CANADIAN MECHANICS MAGAZINE AND PATENT OFFICE RECORD

Vol. 4. JULY, 1876. No. 7.

BUILDERS, AND THEIR RESPONSIBILITIES.

IN using the term "Builder," it is necessary that we should, in the first place, explain who we understand to come under that title. A builder may be a contractor, but it does not follow that a contractor is a builder; between these two terms there does not appear to be drawn, in this country, the proper line of distinction. As we understand it, a builder is a person who is master of the mode of construction, which includes a knowledge of all the other trades necessary to complete a perfect edifice of any kind. A contractor may have no knowledge whatever of the details of construction, or he may know only one particular trade, such as masonry, carpentry or painting, and, therefore, when he tenders for the construction of a building, he is simply a contractor, one who contracts for a certain sum of money to carry out certain work in accordance with specifications and drawings. Builders in the full sense of the term are not numerous in Canada. In Montreal we have but few who could be so classed; all the rest are only contractors with a knowledge of one particular trade, and such a superficial acquaintance with the other building branches as to be often an impediment to the progress of the work undertaken.

The responsibilities of a builder, according to the law of the Province of Quebec, are very great. For ten years he is answerable for giving way of any part of the structure he has erected, arising from causes that can be laid to his door. Not even if he can show that the architect was incompetent, and the strength of the materials provided for in the specification was inadequate for the purpose required, will it exonerate him from the responsibility; not even if he enters a legal protest, and yet still goes on building, can he claim exemption from the law that makes a builder, in this Province, for ten years responsible for his work. In certain cases this law is a very hard one and requires modification.

The reason why we have so few competent builders in Canada is because so few thoroughly learn the business, so few in fact are educated to it as in England. There a young man generally serves his apprenticeship, perhaps for seven years, in acquiring a knowledge of this most important branch of the architectural profession. It does not follow that he should be able to use the tools himself in all the trades that appertain to the business, although many, in the mother country, are master workmen in nearly every branch; but he should possess a perfect knowledge of all the practical methods of construction, the value of building and decorative materials, the strength and quality of iron, and the quality of cements, mortars, &c. He should likewise be a good book-keeper to keep his accounts correctly, and sufficiently of a draughtsman to draw out all his own working plans. When an architect has the good fortune to have a tender accepted from a builder—in the term as we understand it—he feels that he can place reliance on the work being properly executed during his absence; but when, on the other hand, he has to deal with a person who has a knowledge of carpentry only, and no knowledge of masonry or other portions of the work, as too frequently happens to be the case, his time, from the laying of the first foundation stone until the key is turned in the door of the building when completed, is often a period of anxiety and vexatious disputes about inefficient work and the use of improper materials. The contractor in such a case, not being a trained judge of work to which he has not been educated himself, cannot understand the points of objection raised by the architect, and too frequently sides with those he employs to undertake branches of the business with which he has no acquaintance.

To obviate this difficulty, architects frequently have to accept contracts for a building in separate portions; masonry, carpentry, roofing, painting, &c., being undertaken by separate contractors; but in such cases, he is more than trebling his own superintendence, when one skilled builder could have better performed the work. We do not mean to infer that because we approve of a professional class of builders, we are to endeavour to shut out those carrying on other branches of building and thus making a monopoly; we merely consider that the builder should become the party under whom they should contract, instead of coming into direct contact with the architect, and the builder should be the only one answerable to the architect for the performance of the whole work in all its branches.

The law as it now stands leaves it in the power of a contractor frequently to cause great delay in the execution of the work, when he thinks an architect unnecessarily strict, by protesting, through a notary, against his orders. In all cases of dispute, the question at issue should be left to professional arbitrators, or experts, whose decisions, on such matters, should be final.

