places. A shallow tray of guttapercha or of sheet-lead must then be taken, and into it be placed about half an inch of the dilute hydrofluoric acid of commerce. The glass must then be placed wax-side down over the tray, and left exposed to the vapor of the acid for some time. On removing it, washing with water, and cleaning off the wax, the design will be found etched in opaque lines upon a bright ground. If required bright upon an opaque ground, the waxed glass, instead of being exposed to the vapor of the acid, should be dipped into the acid itself. After the removal of the wax, the surface of the glass should be ground with very fine emery.

Another way is to draw the design on the glass with a pencil and Brunswick black, using as a guide of sketch on paper placed beneath the glass. On exposure to the acid vapor, the whole background will be rendered opaque. The Brunswick black can be cleaned off with turpentine, leaving the design in clear glass. Instead of Brunswick black an ink may be used, made by dissolving asphalte in turpentine, and thickening with beeswax and resin. Where it is desired to produce an artistic effect by the introduction of shading, recourse may be had to Gruene's patent process, wherein the wax or Brunswick black is replaced by substances not altogether impervious to the action of the acid. The design is drawn with oil-varnishes, greasy printing ink, or some such substances (using a good protector for the high lights, a bad protector for the deep shades, and so on), and is then dusted over with finely powdered metal, copal, &c. When dry, the glass is dipped into hydrofluoric acid and allowed to remain in for a few seconds, and is afterwards washed. If care is taken in the selection of the protecting materials, it is possible for an artistic workman to obtain very striking results.

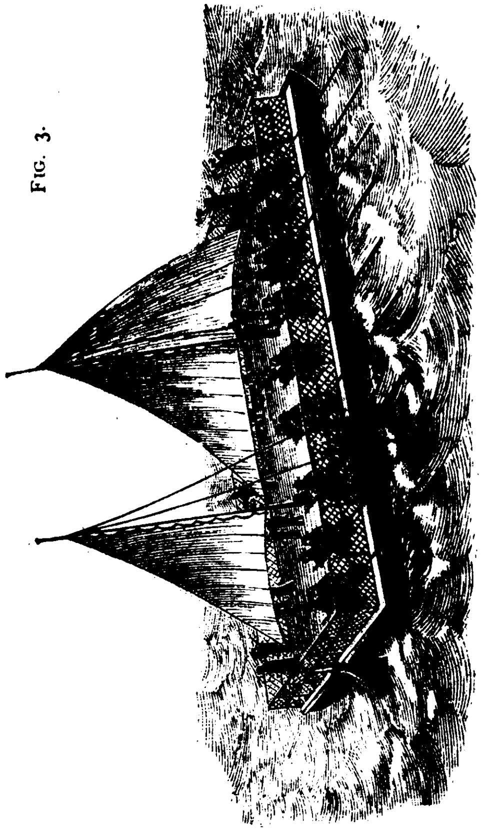
GILDING.—Gilding may be done either with bronze powder or with gold leaf. If the powder is to be used, the design should be traced on the wrong side of the glass with Japan gold-size thinly laid on, which is afterwards dusted over with bronze powder. When dry, a coat of varnish is laid on. In tracing the design, it must not be forgotten that the wrong side of the glass is being worked at, and that when viewed from the front everything will appear twisted round—the right being to the left, and the left to the right. To gild with leaf the glass must be carefully cleaned and laid upon the design. Then a solution of isinglass is put on by aid of a flat camel hair brush. While still wet, gold leaf is laid on with a gilder's tip (for the sake of economy adhering to the design as nearly as possible). When quite dry, the design, the outline of which has been pricked out as before described, is taken and placed upon the gold. Dark colored powder is then sprinkled on as before. The paper is next removed and the outline carefully

Fig. 2.



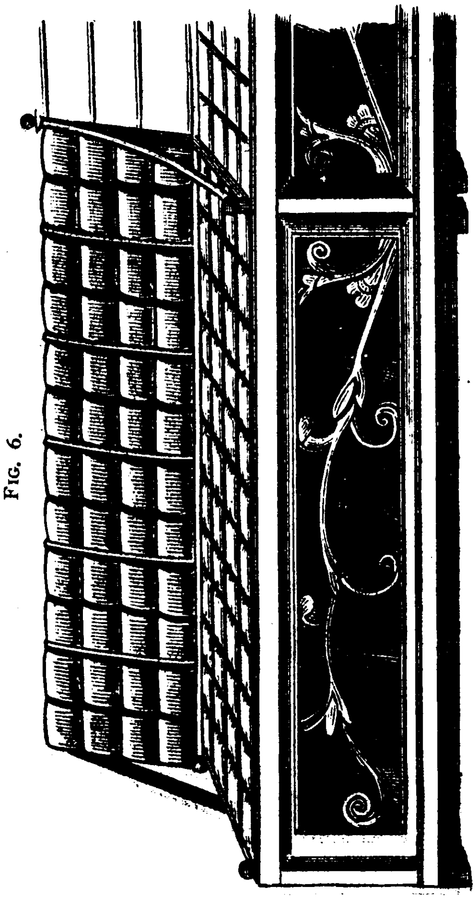
ROPER'S LIFE RAFT.

Fig. 3.

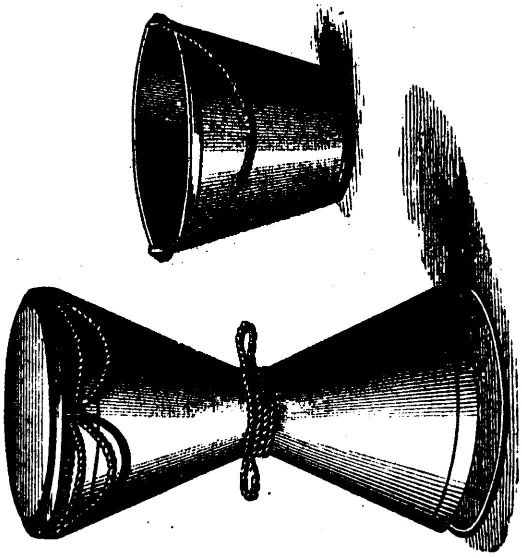


ROSE'S LIFE BUOY SEAT.

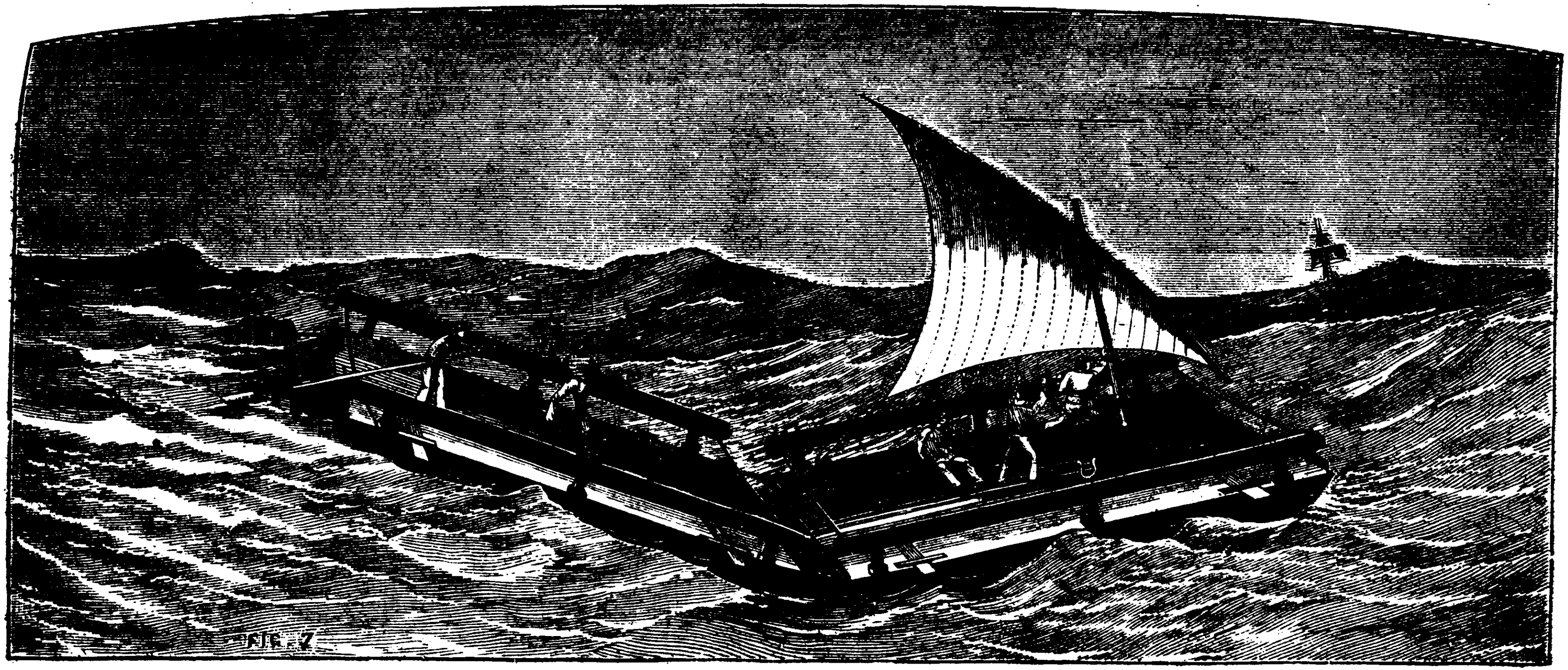
Fig. 6.



ROSE'S LIFE SEAT.



Figs. 4 and 5.—ROSE'S LIFE BUOYS.



COPEMAN'S SEAT RAFT.

LIFE-SAVING APPLIANCES AT THE NAVAL AND SUBMARINE EXHIBITION, LONDON.

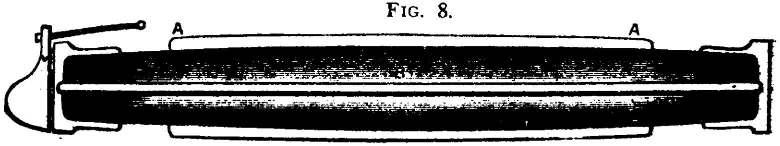


FIG. 8.

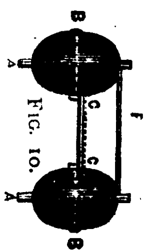


FIG. 10.

HODGSON'S WRECK ESCAPE.

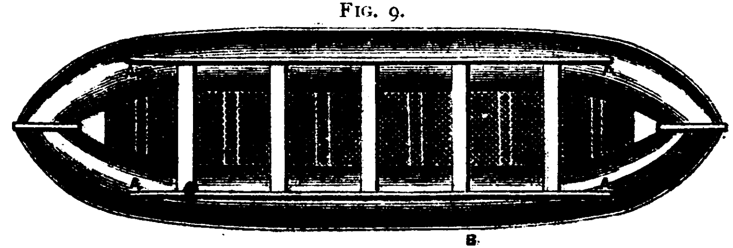


FIG. 9.

gone over with Brunswick black. The superfluous gold is cleaned off by the aid of a sharp, narrow chisel. The size is made by dissolving ¼ oz. of isinglass in a sufficiency of water, adding a quarter of a pint of rectified spirits, and making up to half a pint with water.

NOTE.—If hydrofluoric acid is dropped upon the fingers it is desirable to wash it off without unnecessary delay; but let no one be deterred from using the acid by the dreadful things the textbooks say of it. They don't apply to the diluted acid sold at the shops.

Scientific Items.

A simple process of nickel plating by boiling has been described by Dr. Kaiser. A bath of pure granulated tin tartar and water is prepared, and after being heated to the boiling point, has added to it a small quantity of pure red hot nickel oxide. A portion of the nickel will soon dissolve and give a green color to the liquid over the grains of tin. Articles of copper or brass plunged into this bath acquire in a few minutes a bright metallic coating of almost pure nickel. If a little carbonate or tartrate of cobalt is added to the bath a bluish shade, either light or dark, may be given to the coating, which becomes very brilliant when it is properly polished with chalk or dry sawdust.

A SOLUTION FOR SILVER PLATING.—The following is a good bath: Soft water, 1 gallon; cyanide of potassium, 8 ounces. Dissolve the silver nitrate in a small quantity of soft water, gradually add, with constant stirring, solution of cyanide of potassium until no further precipitate of silver cyanide forms (avoiding any excess of the precipitant). Throw the precipitate on a fine cotton cloth filter, and as the liquid runs through, wash the precipitate on the cloth with pure water. Mix and dissolve this waste precipitate with water in which has previously been dissolved the cyanide of potassium. If the silver cyanide does not dissolve readily add more cyanide until it does.

BRONZING FOR BRASS.—The articles, which must be free from grease and polished, are first immersed for ½ minute in a cold solution of 10 gm. of potassium permanganate, 50 gm. of sulphate of iron (ferrous), and 5 gm. of hydrochloric acid in 1 liter of water. They are then washed off and dried in fine, soft sawdust. If the color has become too dark, or if a more reddish-brown color is required, the objects are immersed, immediately after they have been taken out of the liquid, for about 1 minute into a warm (60° C=140° F.) solution of 10 gm. chromic acid 10 gm. chloric acid, 10 gm. potassium permanganate and 50 gm. sulphate of iron in 1 liter of water, and treated as above. By using the second liquid alone, a brighter dark-yellow, or red-brown color is produced.

THE following is recommended as a cement for stoves and steam apparatus: Two parts of ordinary well-dried powdered loam and one part of borax are kneaded with the requisite quantity of water to a smooth dough, which must be at once applied to the joints. After exposure to heat this cement adheres even to smooth surfaces so firmly that it can only be removed with a chisel. Another cement for steam pipes is prepared, by mixing 430 parts in weight of white lead, 520 of powdered slate, 5 of chopped hemp and 45 of linseed oil. The two powders and the hemp cut into lengths of ¼ to 5-16 of an inch are mixed, and the linseed oil gradually added, and the mass kneaded till it has assumed a uniform consistency. This cement is said to keep better than ordinary red-lead cement.

PREVENTING FOREST FIRES.—The idea that the best way to prevent forest fires is to burn all trash and small undergrowth annually, seems to gain popularity. One who is well posted in forestry matters says: "If the undergrowth is kept down and dead matter not allowed to accumulate, there will be no fire to hurt the live trees. We know a piece of woods that is burned under every year by sparks from the Reading railroad locomotives, but the standing timber has never been injured. It will not cost a thousandth part as much to clear out all the brushwood in the United States as we lose in one year by the forest fires, and the true way to preserve our forests must start from just here. At any rate, this idea removes the great objection to forest planting—that it may get burned. If rank vegetation is kept down for a few years during the growth of the forest, it will, by its own shade, keep down the growth thereafter."