In concluding these remarks on the architectural profession, we desire to say that in no respect whatever are they intended to apply individually to any person or to any class: they have been given with the hope that they may lead the profession, in all its branches, to reflect, and consider in what way they can combine together, and obtain a law properly defining their duties and privileges, and doing away with any distinction, in the eyes of the law, between themselves and their brethren in the other Provinces; and, also, in the hopes that such a combination would stimulate its younger members to endeavour to raise their standard of excellence equal to that of the mother country.

SANITARY ARCHITECTURE AND ITS APPLIANCES.

MR. F. N. BOXER,

Editor of the CANADIAN MECHANICS' MAGAZINE.

SIR,—I have read with much interest the portion of your article upon "*Sanitary Architecture and its appliances*," contained in the April issue of the CANADIAN MECHANICS' MAGAZINE, and in this connection, if you will permit me, I desire to lay before you and your readers some considerations derived from my own experience in this department.

I am particularly moved to this communication because I have never yet found in point a statement of the true conditions at once so complete and so concise as is contained in your answer to "objections" to Professor Godfrey's plan. You will therefore not fail to understand and appreciate what I have to say. It very seldom happens that the same mind conceives and elaborates any plan of extensive application, and no investigator in the department of Sanitary Engineering can fail to be struck with evidences of pure theory without any basis in common sense. The plan suggested by Professor Godfrey appears to be admirable *in the building where he has placed it*, and will be equally effective wherever the same favorable conditions exist. Those favorable conditions consist of a constant and *strong* upward draft through the stand pipe. Its weak point is in the unreliability of such conditions. It is not in every building such a draft can be secured, nor do I know of any way in which it can with any certainty be predicted.

There is one prime fact which must not be overlooked for a moment in considering this subject, viz., that every inch of interior surface of a waste pipe soon becomes foul and stinking. Therefore in Professor Godfrey's plan the draft must be *strong*, in order to draw in through the closets and wash bowls a current of air sufficiently strong to carry down with it all the odor arising from the foul interior of the connecting waste pipe. If this current is not *strong* it will not so carry away these odors, but they will find their way upward into the apartment. In this connection it is pertinent to inquire what is the source of this strong upward draft in Professor Godfrey's stand pipe. Is it due to causes in the house, or in the sewer? If it is due to causes in the house, then it is evident that Mr. Springle's running trap will be an advantage, because it will restrict the sources of supply to the apartment and will also restrict the quantities of odor to be removed to that supplied by the drain pipe itself, and it certainly is not *desirable* to a householder to make his house a duct for sewer ventilation, that should be accomplished by independent means.

If the source of this current is in the sewer, then it is evident there would be an escape of it through the laterals leading to each closet, bowl, &c. It would be highly desirable to prevent that, and the fact that Professor Godfrey's house is not filled with sewer gas shows that the cause is not in the sewer and that the running trap ought be employed.

The defect of Alderman McLaren's plan is analogous to the defect of Professor Godfrey's plan, viz., it does not provide against the escape into the apartment of stenches from the interior of the closet itself. And in this respect Mr. Springle's plan is no improvement. Excrement remains in the trap until dissolved, and principally on the closet side. From this effluvia will certainly arise, and have but one way to escape, to wit, into the apartment. The only method of preventing the escape of foul odors with Professor Godfrey's plan and a feeble draft, or from the closet traps of Mr. McLaren's plan, is by ventilation applied to the closet *above the highest point* to which the foul surface can extend, and even that alone will not be effectual except when coupled with a structure which will ensure the passage of sewer gas and odors *into the ventilator*. That method of applying ventilation is my invention. It has proved upon trial to be the perfection of sanitation in protecting inhabited apartments from sewer gas and foul odors from closets and waste pipes of all descriptions. It has gone extensively into use in this city during the past year, and is approved by the official architects of the United States Capitol and of the Treasury Department. It is also in successful use in many other places throughout the United States, from Maine to Georgia, and Iowa.

You will find my system fully described in the accompanying pamphlet, and it only remains for me to add that the ventilation pipe for the closets, &c., should *not* be the soil pipe which receives the rain water.

Respectfully,

R. J. O. SMITH.

Washington, D.C., 3rd May, 1876.

We have much pleasure in bringing before the public our correspondent's remarks on this important subject. We have said before that Dr. Godfrey's plan was excellent, but like all other plans, subject to modifications according to circumstances. We repeat our former assertions, however, that the main cause of trouble in drains and water closets lies in imperfect workmanship and the want of efficient officers to superintend sanitary matters.

VIEW OF THE GREAT FLOOD ON THE OTTAWA RIVER.

The sketch furnished on page 196 shows the great height of the water under the Suspension Bridge. The falls, which are within a couple of hundred feet of the bridge, were almost obliterated by the boiling surge of waves, heaving and twisting through the narrow gorge of limestone rock, with a gigantic power that threatened at one time to carry bridge, piers, and even the solid rock away in its impetuous course.

KELSEY & MULTER'S IMPROVED METHOD OF MANUFACTURING GRAIN CRADLE-FINGERS.

(See page 209.)

On page 209 we afford an illustration of this method of making grain cradle-fingers by which as much work can be accomplished as twenty-five to thirty men could do by hand in the usual way. The operation of cutting out the grain cradle-fingers is performed by means of a serrate-edged or denticulated knife, Fig. 1, set in a rotatary cylinder cutter-head, and which is passed over, or under, a tapering piece of timber, Fig. 2, grooving it out, on one side first, so as to form a set, more or less in number, of grain cradle-fingers, at the same time giving them an elliptical, or other sectional form, as shewn in Fig. 5. Then, after being bent, as in Fig. 5, the reverse side is passed over the knife, thus completing a whole set of cradle-fingers, but leaving them attached at their ends.

The advantage of cutting a lot of cradle-fingers out of one quality of wood, and of bending them in an uniform manner, to any curve, and still keeping them attached at their ends until they have become thoroughly set by seasoning, will be obvious to all manufacturers of agricultural implements. The knife is formed in one solid piece, or may be made in sections, and blocked together into one blade.

Patented in Canada through the Editor of the CANADIAN MECHANICS' MAGAZINE. For further particulars address J. L. Multer, Richmondville, Schoharie Co., New York.

THE CITY OF FIRES.

On page 197, we give a sketch of the great fire at Quebec, which, on the afternoon of the 30th May, laid in ashes nearly 500 dwellings, and made over 3,000 persons houseless. The sketch only partially illustrates the extent of the fire, as it swept over a narrow strip, and terminated at the fortifications when it had no more inflammable material whereon to feed. To-day we have the news of another great conflagration in the town of St. Johns, about 24 miles from Montreal, which, in point of the value of property destroyed, exceeds even that of Quebec.

We consider it the duty of newspapers, and periodicals of a scientific nature, not only to record in their columns the occurrences of such terrible disasters, but to sift out the case, and if found attributable to negligence, want of forethought, parsimony, or apathy of the citizens, to pass upon those culpable the severest censure such conduct merits. The simple recordance of the fact that a large fire has taken place, the amount of property lost, and the sums of money insured in different insurance offices is not enough. The want of prudence and forethought in any community to provide efficient means to put out a fire before it has gained headway sufficient to be uncontrollable, is a crime against society; and the parties responsible should not only be exposed in the public papers, but should be made punishable by law. We have not before us any reliable statement as to the efficiency of the fire brigade and fire engines at St. Johns; but we well know that at Quebec, the inefficiency of the staff, and the whole machinery, was a disgrace to the city; and no censure, however severe, is strong enough to record the fact. We were an eye witness of the fire from its commencement to the end, and had not the wind changed, and lulled at the same time, no human effort could have saved the whole of the western suburbs above St. Rochs, the town inside the walls, and probably the lower town and shipping. The fire commenced within a few feet of a fire engine house, and not a drop of water could be obtained from the water works, or was any reserved on hand for an emergency; even the wells in the *immediate vicinity* seemed to have been forgotten, and were only brought into use at 10 o'clock at night.