Astronomy and Geology.

THE TOTAL SOLAR ECLIPSE.

The solar eclipse of the 17th of May was successfully observed by English, French, and Italian parties at Soham, a village in Lower Egypt, on the Nile. The duration of totality at that point was only seventy-two seconds, but the observers did prompt and efficient work in this short space of time. The telegraph swiftly bore the record of their labors to our Western World, and the first fruits include the view of a comet near the sun, indications of a lunar atmosphere, and a photograph of the spectrum of the corona.

The precious seconds when the sun's face was hidden by the moon's dark shadow revealed in the first place a comet near the sun. It could not be Comet a or Comet Wells, for this much talked of visitor to northern skies does not reach perihelion until the 10th of June, and has, therefore, three weeks' time in which to speed its course to the near neighborhood of the great luminary. It will be comforting to those who have borrowed trouble from its close approach to the solar fires to know that another comet, eluding the grasp of terrestrial observers, is safely circling around the magnet of the system without let or hinderance. It has not thus far fallen into the sun to add fuel to his flames and bring destruction to the earth. It will doubtless keep on its harmless course and pass with quickened step beyond solar bounds to star-depths unfathomable, as myriad other comets have done before and will do again, for observation confirms the theory that space is full of comets, meteors, and intangible forms of matter. A small portion of the mighty army becomes visible in the form of comets and meteors, but the invisible denizens of space far exceed those that are visible. For every comet that spans the sky with its gossamer tail millions pass over our heads unseen. For every meteor that falls upon our world millions of millions fall upon other worlds, while vain would be the effort to form any idea of the infinite numbers of those that fall upon our sun, or the countless suns of space. The comet seen near the darkened sun has been photographed, and the picture of the daring intruder in solar domains will form a study of attractive interest.

The second item coming from the eclipse observers is more astounding than the first, for the darkening of the lines of the spectrum, as seen by the French astronomers, gives indication of a lunar atmosphere. If this observation is substantiated there will be a revolution in existing ideas concerning lunar physics. Our nearest celestial neighbor, the moon, at least the side turned toward the earth, has for a long time been considered the abode of desolation, her purpose in the material economy accomplished, a dead world, a symbol of the fate in reserve for the earth in the slow revolution of ages. Years ago an observer detected a rosy cloud floating over the lunar crater Linnæus, but the phenomenon was looked upon by more staid astronomers as a flight of fancy. A few years ago an observer in one of the Western States detected a change of form and an appearance of volcanic action around one of the moon craters, but the scientific world in general considered it an optical illusion. It may be that these observers were not so far out of the way, though the startling discovery will not be accepted without strong proof to verify it. Those who are best acquainted with the moon as seen in the telescope will be slow to believe in the slightest manifestation of life on her chaotic surface.

One more meager item closes the first bulletin from the eclipse expeditions. It is that the spectrum of the corona was photographed for the first time. We may, therefore, hope for increased knowledge of the constitution of the sun's magnificent appendage, seen only in a total eclipse, so grandly beautiful as to make the beholder feel like veiling his eyes in the celestial presence. The corona, with its silvery light, its spreading wings, its circles, arches, and curves stretching out into fathomless depths around the darkened sun, is considered as one of the most impressive and awe-inspiring sights in which celestial majesty and grandeur are ever embodied. Its constituents and office in solar economy are problems whose solution is much desired.

The English eclipse expedition observing at Soham, with Professor Lockyer as the chief director, laid out an organized plan of operations. Some of their points of observation were to note if the abundance and activity of the rosy protuberances gave proof of the present disturbed condition of the sun while passing through its maximum period of sun spots; to compare and detect the difference in the spectra of rosy flames and sun spots; to get an idea of the physics of the solar atmosphere — that is, to find what it looks like, to study — if the expression may be used — its circulatory system; and to determine its chemical nature, especially if the chemical elements existing in the sun are dissociated or separated by the intense temperature existing there. Special attention is now directed to solar physics and chemistry, in consequence of the bold and ingenious theory of Dr. Siemens on the conservation of solar energy.

Photography was greatly relied upon in the solution of these intricate problems, and so much have methods improved in the rapidity with which the image can be impressed on the sensitized plate that seconds will now record more than minutes did twenty years ago. The telescope and the spectroscope combined with the photograph in the attack on the sun's surroundings during the eclipse.

There is every reason to hope for noteworthy results to be obtained from the recent solar eclipse with the best astronomical instruments the world can furnish, and with astronomers of world-wide renown to use them effectually under the cloudless sky and in the serene atmosphere of the station on the Nile. We have still to hear from other stations on the thin line of totality, and to wait for fuller details and photographs that will tell more of the good news.

Professor Lockyer and his assistants spent three months in hard work to prepare for seventy-two seconds of observation. They traveled thousands of miles and transported thirty cases of instruments to aid them in the work. If their time, talent, and labor have succeeded in drawing a single secret from the sun, or helped to confirm a single theory, the reward is all they ask; they have not labored in vain. For this heaping up of observation upon observation is the work of the present generation of astronomers, the only means of wresting knowledge from our sun, our brother planets, and the suns that people space.—*Sci. American.*

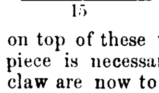
A SIMPLE WAY TO CONVERT A PILLAR AND CLAY STAND TO AN EQUATORIAL.

BY F. G. BLINN.

Almost every one who is the possessor of an astronomical telescope mounted on a pillar and claw stand has remarked the difficulty experienced of keeping in the field of view any of the heavenly bodies, and, if the observation be interrupted for a short time, of finding them again. This is especially noticeable if using a high power eye piece and not having a finder.

The contrivance here described answers the purpose of an equatorial mounting when used with the pillar and claw stand, *i. e.*, enabling one to follow the star by a single motion.

The parts should be made from $1\frac{1}{2}$ or 2 inch boards, and should consist of two pieces say 15 inches square, and two wedge-shaped pieces subtending an angle equal to the colatitude of the place (*i. e.*, 90°—lat.; thus, if the lat. be 40° 00' the angle should be 50° 00'), and 15 inches on two edges. Now fasten these two triangular shaped pieces, at A, on opposite sides of the piece B, taking care they should stand perpendicular to B, and their ends even with the side, D; on top of these two pieces fasten C; no adjustment for this piece is necessary; now you have finished. The pillar and claw are now to be taken from the tripod head and fastened at F. In case, the glass is 4 inches or over it would be advisable to fill the inside of the stand with iron or rocks to insure steadiness.



If one have the space out of doors it would be a good plan to erect a pillar having a level top, on which is fastened a strip of brass lying in the plan of the meridian; then it is only necessary to set the edge, B, parallel in this to insure the whole being in adjustment, as the stand might be occasionally disturbed.

RUST may often be removed from steel tools by immersing them in kerosene oil for a few days. This loosens the rust so that it may be rubbed off. Where the rust is not very deep-seated, emery paper will do; but if of long standing, the tools must be refinished.

The total production of zinc in Europe in 1880 was 203,330 tons. Germany produced 99,405 tons; Belgium, 65,010; England, 22,000; France, 13,715; and Austro-Hungary, 3,200.

Sanitary and Plumbing.

AN IMPROVED SYSTEM OF HEATING AND VENTILATION.

The subject of the proper heating and ventilation of dwelling houses and public buildings is one that is at length coming to receive at the hands of architects and builders something of the serious attention to which its importance as the first of sanitary considerations entitles it. It was not so long ago, as most of our readers will remember, when the constructor of a building, even of some pretensions, scarcely deemed the problem of heating and ventilating it worthy of his professional consideration, or if he gave it any thought, it was to dismiss it to the charge of some irresponsible, and probably ignorant, subordinate. Of late years, happily, there has been so pronounced a change in public sentiment upon all matters relating to household sanitation, as to amount to a positive revolution from indifference to anxiety, and heating and ventilation are matters which are ranked as high in value and importance as drainage and sewerage, and receive as much attention at the hands of intelligent constructors as the latter.

To heat and ventilate buildings comfortably and properly is by no means the easy task that one unfamiliar with such matters would imagine. We are sufficiently well acquainted with the laws governing the circulation of aerial currents, to be able to affirm that we know the principles upon which such a system should be based; but to carry them into successful practice is a task that has puzzled the brains of the ablest constructors. The heating alone, or the ventilation even, would not prove so serious a task, but to properly combine the two, so that, as it should be, the one shall supplement the other, and both combined shall form an effective system, operating in conformity with sanitary principles, is an undertaking, the difficulty of which can only be duly appreciated by one who has undertaken it. In many cases, too, the most obvious blunders are committed, and persisted in, in the apparently simple problem of ventilation. An old custom for a long time, and even yet to some extent in vogue, was to admit fresh air at a low level in the room, and allow it to escape at a high level, on the mistaken notion that the vitiated air of the apartment that has been breathed, being warm as it issues from the lungs, would rise, and that the placing of a ventilating register at the top of the room, to effect its withdrawal, solved the problem. The notion is entirely wrong. The vitiated air expelled from the lungs speedily acquires the temperature of the stratum of air into which it enters, and, heavily laden with carbonic acid and water vapor, sinks to the floor, and unless removed by some means, accumulates there in a stratum of constantly increasing volume. To attempt to remove this stratum of vitiated air by providing openings for its escape at the top of the room, is simply absurd; and it is not only incorrect in principle, but wasteful of heat (and consequently of fuel), for the warm, fresh air entering the apartment, no matter at what level, being specifically lighter than the air already in the room, immediately rises to the ceiling and escapes through the ventilating apertures without warming the apartment, leaving the bulk of the vitiated air of the apartment undisturbed. Intelligent observers have, therefore, in view of these facts, come to the conclusion, that, both for the efficient renewal of the air of an apartment and for economy of heat, the proper plan is to have the openings for the escape of foul air near the floor.

The preceding remarks will serve to introduce a description of the combined heating and ventilating apparatus, and which is at once simple in construction, rational in principle, and effective in operation.

In describing the steps that led the inventor of this apparatus to the desired construction, it will be well to note the circumstance, which he claims to have proved by actual experiment, that in a room warmed by a supply of heated air, delivered through a register near the floor, the *coolest* spot in the room is invariably directly below the entering stream of warm air. How the inventor took advantage of this fact, in connection with the general principles previously announced, will shortly appear. We owe this very simple and efficient system to the ingenuity of the late George R. Barker, of Germantown, Philadelphia, by whom it was introduced with most satisfactory results into many public buildings and private residences in Philadelphia and its vicinity. It will be understood from the following description:

The air in a room is in a constant state of circulation; delivered from a register, it rises; reaching the ceiling it moves

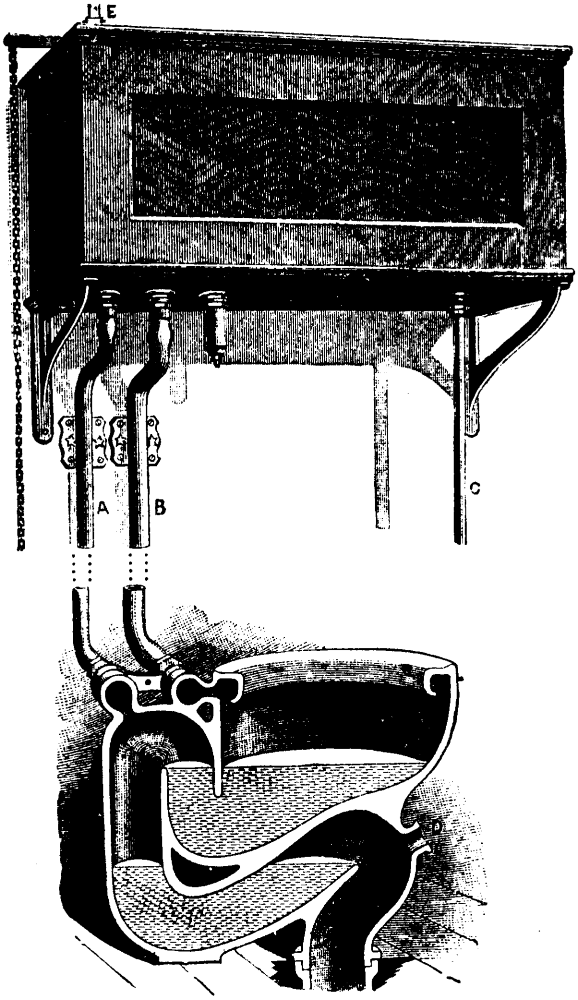


FIG. 1.—"Tidal Wave" Water-Closet, Showing Basin and Supply Tank Connections.

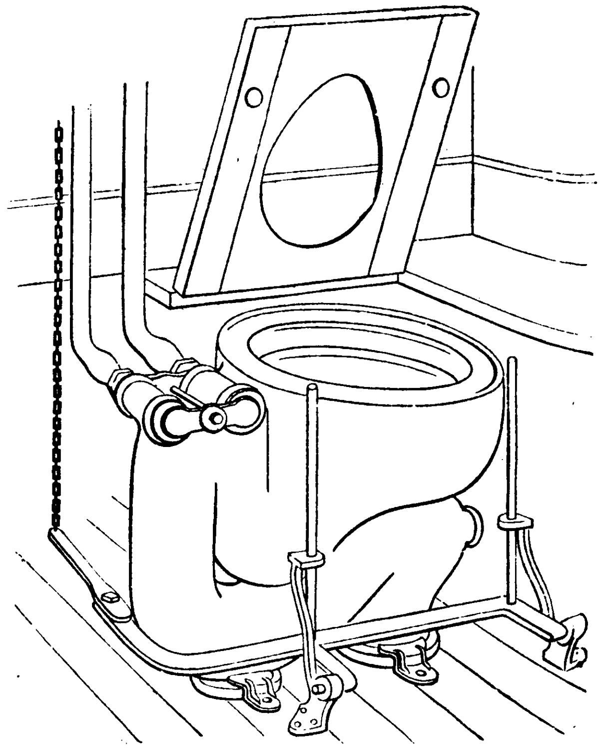
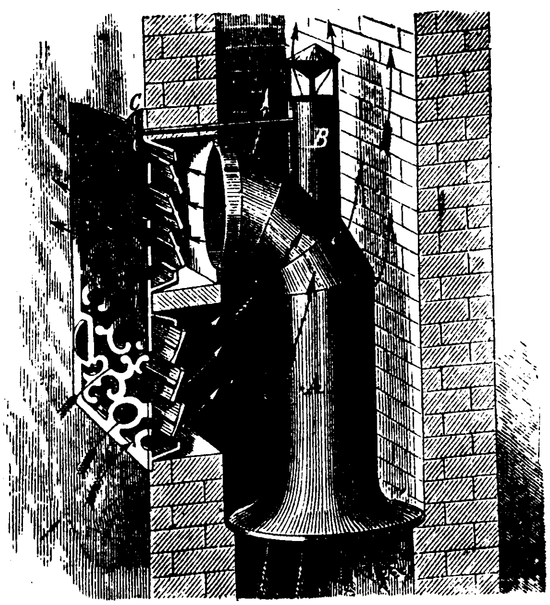
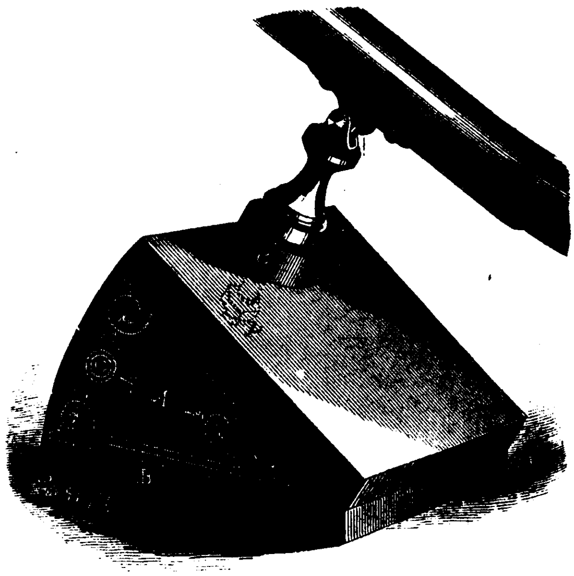


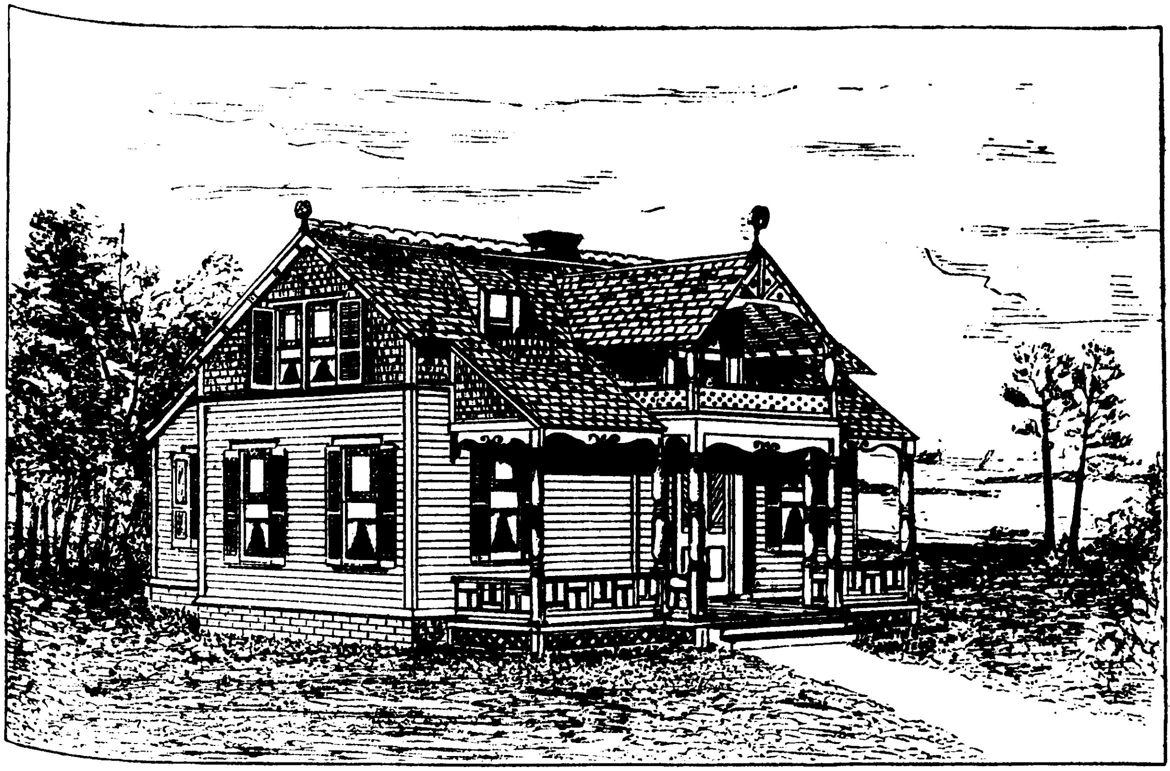
FIG. 2.—"Tidal Wave" Water-Closet, Showing Seat Connections with Supply Tank.



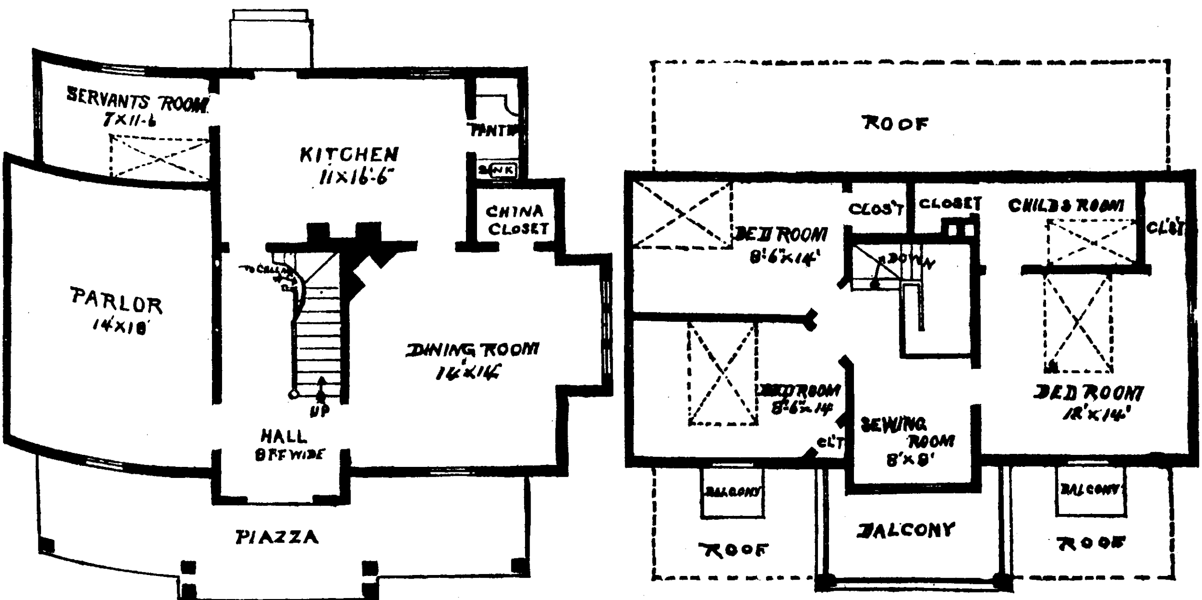
IMPROVED HEATING AND VENTILATING APPARATUS.



EQUATORIAL MOUNTING.



DESIGN FOR A SEASIDE COTTAGE.—ESTIMATED COST, $2,200.



FIRST STORY. SECOND STORY.

ARRANGEMENT OF FLOOR PLANS.

across the room and being gradually cooled falls to the floor. There it is, and must be drawn off and removed in some thorough and simple way. Our illustration, partly in perspective and partly in section, shows the invention quite clearly. A supplementary flue A, flared at its lower end, surmounts the flue leading from the furnace. This pipe is smaller than the air flue, leaving a space all around between it and the walls of the air flue for ventilation. Its upper extremity is curved to terminate in the upper half of a register, through which the hot air is delivered into the room. It will be observed that the register, though having a single grating of the usual size, is divided by a horizontal partition, and each portion is provided with a separate set of slats, either of which may be opened or closed at will. While the hot air from the flue A pours into the room in an ascending current, as indicated by the arrows, the cold and heavy vitiated air, which sinks to the floor, makes its exit into the lower half of the register, entering the main flue in the space between the supplementary pipe and the brick-work, and thence passing up the chimney. By this means a constant circulation of air is maintained in the apartment.

It will be noticed from the foregoing account of the Barker apparatus, that the draft of the flue which is used for ventilation is materially increased by the warmth of the galvanized iron pipe through which the fresh warm air is delivered to the apartment. Its action is at once simple and rational, effecting a frequent and thorough change and renewal of the air of the room to which it is applied, and by the completeness of the circulation which it establishes and maintains effecting a considerable economy of heat, representing a corresponding economy of fuel.

The thoroughness of the circulation effected by this apparatus, has another and highly important advantage — namely, that of producing a very nearly uniform temperature in all parts of the room. With this simple apparatus then, operating automatically, it is claimed, and we believe without exaggeration, that the problem of wholesome heating and ventilation, involving the essential conditions of comfortable warming, frequent and thorough renewal of the air, and the maintenance of practically uniform temperature throughout the apartment, is solved, affording an experimental demonstration of the fallacy of the argument that the only way to secure efficient ventilation is to force the air into or out of a room of machinery.

The following additional details respecting the mechanical operation of the Barker apparatus are of interest to note: The small pipe B arranged above the flue A, is provided within with a valve operated by a suitable rod and handle C outside the register. By this device either a portion or the whole of the hot air rising in the flue A may be discharged into the vitiated air flue, the register of the hot-air pipe being either opened or closed accordingly, and thus increasing the warmth and consequently the draft of the vitiated air flue, a result of much importance in crowded rooms, where the heat becomes excessive and the air very impure. From our own personal observation of the practical operation of the device, we feel satisfied that the truth of the views above noted is fully proved —a candle or handkerchief held before the two portions of the combined register indicating clearly the direction of the ingress and egress currents. By a simple modication the device is adapted for floor registers, and in cases where several flues pass up the wall side by side, a metal partition is used to separate each at the point of location of its register, enabling the apparatus to be conveniently and readily applied. The invention has already elicited favorable notice from eminent sanitary authorities in New York, Philadelphia and Washington. This apparatus has been introduced with great success all through the hospital and medical department of the University of Pennsylvania; the new public school buildings, Camden, N. J.; the People's Bank (Girard Building), the City National Bank, the Western Saving Fund, the Baptist Publication Building, Memorial Hall (Art Building), Philadelphia Stock Exchange, and in many private residences in Philadelphia.—*Manuf. and Builder.*

AN IMPROVED WATER-CLOSET.

We describe in what follows, with the aid of the accompaying illustrations, an improved water-closet, which, to use the words of the makers, is a self-emptying, automatic water-closet, that takes care of itself, is simple and positive in operation, clean in use and all that it should be in a sanitary point of view. To this improved device the makers have attached the expressive title of the "Tidal Wave" water closet.

It is made of one single piece of white earthenware, dispensing with plug, soil-valve, floats, float-chambers, putty and cement joints, and complicated supply valves.

Referring to Fig. 1, A is a ¾ inch air and ventilating pipe; B, a 1¼ inch flushing pipe; C, the supply pipe; and D and E, vents. The construction of the basin is such that a large body of water is retained in the bowl by a trap of unusual dip, under any circumstances, while a second trap directly under the bowl, in connection with the vent at D, forms an additional safeguard against sewer gas. The closet is provided with a copper-lined tank, with service box of the usual construction, and can be operated by a lever and chain attached to the closet seat in the usual manner, or by a bell-pull, or by an ordinary closet-pull. The seat attachment (see Fig. 2) is automatic, as will be seen from the following description, and is a most desirable feature in connection with apparatus of this class, being especially adapted for the use of children and others too thoughtless to make use of mechanical devices. From the following description the working of the apparatus will be understood: While the seat is occupied, the service box fills, the water expelling the air from the service box into the ventilating flue E at the top of the tank. Relieving the seat changes the position of the valves in the service box, closing the supply and opening the outlet valve to the flushing pipe B. The water rushing down to the flushing rim of the bowl, creates a partial vacuum in the service box and air pipe A, causing the air between the two traps to rarefy, and the contents of the bowl are inst ntaneously discharged into the lower trap, starting at the same time a continuous 4-inch siphon which carries everything with it into the soil pipe. The vacuum is broken after the water in the service box has run off to the extent of two-thirds, and the remaining one-third of water in the service box is reserved to refill the bowl.

The closet here described can readily be substituted for any other in use, without changing the soil pipe connections. It can be reversed, so as to be conveniently supplied either from the right or the left, and the supply tank can be placed at any desired height from the floor.

REGULATIONS FOR HOUSE PLUMBING IN NEW-YORK.

Under the new law for the registration of plumbers and the inspection of plumbing by the Board of Health, the board has adopted the following regulations, as given by the *Scientific American*:

Whenever any plumbing work is completed, and before it is covered from view, the Board must be notified in order that it may send an inspector. The arrangement of soil and waste pipes must be as direct as possible. The drain, soil, and waste pipes and the traps should, whenever practicable, be exposed to view for ready inspection at all times. When placed within walls or partitions they should be covered with woodwork fastened with screws, so as to be readily removed In no case should they be absolutely inaccessible. Every house or building must be separately and independently connected with the street sewer by an iron pipe caulked with lead. The house drain must be of iron, with a fall of at least half-an-inch to the foot if possible. It must be provided with a running trap placed at an accessible point near the front of the house, and there should be an inlet for fresh air entering the drain just inside the trap of at least four inches in diameter, leading to the outer air, and opening at any convenient place not too near a window. No brick, sheet metal, or earthenware flue shall be used as a sewer ventilator, nor shall any chimney-flue be used for this purpose. Every soil pipe and waste pipe must be of iron and must extend at least two feet above the highest part of the roof or coping, of undiminished size, with a return bend or cowl. Horizontal soil and waste pipes are prohibited. All iron pipes must be sound, free from holes, and of a uniform thickness of not less than one-eighth of an inch for a diameter of two, three, or four inches, or five thirty-seconds of an inch for a diameter of five or six inches. Before they are connected they must be thoroughly coated inside and outside with coal tar pitch, applied hot, or some other equivalent substance. Iron pipes, before being connected with fixtures, should have openings stopped and be filled with water and allowed to stand twenty-four hours for inspection.