It is now over twenty years since the water works were constructed at Quebec; at that time the engineer, Mr. Baldwin, strongly advised the construction of a reservoir on the highest point of land outside of the citadel. This advice was set aside on account of the cost, and before the works were fully completed, Mr. Baldwin was dismissed, because he received a salary of $4000 a year, in order that his place might be filled by friends of members of the Corporation, who were totally unfit, both by education and practical experience, to superintend and manage such important duties. The inefficiency of the staff grew so apparent that proposals were shortly afterwards made to the late Mr. Chessell, C.E., of the Royal Engineer Staff, to accept the appointment of manager and chief engineer. This gentleman was well qualified for the important duty, but knowing the petty intrigues to which Mr. Baldwin had to submit by certain members of the Corporation, who, also, were constantly interfering with the work when their friends had contracts, he gave the City Council very plainly to understand that the first of its members who should attempt to interfere with his superintendence, he would throw him into the excavation. Such an independent spirit was not desirable, and the negociations there ended. We watched the progress of the laying down of the water pipes in Quebec, and do not hesitate to state that the construction was faulty in the extreme; but for much of thi: their engineer, Mr. Baldwin, was not to blame, but only for a want of sufficient independence in not throwing up the management of them at once, when the most essential points necessary to make them perfect was rejected by the Corporation. We cannot go into details as to the mass of ignorance displayed by the city authorities from the time the water works were commenced until the present day, and what large amounts of the public money have been squandered away in fruitless experiments; to our own knowledge, we know of a former mayor of the city, who, in the plenitude of his wisdom, caused an expenditure of several thousand dollars to carry out a theory of his own. So absurd was it, that we placed in his hands the opinion of the highest authorities on the subject of water works to deter him from a most useless expenditure of public money; the result was as foretold—the money was spent, and the pressure in the pipes reduced to less than it was before.