All joints in the drain pipes, soil pipes, and waste pipes must be so caulked with oakum or lead, or with cement made of iron filings and sal-ammoniac, as to make them impermeable to gases. All connections of lead with iron pipes should be made with a brass sleeve or ferrule, of the same size as the lead pipe, put in the hub of the branch of the iron pipe, and caulked in with lead. The lead pipe should be attached to the ferrule by a wiped joint. Every sink, basin, wash tray, bath, safe, and every tub or set of tubs must be separately and effectively trapped, and the traps must be placed as near the fixtures as practicable. Traps should be protected from siphonage by a special metallic air pipe not less than one and a half inches in diameter. Every safe under a washstand, bath, watercloset, or other fixture must be drained by a special pipe not directly connected with any soil pipe, waste pipe, drain, or sewer, but discharging into an open sink upon the cellar floor or outside the house. All waterclosets inside the house must be supplied with water from a special tank or cistern, the water of which is not used for any other purpose. The closets must never be supplied direct from the Croton supply pipes. A group of closets may be supplied from one tank, if on the same floor and contiguous. The overflow pipes from tanks should discharge into an open sink or into the bowl of the closet itself, not into the soil or waste pipe, nor into the drain or sewer. When the pressure of the Croton is not sufficient to supply these tanks a pump must be provided. Rain water leaders must never be used as soil, waste, or vent pipes, nor shall any soil, waste or vent pipe be used as a leader. No steam exhaust will be allowed to connect with any soil or waste pipe. Cellar and foundation walls should be rendered impervious to dampness by the use of asphaltum or coal-tar pitch in addition to hydraulic cement. Yards and areas should always be properly graded, cemented, flagged, or well paved, and drained by pipes discharging into the house drain. These pipes should be effectively trapped.

Cabinet Making.

A GIPSY TABLE.

BY A PRACTICAL WORKMAN.

Though a gipsy table is such an ordinary piece of furniture, and so much in request, yet its manufacture is confined to but few makers. It is known well enough as represented in Fig. 6, but given the round unbored ball, the top, and the turned legs, to bore the holes in the ball, and to bore them rightly, is not so simple a matter as it would seem at first sight, and is well worthy of an explanatory paper.

We will suppose that Fig. 1 is the top of the table, a piece of clean pine, 21 in. in diameter and ⅞ in. thick, and that the circle A is the ball, 4 in. in diameter, into which the legs are screwed or glued, the line which reaches from E to the ball being the plan of upper part of leg. To obtain the exact points for boring the ball, we shall have to draw an elevation as well (see Fig. 2). The base or floor line, B, must first be drawn, then the required height of the table top, 2 ft. 4½ in., must be marked, as at DD, and the thickness of the top shown. The top of the gipsy table legs should come as near the edge of the top as possible, so that the table may be steady; therefore draw a circle, EF, defining the exact center line of the legs. The tops of all three legs must come on this line, and the lower ends of the legs will come out from the center of the table to exactly the same distance; so drop a perpendicular line from the point E down to the under side of the top at D. This point is the center of the top end of one leg. The plan of the lower part of the leg will be obtained by drawing the line EA (Fig. 1) to F, and from the point F drop a perpendicular line to G on the base line Fig. 2; draw a line from G to D, and it will pass right through the center of the ball, because the ball H is just midway between the under side of the top and the floor. We cannot draw the remaining two legs in this manner so as to show the exact distances of the boring points from the center of ball, because in the elevation, Fig. 2, the legs would be foreshortened, *i. e.*, they would appear to the eye in positions which they do not really occupy, and, therefore, could not be measured. Fig. 6 will illustrate the latter remark. The gipsy table is there represented just as it appears to the eye when turned one-twelfth of a revolution from the position shown in Figs. 1 and 2. It is needless to say that no workman would think of boring the ball so as to throw the leg I or J or K in the varying bevels in which they are there shown, although Fig. 6 is correctly drawn from the plan Fig. 1, yet the table having been turned a little round, the apparent positions of the legs present such foreshortened views that it would be impossible to work from them. Hence we take one leg only, and have it exactly in the vertical plan, as E F, Fig. 1; we then obtain the true bevel, boring points, and length of that one leg, and having once obtained these it is an easy matter to place the remaining boring points; the lengths and bevel will be the same.

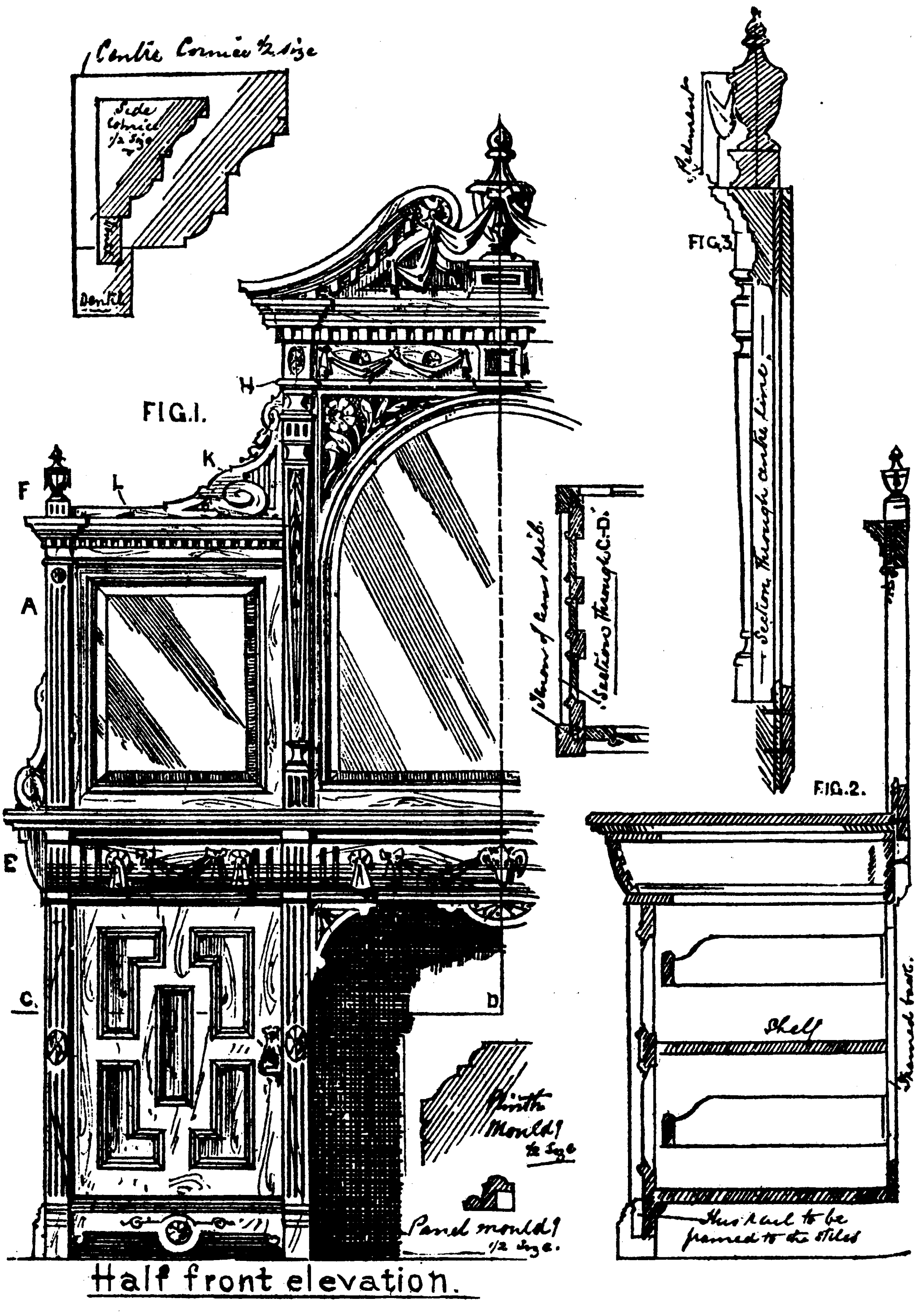
Fig. 3 is an enlargement of the ball H, and L and M are the boring points. Suppose we have the solid round ball in our hands, and we want to mark the boring points, we see the exact chuck centers O and N. Set a pair of compasses to the distance L N and with one leg of the compass on the chuck mark draw a circle on the ball, draw a second circle on the other side of the ball with the other chuck mark for the center, obtain a cardboard straight-edge 9 in. long, and bend it round the ball, taking care that the edge is just coincident with the chuck marks; then draw a pencil line along the straight edge so as to intersect the circles drawn round the chuck mark, see Fig. 3; the line will pass through N L O and M, and if a screwbit is started at L, and it comes out at M, the hole will be right, but before the hole is bored the remaining two points must be obtained. Fig. 4 is the same as Fig. 3 would appear if we were looking down upon it from the point D, it is a plan of Fig. 3. P is the chuck mark, and S S S is the circle round it, on which the boring points are placed; P Q is the cardboard straight-edge, the boring point T, being the same in plan as the boring point L in elevation Fig. 3. To obtain the remaining points, take the radius P T, and starting from the boring point T, set off the distances round the circle S S S; it will just go six times, and each alternate point, as U U, will be the boring points. It will be advisable to make a tin template of these points, with the chuck mark in the center, and always stick to one size of ball, one size of top, and one height of table, which will save much waste and disappointment. Fig. 5 gives the length of the legs, and is obtained from D G, Fig. 2, the pattern for the turning being shown. Black and gold is the usual finish for gipsy tables, the tops being covered generally with cloth, and trimmed with fringe.

SMELL OF PAINT.—To get rid of this most objectionable odor in a chamber or a living-room, slice a few onions and put them in a pail of water in the center of the room; close the doors, leave the window open a little, and in a few hours the disagreeable smell will have almost gone. Another method is to plunge a handful of hay into a pailful of water, and let it stand in the newly-painted room over night; this plan is also effectual. The foregoing have the important advantage of being simple remedies, as the necessary materials are always easily obtainable. Yet another plan, but it is rather more complicated. Place a grate of lighted charcoal on a piece of flag or slate in the center of the room, and throw on it a handful or two of juniper berries; shut out all ventilation from the room for 24 hours. The doors and windows can then be opened, when it will be found that the nasty sickly smell of paint has entirely gone. The furniture may be left in the room during the process, and none of it will be injured. But the best way to avoid the smell of paint is by not having the painters in the house.

BLACK WALNUT can now be manufactured very cheaply. One part of walnut peel extract is mixed with six parts of water, and the wood is coated with the solution. When the material is about half dry a solution of bi-chromate of potash with water is rubbed on it, and then your walnut is ready. Furniture dealers have been known to make excellent walnut from very poor pine, but the difference was slightly perceptible; however, this method is said to defy detection.

AN experienced cabinet maker says that the best preparation for cleaning picture frames and restoring furniture, especially that somewhat marred and scratched, is a mixture of three parts of linseed oil and one part spirits of turpentine. It not only covers the disfigured surface, but restores wood to its original color, leaving a lustre upon the surface. Apply with a woolen cloth, and when dry, rub with woolen.

A firm and fusible wax for ornaments and inscriptions put on loam moulds of bells, for instance, is prepared as follows: Melt at a gentle heat a mixture of 80 parts wax, 13 white pitch, 4 fat and 3 poppy oil. After a thorough stirring, filter through wool flannel.



A SEVEN-FOOT SIDEBOARD.—By Mr. W. Robinson, Dublin.

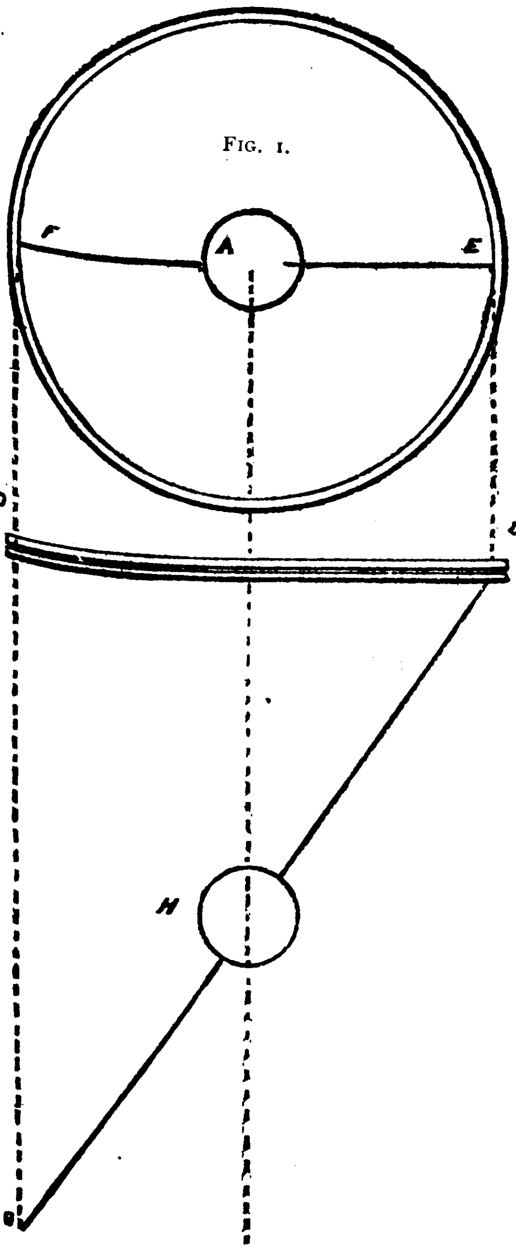


Fig. 2.

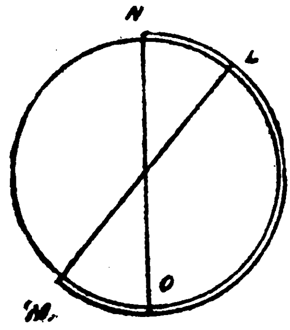


Fig. 3.

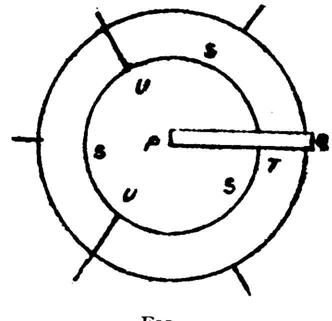


Fig. 4.

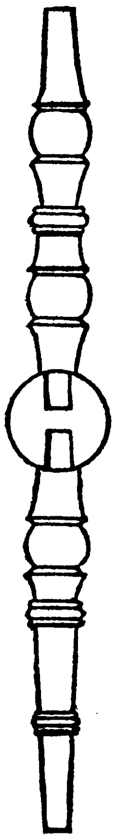


Fig. 5.