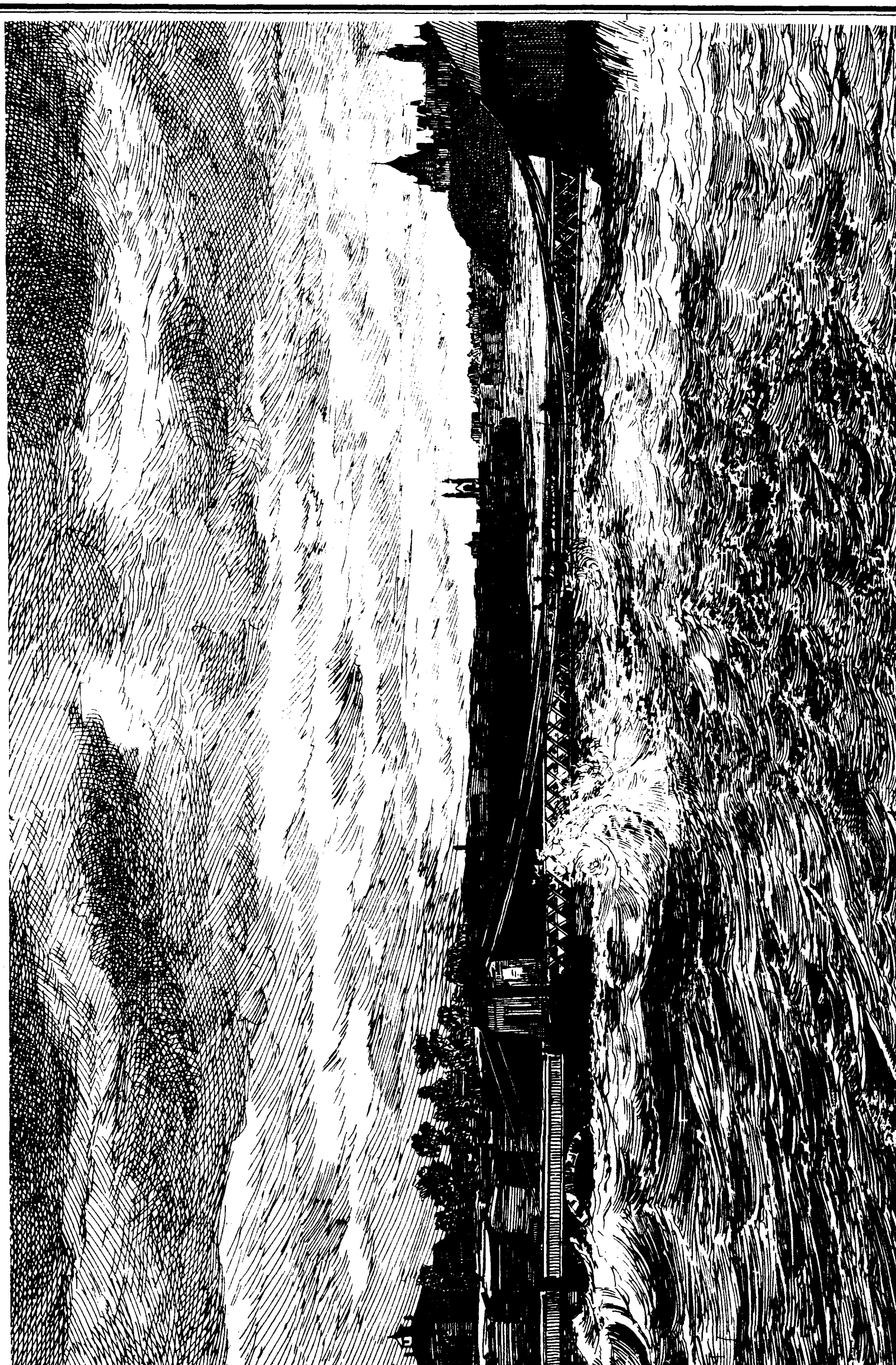
We know enough of these matters to assert that more money has been uselessly expended on the water works in Quebec since the first pipe was laid down, than would have built three reservoirs, and have given the city a Fire Establishment, equipped and disciplined as well as that of Montreal; and therefore upon its public men does the censure and responsibility now lie. To think that with a water head of nearly 480 feet, being considerably over the highest land in the city, the supply is so short that it can only be given to the city in sections, and at certain hours, is simply ridiculous. The deficiency of water cannot be set down altogether to the smallness of the main pipe and to loss of pressure from friction, but to other causes, such as imperfect workmanship, leakage and obstruction in the pipes, and engineering errors. It would come hard upon those who have for years paid for insurance and have never been burnt out, to be deprived of its advantages, but it is only by the withdrawal of the insurance offices altogether from such cities, that its citizens will awaken to their responsibilities and interests.

THE GREAT DOLWILYM CROMLECH.

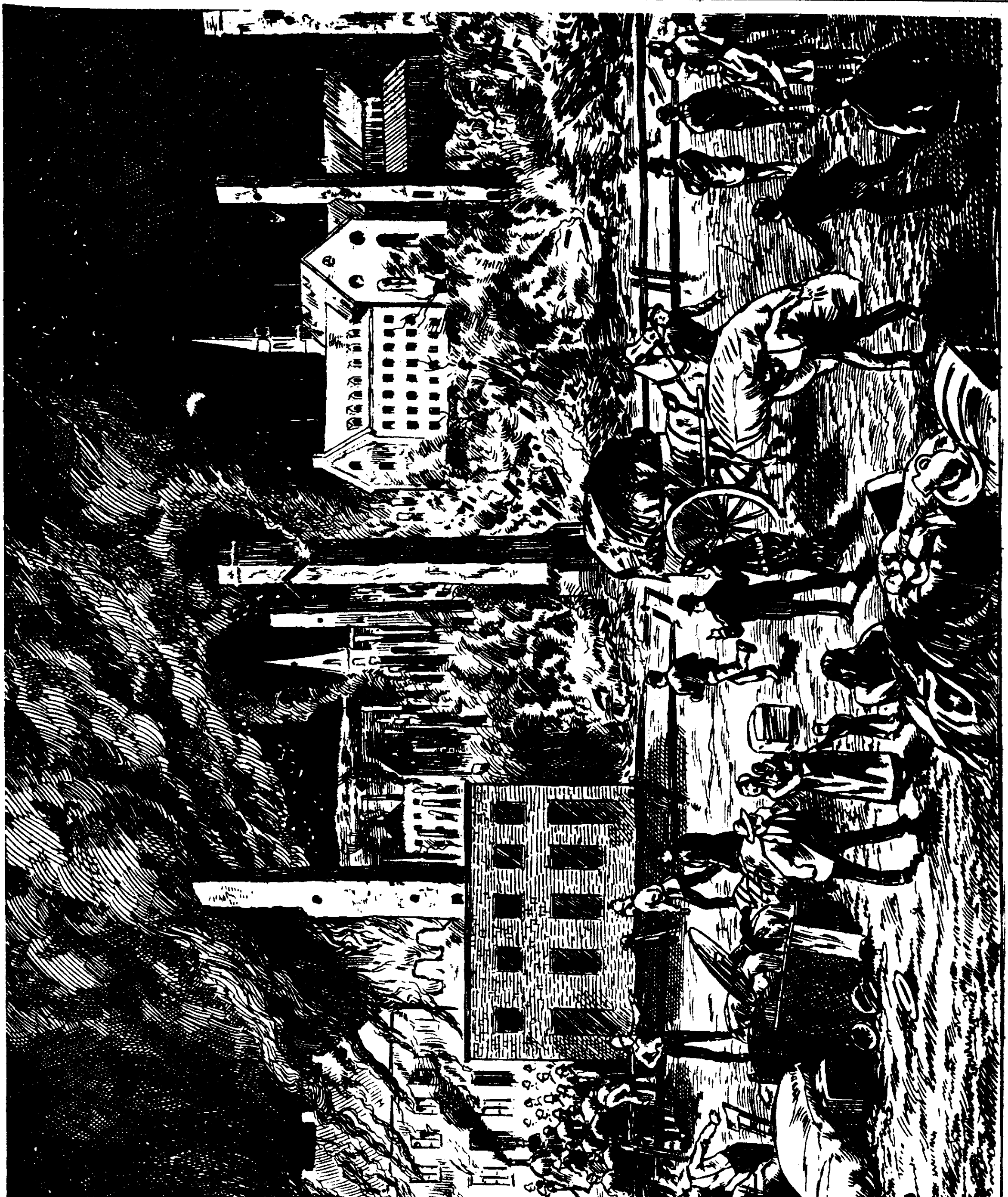
(See page 224.)

The sketch given of this grand pre-historic structure is taken from the London *Builder*. It is said to be one of the most perfect and interesting of the Druidical remains in Wales. Originally it consisted of five or rather six stones. The tallest upright stone is 4 ft. 4 in. high, and the gigantic cap-stone measures 11 ft. 6 in., by 8 ft. 10 in.

When the chambers formed by the upright stones of cromlechs are examined for the first time, unquestionable evidence of burial is invariably found; it may therefore reasonably be inferred, that as all cromlechs are so much alike in general design, they have all been constructed over places of burial. It is also generally supposed that the interstices of the stones were originally filled up with rubble-work, and the whole structure covered with a mound of earth. The labour of erecting some of the dolmens found in this country must have been immense, and the honours of cromlech burial must have been extended to a very limited class, a class belonging to a past time so remote that, as far as present knowledge goes, no date can be assigned to it.



THE GREAT FLOOD, CHAUDIÈRE BRIDGE, OTTAWA.



THE GREAT FIRE AT QUEBEC.

CONCRETE AS A BUILDING MATERIAL.