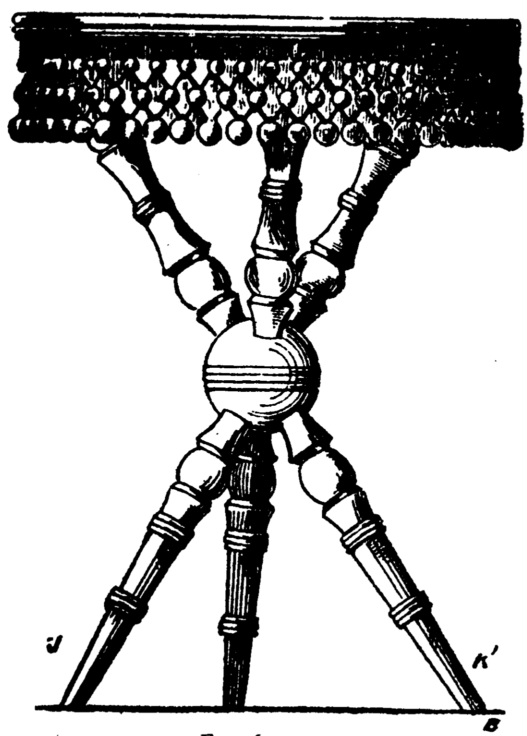


Fig. 6. [*Scale*, 1½ *in. to* 1 *ft.*

A GYPSY TABLE.

Educational.

THE NEW EDUCATIONAL CODE OF ENGLAND.

An educational movement of great moment has been in progress in England for several months. On March 6 the New Education Code was completed by the Education Department, signed by Spencer, Lord President of the Council, and A. J. Mundella, Vice-President of the Committee of Council of Education, and placed before Parliament. Education Department is defined to mean the Lords of the Committee of the Privy Council on Education. The first code was adopted by Parliament in 1870, it being the work of Mr. Robert Lowe. The new code will go into effect April 1, 1883. The revision has been very elaborately and conscientiously performed. Mr. Mundella has been the responsible agent to complete the work; he has invited suggestions and criticisms from all sources. The following statement from the provisions of the code is condensed from the London *Times*.

The details of the code are arranged in the following divisions: (1) Infant Schools, (2) Subjects of Instruction for Children over seven, (3) the Annual Examination, (4) the Attendance Grant, (5) School Expenditure, (6) Night Schools, (7) School Attendance, (8) Pupil Teachers, (9) Miscellaneous Regulations, and (10) the Rate of Payment for Arithmetic, Reading, and Writing. The average attendance of the year will form the basis of the whole grant. The items have been settled as follows: The fixed grant on attendance is raised from four shillings to four shillings and sixpence. The grant for reading, writing, and arithmetic is eight and fourpence per head, if the whole of the children on the school-books pass satisfactorily in all three. For each child that fails to pass, a deduction of one penny will be made, so that a school which passes,—*e. g.*, 80 per cent. of its scholars will receive, not eight and fourpence, but six and eightpence per head on the average attendance. In the grant for singing no change is introduced, except that only sixpence per head will be given if singing is taught by ear, and the full shilling if it is taught by note. In the grant for "class subjects" the sum payable will be one shilling or two shillings per subject, according as the knowledge shown is fair or good. For general merit, such as organization, discipline, intelligent teaching, and quality of school-work, there is a further grant, varying in amount in accordance with the inspector's report. A report of fair, or good, or excellent, will carry a corresponding grant of one or two or three shillings per head, calculated, like all the rest, on the average attendance of the year.

As regards the specific subjects, some changes are made in the contents of the schedule fixing them; and the children offering them must be of at least the fifth standard (the fifth school-year), instead of the fourth standard (the fourth school-year) as now. In these, and in these alone, the payment will be individual, and will not be calculated by any reference to the average attendance of the year. The intended result of the new arrangement is that good schools will be able to earn more than they do now, and that bad schools will earn less. This will be insured chiefly by the rule that the scholars presented for examination must be the whole number on the school-books, and not only those who have made a full number of attendances. The percentage of failures will thus be increased in every case, and the worse the school and the more irregular the attendance the more numerous will the failures become.

It is claimed, also, on behalf of the new system, that it admits of greater flexibility and a more exact adaptation to the merits of each case. The grant for reading, writing, and arithmetic will obviously fix itself by an easy, self-working rule, and it will be possible, as it is intended it should be, that a school in which the teaching is sound and the general intelligence good should earn a higher grant on a lower percentage of passes in reading, writing, and arithmetic than a school can in which the actual bare passes are more numerous, but the teaching and general intelligence are of a lower order. Each certified teacher will count as providing for the instruction of sixty children instead of eighty.

The code abolishes the child's school-book system, with its separate record of the date of birth, date of entry, and year's progress of each child. The examination of classes by inspectors will not be made by sample but by bulk. Teachers holding first-class certificates will not need to be endorsed each year by the inspector, but will be entitled to claim from the school-managers a certified copy of the inspector's annual report on the school. Graduates of universities and women who have passed certain specified university examinations are to be eligible at once for assistant teachership, their promotion to the rank of certificated teacher being subject to the same conditions as those of other assistants. Experienced teachers are to be admissible to the post and pay of sub-inspectors. The code bestows a premium on intelligent and sound methods of instruction in infant schools and night-schools. The new code has the merit of being more simple, more distinct, and more carefully thought out than its predecessors have been.—*Journal of Education.*

THE GREAT BELL FOR ST. PAUL'S.

The following particulars of the great bell for St. Paul's have been forwarded by a well-known correspondent, Mr. W. S. Franks, of Leicester, who has had an opportunity of personally inspecting what is, we believe, the largest bell ever cast in England. It is standing mouth upwards at the foundry of Messrs. Taylor, Loughborough, and struck as it stands, the deep boom is almost too deafening for the ear in such close proximity. The weight of the bell is 17½ tons; its diameter at the mouth 9ft. 6in., and thickness at soundbow 8¾in. The bell itself exceeds 7ft. in height, but from the lip to the top of the cannons it measures 8ft. 10in. Our correspondent says that the note is E flat. At present the bell is struck by means of an iron ball weighing 600lbs., which is slung by a chain to an overhead girder. When the question for a big bell for St. Paul's was first mooted there were objections. It was said that the Chapter had got a bell of four or five tons weight which they scarcely ever rang, and what did they want with more? It was urged that the tower which was destined for the bell would certainly come down; that the neighbouring men of business would be disturbed in their operations; that nobody in England could cast a big bell. This last allegation has been satisfactorily set at rest. A bell weighing some seventeen tons and a half — that is four tons heavier than the great bell at Westminster—has actually been cast in a satisfactory manner by a Leicestershire firm. There is an idea in England that all big bells are necessarily named Tom. Peter, of York, and Harry of Canterbury suffice to counterbalance the Toms of Oxford and of Lincoln. Tom or no Tom, however, the big bell of London outweighs its rivals both of Lincoln and Oxford by many a ton. It is, indeed, insignificant beside the vast and partly-ruined monsters of Moscow, but with the great bells of Western Europe it can vie very fairly. Moreover, it is said to be excellent not only in size but in quality, which may be frankly admitted to be the more important excellence of the two. Sir E. Beckett, calculating the weight of the great Russian bells by their dimensions, makes the great bell of Moscow 220 tons in weight, and another 110 tons, but practically these are bells only in name. Of the great bells of Western Europe, those of Rouen (destroyed), Olmutz, and Vienna alone exceed the weight of the new bell, and that only by a few hundredweight, but the most famous bell—that of Erfurt—weighs much less (13 tons 15 cwt.). Mr. Froude has somewhere called bells a special and characteristic creation of the Middle Ages. They are, no doubt, specially characteristic of that side of the Middle Ages which, if not the most historically true, is the most poetically impressive — its mystical and romantic side. The conclusion that they are out of place in a modern town is a hasty and an unphilosophical one. Except in a very confined space, and at too low a level, bells are by no means intrusive. When Big Ben was hung the same prophecies of evil were made, and with all his drawbacks, exaggerated as they have been, Ben has been long accepted as a rather pleasant ingredient of the *strepitus* of our modern Rome, than which the old one could hardly have been more noisy, as it probably was not wealthier, and certainly not half so smoky. A rival at the other end of the Embankment will be far enough off to enter into no indecent competition, and the greater size of the new bell will enable it to master the louder roar of the neighbouring streets, though wood and asphalte have come to its assistance beforehand in that matter. Only it is to be hoped that the tower will be well looked to before the bell is hung. Report has it that the Midland Railway is shy of a passenger some eighteen tons in weight and some 9ft. high by 10ft. broad, and that the bell will have to be brought by road, meeting, let us hope, with no opposition from alarmed highway boards, and not crushing in more culverts, cellars, and other traps of their kind than is reasonable.

Miscellaneous.

INFERNAL MACHINES AND THE EXPLOSIVE AGENTS USED IN THEIR CONSTRUCTION.

The probabilities are that infernal machines will come into a more general use than is desirable either for purposes of private revenge or the removal of tyrants and nuisances. With the invention of such explosive substances as gun cotton, nitro-glycerine, dynamite, litho-fracteur, cotton powder, tonite, glonoine, dualine, saxafragine, mataziette, gluoxiline and blasting gelatine, there are substances enough to terrify the lords of the earth for years to come. In general terms, it can be said that all these substances resolve themselves substantially into two, namely, gun cotton and nitro-glycerine. Both are nitro compounds, the former in a solid form, the latter in a liquid. Cotton powder is gun cotton reduced to a fine state of division ; tonite is the name with the admixture of a nitrate or similar body ; dualine is nitro-glycerine and sawdust, and blasting gelatine is nitro-glycerine in which gun cotton has been dissolved so as to form a jelly. Nitro-glycerine is prepared by mixing glycerine with nitric acid and then permitting the mixture to drop or fall into a narrow stream into water, when the nitro-glycerine at once separates. Gun cotton is simply cotton immersed in nitric acid. It was discovered in 1846 by Schonbein, a Swiss chemist. A solution in camphor is extensively employed to imitate bone and ivory, and is known under the trade name of celluloid. Gun cotton is also extensively used in photography. That which is sold in this country is soluble in a mixture of alcohol and ether, and is not explosive.

Another peculiarity of gun cotton is that wet gun cotton can not be exploded. Dry gun cotton burns vehemently ; wet gun cotton is absolutely uninflammable. You can put out a fire with wet gun cotton just as you would with a wet blanket, and yet you can use the same material for blowing up a fortress. Now, see the advantage it has over gun powder. This must be as much protected from water and damp as from fire in order to be effective, while gun cotton the wetter it gets the safer and more uninflammable it becomes, yet detonates if it has absorbed 30 or 40 per cent. of water as readily as if it had absorbed but 2 or 3. It may not be improper here to relate how this gun cotton is exploded under water, or wet. There is no difficulty with dry gun cotton, it producing an explosion. The wet is detonated by using on intermediary between the primary charge of fulminate and the wet gun cotton. The intermediary is a slab of dry gun cotton termed a primary. The fulminate, for convenience sake, is put in a quill tube, and this quill tube inserted into a hole in the gun cotton slab or primer. The quill of fulminate that furnishes the primary cause of the explosion is called a detonator, and the detonator fixed into the primer or dry gun cotton slab causes the latter to explode. A torpedo of 450 pounds of gun cotton sunk in the water will throw up a cone of water 60 feet in height having a base of no less than 220 feet. This was the principle by which the rocks in Hell Gate were blown up, and it is the same principle used by the Russians in the Crimean War. Then it will be seen how easy it is to construct an infernal machine which, wet or dry, will easily explode. Dynamite cartridges are about as explosive infernal machines as an ordinary conspirator wonld need. At a ball in Schwarzenburg, Saxony, lately a young man entered with something in his mouth, which appeared to be a cigar. He went to the chandelier as if to light it, and a terrible explosion ensued. The lights were extinguished, the walls partly gave way, some of the dancers were covered with blood and pieces of flesh, and the young man had blown himself clear out of identification by means of a dynamite cartridge.—*Am. Inventor.*

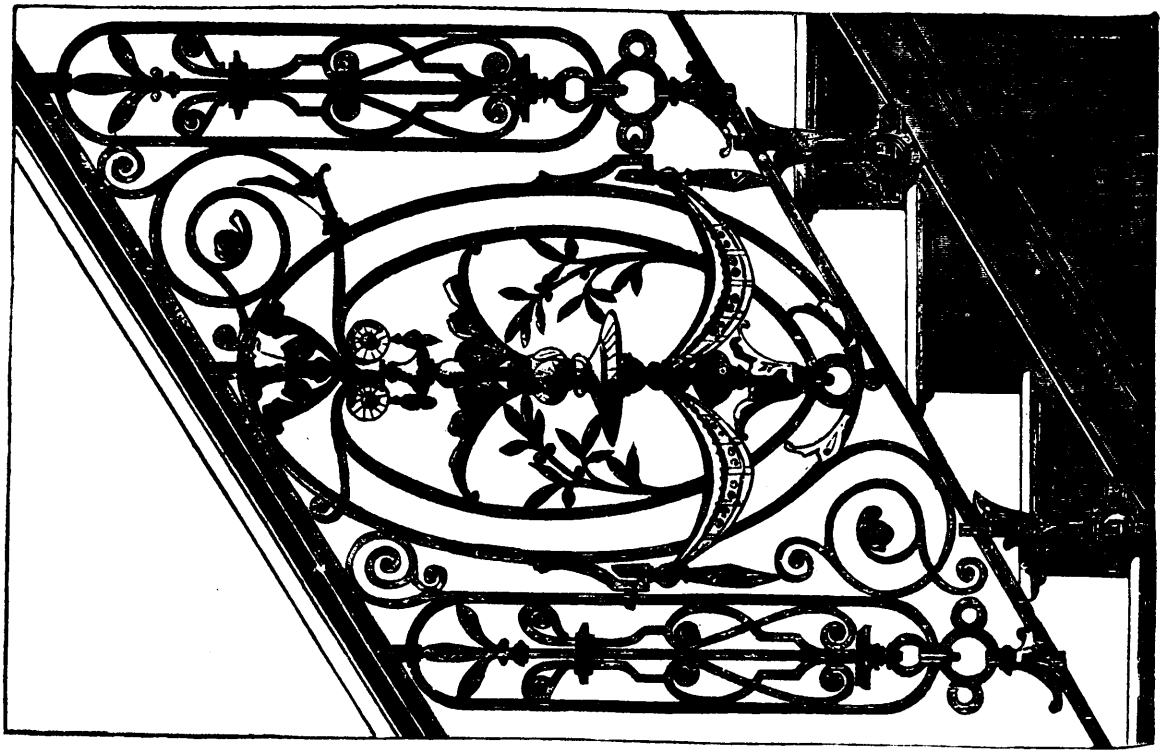
POP CORN.

A New York contemporary thus describes the process : "The basement in the wooden house at 28 Thompson Street, is perpetually so full of coke smoke that a visitor is nearly choked on going into it. There are two rooms, one front and one back. The front room is littered on one side with barrels, and the other side is taken up by a broad shelf and a capacious bin. From the shelf rises an airy pyramid of loose popcorn ; the bin contains several thousand pop-corn balls. In the dark rear room, seen through the door way, glows the coke fire which produces the smoke and pops the corn. It burns in a deep fire-place, in the top of which is set an iron hook. From the hook hangs a wire work cage two feet square and height inches deep. A long handle fixed in the cage runs out into the room, and the end of the handle is grasped by a pair of red and massive hands, which shake the apparatus as if the object were to annihilate it. The owner of the hands sits on one barrel and is surrounded by twenty or thirty more. He is the centre of a small area of brilliant illumination, and appears of a fine red color, while the space about him is pitch dark. He is coatless and bare-armed, and his shirt is rolled away from the neck and breast. Every two minutes he throws into the wire cage a quart measure of yellow kernels of dried corn, and hanging then the cage upon the hook before mentioned, jerks the handle back and forth with a short movement of so energetic a nature that the perspiration rolls from him. In half a minute there is a noisy and violent commotion in the wire-work cage. It begins with a single sharp report, which runs rapidly into a tremendous volley. The kernels leap as if in pain, and dash themselves against the glowing iron walls which encompass them. Simultaneously they dilate, each to twenty times its original size, and the cage seems on the point of bursting under the pressure of the mass, which is as fleecy and as white as newly fallen snow. A final pop, denoting that the last kernel has succumbed, and the man in a jiffy swings the cage from the hook, throws open a lid in the top, and dumps the contents into a vast dark bin at his side. In this way and at this place pop-corn is turned out during the holiday season at the rate of about thirty barrels a day. It goes as far South as Virginia, and finds its way East into Massachusetts and Connecticut. The pop-corn man has three assistants. Corn pops in his establishment for sixteen hours a day, Sundays included, and two dollars a barrel is the price which the perfected product brings."

THE SUN'S FUEL.

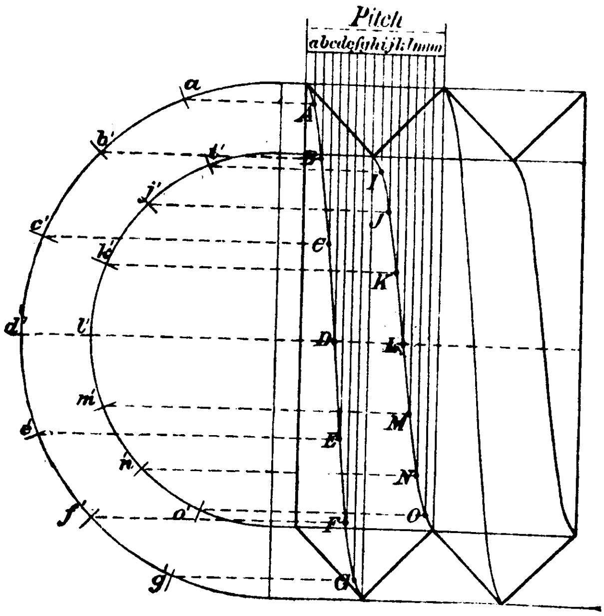
What keeps the majestic ball hot and bright? This has greatly engaged physicists and astronomers, and various have been their theories. If the sun shone only by mere combustion of its own materials, the calculation is that its fire would not last 5,000 years. It is very kind of Dr. Siemens to come forward with an entirely new theory, which holds out the hope that the men of science are all wrong with their dismal foreboding, and that the creation is not schemed on the poor footing of a German stove or a suburban gas company. The learned ironmaster and physicist believes that the sun may very well go on illuminating and warming our world and the family of sister planets for an indefinite, if not infinite, time. He supposes interstellar space to be filled with an extremely attenuated hydrogen, and interplanetary space with denser gas, albeit more rarefied than the atmosphere drawn round each world. The sun, he thinks, whirling on its axis, draws into its poles the thin hydrogen, hydrocarbon and oxygen of our sphere, and these, being kindled, are projected outward at his equator into space. The accepted view is that the heat and light there developed and radiated perish, as far as we are concerned, except for the small portion arrested by each solar satellite ; but Dr. Siemens argues that this heat and light do their chief work in decomposing the carbonic oxide and watery vapor which were produced by the kindling at the solar poles, so that the sun itself perpetually renews its own supplies, and restores by its energy the waste matter which has fed that energy. The theory is much too technical and complicated to be here discussed, and we should offer a bad compliment to its ingenious author even to attempt such a task. Dr. Siemens, however, has had great experience with the phenomena of radiated heat, and his applications of the new view to the nature of the zodiacal light and of comets is particularly striking. Of course it is startling to hear of something in our own system which closely resembles perpetual motion ; and those who maintain that everything comes to an end, and that all mechanical energy must be gradually degraded and metamorphosed, will be slow to receive the new suggestion.—*London Telegraph.*

CLEANING LIME CHOKED PIPES. — Feed, water and other pipes frequently become choked with lime incrustation, causing great annoyance. The following plan has been suggested as a remedy : After plugging one end up securely, pour the pipe full of coal oil, letting it stand over night, when the whole mass will probably slide out. Pipes have been cleared of incrusted matter in this manner which before were regarded useless.



RAILING BY RATCLIFF & TYLER OF BIRMINGHAM.

BALUSTRADE BY M. BAUDRIT OF PARIS.



WORKSHOP SKETCHING.—FIG. 54.—METHOD OF DELINEATING A COMMON V THREAD.

WORKSHOP SKETCHING.

BY JOSHUA ROSE, M. E.

VI.

For screw threads of a large diameter it is not uncommon to draw in the thread curves as they appear to the eye, and the method of doing this is shown in Fig. 54. The thread is first marked on both sides of the bolt, as explained in the last of these articles, and instead of drawing, let straight across the bolt, lines to represent the tops and bottoms of the thread, a template to draw the curves by is required To get these curves, two half-circles, one equal in diameter to the top and one equal to the bottom of the thread, are drawn as in Fig. 54

These half-circles are divided into any convenient number of equal divisions; thus, in the Fig. 54 each has 8 divisions, as *a*, *b*, *c*, etc., for the outer, and *i*, *j*, *k*, etc., for the inner one. The pitch of the thread is then divided off by vertical lines into as many equal divisions as the half circles are divided into, as by the lines *a*, *b*, *c*, etc., to *o*. Of these, the eight from *a*, *h* correspond to the eight from *a' g'*, and are for the top of the thread, and the eight from *i* to *o* correspond to the eight on the inner half-circle, as *f*, *i*, *j*, *k*, etc. Horizontal lines are then drawn from the points of division to meet the vertical lines of division; thus, the horizontal dotted line from *a'* meets the vertical line *a*, and where they meet as at *A* a dot is made. Where the dotted line from *b'* meets vertical line *b* another dot is made, as at *B*, and so on until the point *G* is found. A curve drawn to pass from the top of the thread on one side of the bolt to the top on the other side, and passing through these points as from *A* to *G*, will be the curve for the top of the thread, and from this curve a template may be made to mark all the other thread-tops from, because manifestly all the tops of the thread on the bolt will be alike.

For the bottoms of the thread, lines are similarly drawn,* as from *i'* to meet *i*, where dot *I* is marked. *J* is got from *j'* and *j*, while *K* is got from the intersection of *k'* with *k*, and so on, the dots from *I* to *O*, being those through which a curve is drawn for the bottom of the thread, and from this curve a template also may be made to mark all the thread bottoms. We have in our example used eight points of division in each half-circle, but either more or less points may be used, the only requisite being that the pitch of the thread must be divided into as many divisions as the two half-circles are. But it is not absolutely necessary that both half-circles be divided into the same number of equal divisions. Thus, suppose the large half-circle was divided into ten divisions, then instead of the first half of the pitch being divided into eight (as from *a* to *h*) it would require to have ten lines. But the inner half-circle may have eight only, as in our example. It is more convenient, however, to use the same number of divisions for both circles, so that they may both be divided together by lines radiating from the centre. The more the point of division, the greater number of points to draw the curves through; hence it is desirable to have as many as possible, which is governed by the pitch of the thread, it being obvious that the finer the pitch the less the number of distinct and clear divisions it is practicable to divide it into. In our example the angles of the thread are spread out to cause these lines to be thrown further apart than they would be in a bolt of that diameter; hence it will be seen that in threads of but two or three inches in diameter the lines would fall very close together, and would require to be drawn finely and with care to keep them distinct.

The curves for a United States standard form of thread are obtained in the same manner as from the V thread in Fig. 54, but the thread itself is more difficult to draw. The form of this thread is shown in Fig. 55, it having a flat place at the top and at the bottom of the thread. A common V thread has its sides at an angle of 60 degrees, one to the other, the top and bottom meeting in a point. The United States standard is obtained from drawing a common V thread and dividing its depth into eight equal divisions, as at *x*, in Fig. 55, and cutting off one of these divisions at the top and filling in one at the bottom to form flat places, as shown in the figure. But the thread cannot be sketched on a bolt by this means unless temporary lines are used to get the thread from, these temporary lines being drawn to represent a bolt one-fourth the depth of the depth of the thread too large in diameter. Thus, in Fig. 55 it is seen that cutting off one-eight the depth of the thread reduces the diameter of the thread. It is necessary, then, to draw the flat place on top of the thread first, the order of procedure being shown in Fig. 56. The lines for the full diameter of the thread being drawn, the pitch is stepped off by arcs, as 1, 2, 3, etc.; and from these, arcs, as 4, 5, 6, etc., are marked for the width of the flat places at the tops of the threads. The one side of the thread is marked off by lines, as 7, which meet the arcs 1, 2, 3, etc., as at *a*, *c*, etc. Similar lines, as 8 and 9, are marked for the other side of the thread, these lines, 7, 8 and 9, projecting until they cross each other. Line 10 is then drawn, making a flat place at the bottom of the thread equal in width to that at the top. Line 12 is then drawn square across the bolt, starting from the bottom of the thread, and line 13 is drawn starting from the corner *f* on one side of the thread and meeting line 12 on the other side of the thread, which gives the angle for the tops of the thread. The depth of the thread may then be marked on the other side of the bolt by the *d* and *e* and the line 14. The tops of all the threads may then be drawn in, as by lines 15, 16, 17 and 18, and by lines, as 19, etc., the thread sides may be drawn on the other side of the bolt. All that remains is to join the bottoms of the threads by lines across the bolt, and the pencil lines will be complete, ready to ink in. If the thread is to be shown curved instead of drawn straight across, the curve may be obtained by the construction in Fig. 55, which is similar to that in Fig. 54, except that while the pitch is divided off into 16 divisions, the whole of these 16 divisions are not used to get the curves, some of them being used twice over; thus for the bottom the eight divisions from *b* to *i* are used, while for the tops the eight from *g* to *o* are used. Hence *g*, *h* and *i* are used for getting both curves, the divisions from *a* to *b* and from *o* to *p* being taken up by the flat top and bottom of the thread. It will be noted that in Fig. 54 the top of the thread is drawn first, while in Fig. 55 the bottom is drawn first, and that in the latter (for the U. S. standard) the pitch is marked from centre to centre of the flat of the thread.

FRENCH AND ENGLISH WROUGHT IRONWORK.

We have at different times called attention to the possibilities in wrought ironwork in the art line, and have occasionally presented some examples of work showing what has been done and may be done in this direction. Our first-page illustration this month shows two very handsome designs, the one on the left being a specimen of wrought ironwork from the establishment of M. Baudrit, of Paris. It is original in design and admirable in execution. There is a charming variety in the work, characteristic of the highest productions of French artists. The lower portion is solid, as the foundation of the terminal post of a balustrade should be, but it lies on the stairs naturally and elegantly. The upright pillar and hand-rail are sufficiently massive, while the decorative portion has all the light elegance of a flower.

In this country our designers are wont to draw work of this kind for execution in cast iron, and so accustomed have we become to casting all ornamental work of a similar character that our blacksmiths scarcely know what it is possible to accomplish with the hammer and anvil. The second illustration, which we present herewith, is not less striking, and is an example of work in good taste for a similar purpose to that shown in the first instance. It is as unlike it, however, in character and execution as the two nations from which these pieces of work come. The second engraving represents a continuous balustrade executed by Messrs. Ratcliff & Tyler, of Birmingham. An oval in the centre is very happily arranged panel fashion between the scroll work which serves the purpose of pilasters. The design is neither too ornamental nor is it poor. The connecting links of the work, including the attachment to the stairs, are graceful and effective. This pattern also, if made in this country, would very likely be executed in cast metal, and would lose all those peculiar characteristics that render it attractive, and, as at present, considered an example of true art workmanship. Our only purpose in presenting objects of this kind from time to time is to stimulate the effort that is now being put forth to increase work of this kind in this country. The mechanical ingenuity of our smiths is universally acknowledged, but in artistic taste and in the ability to execute ornamental work they are very much behind those of other nations.

THE GUTTA PERCHA SUPPLY.—Reports from Brazil show that the supply of gutta percha, which is used in insulating underground wires, is fast giving out and will be exhausted in 30 years. It is said that this prospect of a scarcity in insulating material is one of the chief reasons for the strong opposition by interested parties to underground telegraphy.

POLISHING BLACK ASH.—Give it a coat of shellac, and then one of boiled linseed oil.

Architecture.

RITUALISM IN CHURCH ARCHITECTURE.

It is good and gratifying in these days of general architectural license to revert to "first principles" to find a solid foundation under our feet—to revert to the classical orders, or to our more national Gothic, with its sound principles. It is likewise good, when weary with the effort to discriminate between the many-spired and Gothic-windowed buildings put up by our too-numerous Protestant sects and the Established Church of the land, to perceive the aims of a section of our national Church members, which appear to be very much the assertion of a ritual.

Mr. Street writes of the artists of the Middle Ages:—"They were men who had a faith and hearts earnestly bent on the propagation of that faith," and questions his readers, "Have we less to contend for—less faith to exhibit or less sacrifice to offer than they?" Surely not a less "faith" because freer from superstition. The Ritualistic movement is one which pervades not the clergy only, it seems like a call from the Church's members to open all these "silent sepulchres" and let human sympathies be allied with the principles of worship and artistic with spiritual aspirations.

When we refer to the origin of Christian ritual in the rites of the Tabernacle of Moses, we can observe at the same time the assimilation in the plan of their churches, of the general arrangement of the Divinely-appointed type. Whether this was adopted from perception of this as a key or type, or whether the earliest Christians approximated the Jewish form and plan in order not to offend the Jewish converts, it is not easy to affirm. We observe the arrangement of their Church plans as follows:—The Narthex, or vestibulum, where the penitents and catechumens stood; the Naos, or temple, where the communicants were seated; and the Bema, or sanctuary, of the clergy. After entering the magnum or great porch in front, there was a large court or atrium, in the centre of which stood a fountain and round which a colonnade or cloister was built; under the cloister stood those who were not allowed to enter the church: here they sought the prayers of the faithful as they went forward to church. In the early churches it was customary to separate the sexes, the women generally having the galleries appropriated to them. The ambo or reading desk stood in the middle of the nave, and was used sometimes as a pulpit, though the rising steps of the altar was the recognized place for preaching. In the nave also stood the canonical singers, and here the clergy administered the first service, called the missa catechumen.

In the time of St. Augustine, too, the ritual involved or included high ceremonial and all that tended to promote exalted taste and feeling and desire for the appropriate adornment of the churches.

The development of the Liturgy in England through slow centuries, and its eventual almost general acceptance in the form of the Sarum Breviary and Missal of A.D. 1085, witnessed wonderful advances in church architecture simultaneously going on, and from that date our architectural remains speak for themselves, suffice it to say, that same Liturgy with occasional emendations, continued in use during the attainment of ecclesiastical art and architecture to their climax during the three following centuries. Referring to the Decorative Period, Paley exclaims, "This was the glorious age of church architecture. It was the climax beyond which Christian art was never carried. Though all that riches and devoted piety and sublime talents could effect was done to sustain its consummate excellence, it followed the universal law, and having once reached perfection, began gradually to decline." And soon followed the revival of the Sarum use—in 1516-31-33-40, in the latter revision, the lessons appointed to be read in the English tongue. The various stages in the transition of the Liturgy from the Catholic to its Protestant form must be left for the student's own reference, it will not be fruitless, if he is not already well acquainted with them. Cranmer's "Rationale" of the ceremonies to be used in the Church of England, together with an explanation of the meeting and significancy of them, including a list of the vestments to be worn by the officiating clergy, with their distinctive meanings and significance, still preserve to us the reverence observed for the hallowed uses of the Church, and the realization of the emblematical meanings in them. In such crises as the Reformation, which was a work of development, we know that there was a paramount exercise of passion as well as reason, as the dissolution and spoliation of the Priories, the lesser and greater monasteries. the destruction of the church altars, decorative sculpture, painting, and glass testi- fies.

The Genevan party succeeded in getting altars removed by Royal injunction in the third year of Edword VI. ; still, after the storm was parted, the Rubrics of Elizabeth and Charles II. deliberately ordered that the ornaments of churches were to remain the same as in the second year of Edward VI. When rails were used universally in the time of Charles II., by which the permanent position of the table at the east end was signi- fied, it is not for us to insist upon the moveableness of them. Paley again shows us, in his admirable allegorical story of the "Gothic Restorers," that from the time of James I. to Charles I. rood screens were erected in the churches, and where the old screens had been destroyed or removed. The number of Jaco- bean or debased screens he had seen was a very interesting token of this Catholic practice by the Reformed Church, and in several instances, he adds, I have seen Jacobean doors added to existing screens. Even Wren's churches always had screens, and in truth till the last hundred years I suspect they were scarcely ever omitted ; see St. John the Evangelist Church, Leeds, for an example of one of Charles II. reign.

Now, to revert very briefly to emblematical meanings adopt- ed by early Christians in their buildings. The adoption of the Basilicas for their worship in the first place may have, and no doubt had, some influence in the arrangement of their church plans in succeeding times. These Basilicas, as we know, had a ternary or threefold division of the main body of the building, viz., nave and side aisles, in all probability for economy in the roofing. Still, this coincided with Chris- tian views, and has been in a greater degree, generally retained as suggestive in its number three up to the present day. Again the plan of the cross from the earliest times has found favour, and no wonder. The twofold division and treatment of nave and chancel decoratively as indicative of the Church militant and the Church triumphant. The inclination of the chancel northwards, which Durandus, of the thirteenth century, has stated was to be observed in a quarter of the churches in Eng- land of his day, as figuring the inclination of our Saviour's head on the Cross. The placing of the pulpit on the north side.

The Holy Eucharist represented by the altar, to be approach- ed through the other Christian ordinances. There is notice- able in the threefold division of plan—Narthex porch or bab- tistry nave and chancel, a forcible coinciding in their meaning with our Lord's words, "I am the way, the truth and the life."

We will allow the tapering spires to speak for themselves and assert their own influence in devotional aspiration in the absence of definite symbolic meanings. Not having travelled very far, the mention of the spires of St. Etienne, Caen, Bayeux Cathedral, Contames, Salisbury, Chichester, and Lichfield cathedrals, Grantham and Newark churches must suffice. The first-named, St Etienne's spires reminding me of the first sketching tour I ever made, left a profound impression, which will remain ever indelibly engraved on my mental vision, and whenever and however I look at Grantham church spire, it is always with most devoted admiration. We must not forget the change from the short lapse of the Normans to the length- ened chancel of the Early English period, the single lights of the former to the triplet in the square end of the latter. As an instance of a lengthy Early English Chancel, see Breewood, Staffordshire—six lancet windows in the six bays of chancel, with triple lancet lights in east wall. And again, the change from the three lights to the six and particularly seven lights of the decorated period—as instances, Selby and Ripon east windows with a host of others. As coloured glass became the fashion in the 15th century, the window lights and tracery were accordingly multiplied and adapted to the display, and here the symbolism of numbers seem to fail. Who can look at the five tall lancet windows in the North transept of York Minster without feeling a desire to know why they were five, generally termed the five sisters ; yet I feel convinced that there is some meaning or symbolic significance hidden therein. Seven, we know, is the number of completeness composed of three and four many significant applications to which will oc- cur to you from the Scriptures : six, the number of days in the creation ; five, the number of our senses or gates of knowl- edge ; the number of the temple and of the kingdom ; twelve, the number of the Apostleship.

The circular churches will naturally suggest their origin —in the Church of the Holy Sepulchre at Jerusalem—and re- call to our minds the religious chivalry of the Crusaders.

Referring to ecclesiastical sculpture and decoration, the ear- liest records of the former in the Catacombs, furnish us with an expression of simple faith and hopefulness ; though rude in exe- cution, there is purity and reverence of thought. The repre- sentation of Christ as the Good shepherd and as the Lamb were predominantly in favour, the First Person of the Holy Trinity represented by a lamb within a nimbus, the Third Person by a dove within a nimbus, though occasionally by personal repre- sentation, but in preference emblematical signification was given. We see the fear of anything that should detract from the honour of Him who was spiritually present during worship, or lead to a species of idolatry, for the Council of Eliberis in A.D. 305 decreed that mural paintings should not be allowed less that be represented which is worshipped or adored. Old and New Testament subjects never wearied them, and testify to this day of their faith, then why should we weary of them, for ours is the same faith. As art developed in Christendom, the more beautiful the sculpture and painting, the vestsments, shrines and furniture of our churches became, but the more profuse the art. Mimicry, sarcasm, and the grotesque asserted their unedifyidg influence, though this was mostly due to the rivalry between the monastic orders—systems while they work- ed much good yet provoking much evil. Perhaps more correct- ly I should have said the rivalry between the secular and regu- lar clergy, and between the latter and the mendicant friars. The idea of the earlier grotesques was generally the representa- tion of evil spirits—note the fine Norman Chancel arch of St. Chad's, Stafford, where many of these ungainly creatures are crawling out of the sanctuary, around the arch mouldings and jambs, to make a speedy exit westwards. The symbolic forms of the circle, triangle, cross, crown, initial lettering, and that wonderful form of two equal arcs, the "venia piscis," are all familiar to us.

ANTIQUITY OF THE SQUARE.

Among some stools found in a temple at Thebes was a square, which is the most satisfactory evidence we have of the early use of this instrument. From marks upon it, it has been estimated to have been made nearly thirty-five centuries ago. Since the arts in ancient Egypt at that time were at the height of their development, the square must have been known for some time previous, and therefore it is believed that the use of the square dates back not less than four thou- sand years. The square known to the ancients, and the tool with which they accomplished wonders of construction and calculation, was not by any means the square of the present day. This instrument as now employed, with blade and tongue and heel and the graduated lines which appear upon its surface, is an invention known only within a comparatively short time. The square, as an instrument, has been brought to its present state of perfection within a very few years.—*Ex.*

CLEANING FLUXES FROM TIN PLATES.

We very frequently have correspondents asking us in regard to the method of preventing iron or tin from rusting after hav- ing been soldered with acid flux. A little knowledge of che- mistry would generally enable our correspondents to answer this question for themselves. All the acids, whether nitric, sulphuric, or hydrochloric, or the commoner ones like vinegar, lemon juice, citric acid, &c., can be neutralized s that they no longer retain acid properties by the use of what are called alka- lies, that is, substances like lime, soda, potash ; many of the compounds of these alkalies, like bi-carbonate of soda, or car- bonate of soda, the carbonate of lime, in fact, marble or lime plaster will act the part of alkalies when brought in contact with an acid. They are really already in combination with an acid themselves, but the acid is so weak that they leave it and combine with a stronger one. While the acids thus readily attack metals, it is found that the compounds which result from their combination with alkalies are neutral and do not attack metals. These compounds have in chemistry the name of salts. It is easy to see, therefore, that when we wish to render an acid harmless we must immediaiely combine it with an alkali. This holds good in the case of poisoning when an acid has been swallowed. It equally holds true by poisoning by a dose of any of the strong alkalies, in which case some harmless acid like vinegar, lemon juice, or citric acid, or tar- taric acid, may be taken.—*Metal Worker.*

SILVER FILIGREE JEWELRY BOX.

THE FOX KUSU IN THE BERLIN AQUARIUM.

Natural History.

THE FOX KUSU IN THE BERLIN AQUARIUM.

The whole group of animals of the order of Marsupialia derive their names, as is well known, from a pouch situated in the lower part of the abdomen, a broad fold of skin, which is of the greatest importance for the existence and subsistence of the young of these animals.

The pouched animals are born naked, blind, deaf, and with stumpy legs, and are so helpless that it is impossible even with the greatest care, to bring up the little creature artificially.

It was a puzzle for a long time how the young were placed in the pouch, but it has been found that the mother takes the little ones up with her mouth, as a cat does her kittens, and places them in the protecting covering. In this pouch are the nipples, which the little imperfect animal would not be able to find, if the mother did not immediately press them to it.

The little animal remains in the pouch for several months developing and finally reaches out its head to look around the world.

Many weeks pass before it ventures to forsake its warm well furnished little house. Finally it takes the great step, and moves about for the first time in the open air, but at the least noise it returns in haste to its mother's pouch, from which it again looks forth when the imaginary danger is past.

The fox kusu (*Phalangista vulpina*) is a climbing pouched animal, and resembles the squirrel. The length of the body is 60 centimeters, of the tail, 40 centimeters. The color of the upper side is brownish gray, with markings of pale red : the under side is yellow, the back and tail black. The tail is used for grasping and holding firmly to objects, and appears to be an indispensable organ.

It climbs and leaps like the squirrel, but the squirrel far surpasses it in intelligence. Like most of the representatives of this order, the fox kusu shows a certain want of mental capacity ; this is evident in its motions and in its capture by day. If it is pursued it soon gives up the flight and hangs with its tail to a branch, from which it may be easily taken. It has been ascertained that the continual gaze of the hunter wearies the animal and in a measure blinds and bewilders it, so that it finally falls down helpless.

The fox kusu inhabits Australia and Tasmania, lives in the forests, and leads a nocturnal life. Its nourishment consists mainly of vegetables, but it likes eggs and young birds.

It is much hunted by the natives for its flesh, which is repulsive to others. The skin is of some value, and is sometimes seeen in the market.

The kusu of the Berlin Aquarium was soon tamed, is always peaceable and gentle ; but it is difficult to decide whether its amiability does not proceed from stupidity.

FILIGREE JEWEL CASKET.

We give an engraving of an exquisite filigree jewelry box of silver from the celebrated Gruenes Gewoelbe, in Dresden. In this repository many beautiful and valuable objects are stored. Our engraving represents this fine piece of silver work so well that it is unnecessary to enter into a detailed description of it.

TABLE, AFTER SHERATON.

Ingeniously contrived dressing and other tables were among the specialties constructed by Thomas Sheraton. While light of structure, they were generally strong, and such articles, made of Spanish mahogany, are still occasionally met with in a good state of preservation, which latter is partly due to the admirable workmanship that characterized all Sheraton's productions, and partly to the well-seasoned timber he employed. We illustrate below a table which has been adapted from one of his designs, and which we take from the columns of the *Furniture Gazette* of London. In giving sketches like these, our object is not to induce our readers to slavishly imitate them, but rather to enable cabinet-makers and designers to turn them to account in evolving new shapes and forms. Such examples, moreover, help to make modern craftsmen familiar with the distinguishing characteristics of the eighteenth-century styles.

The first saw-mill was erected in the Island of Madeira in 1420 ; and the next at Breslau, in Austria, in 1432.

Miscellaneous.

COVERED PULLEYS FOR BELTING.

In driving machinery which makes a great number of revolutions per minute it is often necessary to have comparatively small pulleys, and as for very high speeds the belt should be as light and thin as possible, some means of getting greater adhesion between the belt and pulley are required. To draw the belt very tight will not answer, as that means both straining the belt and putting a great pressure on the bearings next to the pulleys. To use a tightening pulley to increase the "arc of contact" is an awkward and troublesome expedient, as most who try it will find, even at low speed of belt, and one that causes friction and frequently destroys the belt. One of the best means of increasing the friction is to cover the iron pulley with some substance which will cause a greater friction between the surfaces of the belt and pulley. Wooden pulleys are sometimes used, but as they are apt to split, or get out of truth, they are not so reliable.

A very good plan is to make an endless band of rubber belting, and draw it tightly over the pulley ; the friction between it and the pulley being round the whole circle of the pulley, will always be greater than can well be got between the driving belt and the new face of pulley made by the rubber.

Another plan, and one often much more convenient, is to cover the pulley with leather. A good way to do this is to bore a number of holes around the circumference of the pulley, and drive hard wood wedges into these, then tack on any old belting or strips of leather of nearly uniform thickness. Having done this, put the pulley in a lathe and turn up the leather face carefully but with a rough surface, and then cement or glue on another coating of new leather all in one piece ; if possible, the joint had better be scarfed, and wooden pins may be driven through the leather, so as to fasten the whole together. This method has been successfully done even with large pulleys. In one instance, where a belt 22 inches wide was running on a pulley about 40 inches diameter and required a lightening pulley to prevent it from slipping and had frequently broken, the pulley was covered with leather in the manner described with the result that the tightening pulley was dispensed with, and a new belt gave no further trouble, and drove the machinery without any appreciable slip. The original belt had only been in use a few months, but was found quite brittle from overstraining, and broke short off across its whole width, the elasticity apparently being all exhausted.

It may appear a little troublesome to cover the pulleys, but once well done it is a permanent job and makes a great improvement in the wear and tear of the belt.—*Canadian Manufacturer.*

NEW WATER MOTOR.

A new apparatus for measuring the consumption of water has been introduced that appears to have the merit of simplicity and cheapness. It consists of two cast-iron cylinders, placed together at the bottom, and inclined from each other at an angle of about twenty degrees. They are supported on a pivot, and on this they are free to rock from side to side, as the weight of the water in one or the other causes it to move. These cylinders are connected with each other at the bottom, and are partly filled with quicksilver. There are also inlets and outlets for the water, controlled by the oscillation of the cylinders, which serves to move a registering device that marks the quantity of water that passes through the apparatus. The water, on entering one cylinder, drives out the quicksilver and it passes over the other cylinder. Here the weight of the quicksilver serves to rock or upset the cylinder, and its movement on the pivot opens the outlet port and closes the inlet port. At the same time, a second inlet port is opened and the water flows into the second cylinder, driving out the quicksilver. The same operation follows in the first cylinder, and thus the continuous passage of the water is secured, while the oscillation of the cylinders controls the registering apparatus.—*The Century.*

From the Syriac translation of the Bible we find that Pumps were invented by Otesibus of Alexandria, 224 B. C. and were wholly or partially made of cast brass or bronze.

JAPANESE ENGINEERS AND MECHANICS.

The skill and ingenuity of the natives of Japan, says an English exchange, have long been well known, and proof of these qualities is given by the aptitude which they display in learning the workings of railways and qualifying themselves to fill the more responsible of the subordinate positions. The Japanese, from whom for some time past all the station-masters and porters, as well as the plate-layers and artisans, had been drawn, have latterly been gradually replacing the English engine-drivers, and apparently with satisfactory results. The chief fault to be found with the native drivers is, seemingly, that they do not thoroughly understand the construction of the engines under their charge, but this is a matter which longer experience will rectify. There also appears to be a lack of presence of mind and watchfulness, and it is somewhat ludicrous to read of a driver starting with only half of his train in broad daylight, and not discovering the want of the other half until he had reached the next station. It is, therefore, not surprising that the strictest examination and supervision has to be kept on all engines under native drivers, in order to avoid any chances of failures or casualties. At the same time we are assured that very few mishaps have occurred —indeed, so far as misadventures with the locomotives are concerned, the Englishmen appear to have been quite as often at fault as their native fellows—while the increasing number of Japanese employed bears testimony to the confidence which is felt in their capabilities. In other capacities the native workmen display great skill, the carriage and wagon building, for instance, being carried on in a highly satisfactory manner by the Japanese foreman carpenter; and two engines, which had been transferred from one line to another, having been put together again and got ready for work by a native fitter, without any assistance from Europeans. The only complaint made against them is that they are somewhat slow. It is clear, however, that the Japanese are quite well enough qualified to carry on the workings of their railways; and, after the system has been completed, we should not be surprised to find that eventually they took the entire control into their own hands.

FIRE-PROOF INK.

It appears that the effort to manufacture a fire-proof paper and ink for either writing or printing purposes has recently met with success in Germany. Paper possessing fire-proof qualities was made with chemically-treated asbestos fiber ground or finely divided wood fiber. Ninety-five parts of asbestos was used with five parts of the wood fiber and by aid of glue water and borax were made into pulp, which yielded a fine, smooth paper, which could be used for writing purposes. It had the unusual quality of sustaining the influence of a white heat without injury. Fire-proof printing and writing inks were made by combining platinum chloride, oil of lavender and lampblack and varnish. These ingredients produced a printing ink, and when a writing fluid was wanted, Chinese or India ink and gum arabic were added to the mixture. Ten parts of the dry platinum chloride, twenty five parts of the oil of lavender and thirty of varnish are reported by a local writer to yield a good printing ink of this valuable kind when mixed with a small quantity of lampblack and varnish. When the paper printed with this compound is ignited the platinum salt is reduced to a metallic state and becomes a coating of a brownish-black color. A free-flowing ink for writing on the fire-proof paper with an ordinary metallic pen may be obtained by using five parts of the dry chloride of platinum with 15 parts of oil of lavender, 15 parts of Chinese ink, and one part of gum arabic, adding thereto 64 parts of water.

When the paper is ignited after being written upon with this ink, the platinum ingredient causes the writing to appear transparent, and, as a consequence, it is claimed that such writing as has become black or illegible will become rapidly legible again during the process of heating the paper. Colors for painting may also be made fire-proof by mixing commercial metallic colors with the chloride of platinum and painters' varnish, adding an ordinary aquarelle pigment to strengthen the "covering power" of the color. These fire-proof paints or colors can be easily used in the same manner as the common water colors, and it is claimed they will resist the destructive influence of great heat quite as successfully as the fire-proof printing and writing inks just referred to.—*Ex.*

A new steel manufacturing city will be created in the coal regions of southern Illinois.

HOW STEEL RAILS ARE MADE.

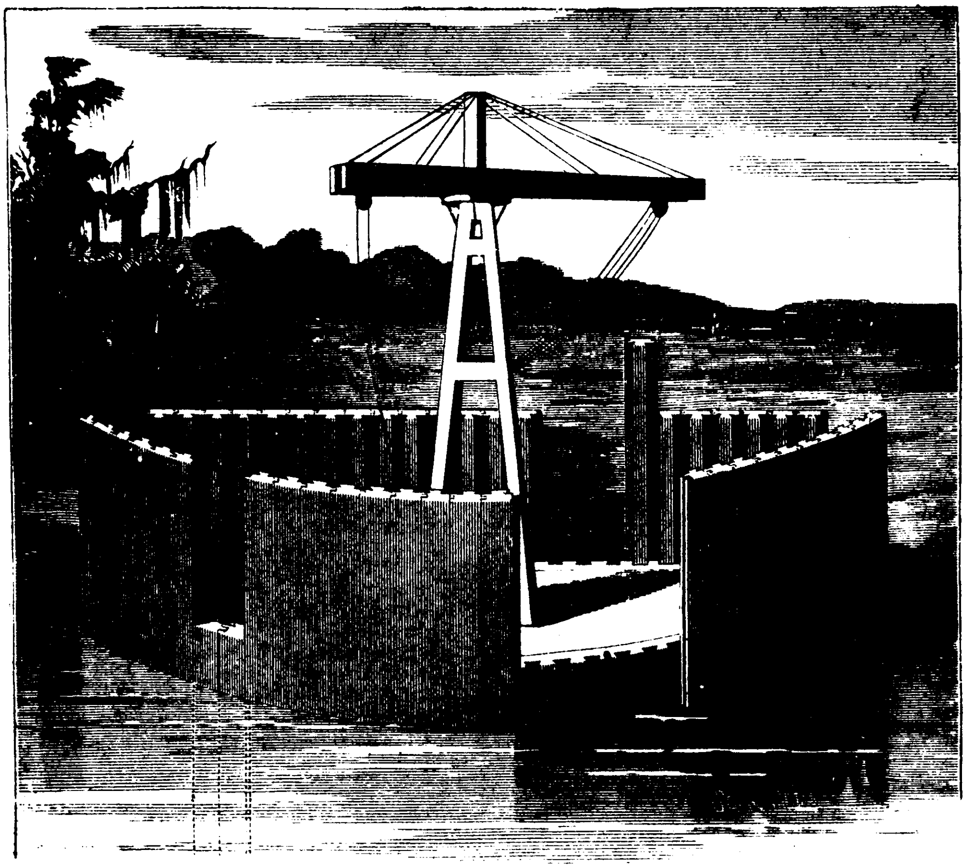
They run the steel into ingots about fifteen inches square and about five feet long, and then, while still hot, carry them to the mill, where they are put into a furnace until they get the required heat, and are then rolled into what are called blooms. These are seven inches square, and are cut, while still hot, with the shears, so that they will roll out into a rail of the required length. They are not allowed to get cold, but are again put into a furnace and reheated, and then run through a series of rolls in what is called a 21-inch mill. I inquired the meaning of this 21-inch, and was told that it meant the distance between the centers of the rolls. When the bloom passes through the last roll it is a finished rail, and runs on to a long carriage, where a saw at one end makes it just the right length. At the other end of the rail is what is called a cambering machine, to camber the rail. This was a new word to me, and I was told that camber means to bend and it did bend. It put a perfect curve in the rail the whole length of it; this is done so that it will cool straight. I was informed that, if the rail were straight when it was hot, it would be cambered when it was cold, so they camber it hot, and have it straightened cold. The rails are then run out of the works and loaded ready for shipment, so that from the time the ore is taken from the mine until it leaves the works all finished, it is never allowed to rest, and, when once hot, never gets cold until completed. The steel ingots especially are hurried off, for if they are allowed to cool they will crack. —*Mechanical Engineer.*

OIL FOR STORMS AT SEA.

Considerable discussion has recently occurred in the daily press regarding the effect of pouring oil upon the sea, at the time of a storm, for the purpose of lessening the action of the waves. It seems to be clearly established that oil thrown from a vessel into the ocean will lessen the effects of a storm. In October, 1861, the Port Royal expedition started from Fortress Monroe, under command of Dupont. A fearful storm was encountered off Hatteras, and it was thought that a small side-wheel steamer, called the "Vixen," could not possibly survive. But as the flag-ship approached the rendezvous off Port Royal she was seen quietly at anchor, having reached there among the first of the squadron. The commander, Mr. Platt, in relating the experiences of the storm to his chief, Mr. Boutelle, modestly recounted that, when the storm grew too heavy for him to keep his course, he had brought the vessel's head to the sea and had put out a drag to assist him in keeping her in that position. As the storm reached its height and the huge waves frothed and combed they began to break on board and the vessel was in great danger. He then poured about a gallon of oil overboard, just abaft the lee paddle-box. It drifted with the vessel and soon formed an oily scum about her, after which not a sea combed or broke on board, and she rode out the gale in safety, arriving at the appointed rendezvous in advance of many vessels of enormously greater power and speed. Mr. Boutelle immediately reported the circumstance to his official superior, Professor A. D. Bache, superintendent of the Coast Survey.

A WHITEWASH THAT WILL STICK AND WASH.—We find in a German paper a formula for a wash which can be applied to lime walls and afterwards become waterproof so as to bear washing. Resenschek, of Munich, mixes together the powder from three parts silicious rock (quartz), three parts broken marble and sandstone, also two parts of burned porcelain clay, with two parts freshly slaked lime, still warm. In this way a wash is made which forms a silicate if often wetted, and becomes after a time almost like stone. The four constituents mixed together give the ground color to which any pigment that can be used with lime is added. It is applied quite thickly to the wall or other surface, let dry one day, and the next day frequently covered with water, which makes it waterproof. This wash can be cleansed with water without losing any of its color; on the contrary, each time it gets harder, so that it can even be brushed, while its porosity makes it look soft. The wash or calcimine can be used for ordinary purposes as well as for the finest painting. A so-called fresco surface can be prepared with it in the dry way.—*Sci. American.*

The electric will effect the colors of cloths, as well as paintngs, in the same way but not so quickly as sunlight.



GOSSIN'S FLOATING DOCK FOR STOPPING CREVASSES.

METHOD OF STOPPING CREVASSES.

Owing to the want of sufficient elevation, both banks of the lower Mississippi river, except at a very few points, are subject to inundation whenever there is a freshet in the river, and earth embankments are thrown up, to protect the rich lands that border on the river. Sometimes a crevasse, as a break in the levee is termed, occurs from too great pressure of water, or imperfect construction of the levee, and no one who has read the daily papers for the past few months needs to be told of the great destruction of property, loss of life, and the want and misery that follows from a crevasse. No certain means of stopping them has been devised; the necessity for such a means was never greater than at present.

In the accompanying engraving is shown Gossin's floating dock for stopping crevasses, which is a flat-bottomed boat of any suitable length, from two to six hundred feet, having one of its sides straight, while the other is curved to better resist the pressure of the current. The boat is provided with water valves of sufficient capacity to secure a rapid sinking by the admission of water, and also with pumps to discharge the water after the break is closed. In the external surface of the hull of the boat are formed perpendicular dovetail grooves, which receive corresponding projections on one of the sides of heavy planks or piles. The location of the grooves is such as will secure close contact of the piles when they are in position on the boat. Cranes to which are connected pile drivers are placed in the boat. In stopping a crevasse, after ascertaining the precise depth of the water in the break over the natural surface of the bank, the dock, completely surrounded by the coating of piles, is taken by a tow boat just above the crevasse, the curved side being next the shore, and fastened at its lower end by strong ropes. The dock is then sunk by admitting water, until the bottom is lower than the natural bank, when by the influence of the current its upper end is swung around until it comes in contact with the levee below the crevasse, the straight side being next to the shore. The pile drivers are instantly put into operation, to drive the piles into the earth, first upon the straight side, and if that does not stop the water, then upon the convex side, and if it is necessary, a tarpaulin may be lowered on the outside of the boat in such a manner as to cover the whole face of the piles and a few feet of the bottom beyond the piles, and this will be found absolutely effectual. As soon as the flow of water is stopped, the levee is thrown up anew and the piles are drawn, and the dock may at once be taken to another crevasse if needed.

Further information in regard to this ingenious device may be obtained from Mr. A. Gossin, Lafourche, Lafourche Parish, La.—*Sci. American.*