We afford some extracts from the proceedings of a general meeting of members of the Royal Institute of British Architects in April last.

We consider the consideration of concrete as a building material, a subject deserving of important consideration by both Engineers and Architects in the Dominion; and believe that it might be used to great advantage as a decorative, cheap, and durable facing foi wooden houses, irrespective of its great importance for other structures. As usually in such discussions, there was much to be said for and against, but we learn sufficient from the arguments used to know that,if concrete can be produced in slabs at 5c per foot super, in England, we possess the material to make it in this country nearly as cheap, and that the suggestion of Mr. W. H. Lascelles might be turned to great advantage in the manufacturing of ornamental concrete slabs for the decoration and facing of timber houses.

Mr. Alexander Payne, associate, then read a paper "On Concrete as a Building Material." He commenced by noticing the Essay by the conductor of this journal to which the first medal of the Institute was awarded, and which appeared in the "Transactions" many years ago, and then proceeded to give a brief review of the subject as it stands at the present time, and noted the principal patents that have been taken out of late years in connexion with concrete building, which were arranged under the following heads:—Firstly, apparatus for moulding walls; secondly, various kinds of building blocks; and, thirdly, compositions for making concrete. On looking at the results of these inventions, it must, the author feared, be admitted that they had not done much in striking out a new line for the employment of concrete, though they might have improved the material. By far the most common mode of building still practised, and perhaps the best for most purposes, was the old method, described by Alberti, of placing planks on each side of the intended thickness of the wall, and pouring pebbles and mortar between, moving the boards when the compound was set. It was conceded on all hands that concrete buildings were durable, strong, dry, and not expensive; but the general outcry was that they were ugly, and the question arose whether this alleged unsightliness was owing to some inherent deficiency in the material, or to the neglect of the subject by architects. Or was it due to the endeavour to mould the material into shape and forms that had been employed in brick and stone built up in a totally different way? Mr. Payne was inclined to think that the latter causes had the most to do with it. He then proceeded to give some suggestions for the architectural employment of concrete in the future, which were divided under the following three heads, viz.:—(1.) How can the apparatus for moulding and constructing concrete walls, roofs, arches, &c., be simplified and turned to artistic account? (2.) Does not iron offer special advantages for use in connexion with concrete? (3.) What is the proper way to ornament concrete walls, arches, and roofs, in accordance with the peculiar properties and nature of the material? Under the first head, it was suggested that the apparatus for moulding concrete buildings might frequently be made a permanent part of the structure by forming a light skeleton framework of wood or iron, of ornamental design, for supporting a temporary moulding-board, and then filling up with concrete. Under the second head, it was stated that no two materials were so admirably suited to go together as iron and concrete. With the one a light skeleton framework could be made of almost any dimensions, and of great strength and lightness; and in the other we had a plastic material that could be moulded into any shape, and could be made to enclose the skeleton and give it substance and solidity; and it was well known that if iron was completely embedded and kept from the air, it was entirely protected from rust and oxidation. But, more than this, iron was just the material to give to walls the tensile and building strength they lacked, and to counteract the failures that most commonly took place in brick and stone construction. As to the ornamental appearance of houses built in iron and concrete, the effect would not be unlike that of the half-timbered houses of the middle ages, but the ironwork would be capable of greater freedom of treatment than the ancient woodwork. Under the third head, viz., "What is the proper way to ornament concrete walls, arches, roofs, &c., with due regard to the peculiar nature of the material?" the author submitted that instead of imitating the projections of stone and brickwork, the aim in concrete work should be to obtain as large wall-spaces as possible, and as few projections, and to ornament instead by indentations. There had been no building material employed which offered such facilities for rich ornamentation by this means, at a comparatively trifling cost, as concrete. It was pointed out that most of the magnificent decorations of the Alhambra and the Mahommedan buildings of India were produced by incised ornament of this description; and there could not be a better or more suitable method for ornamenting a concrete façade. Examples were given of how this might be effected by movable dies fixed on the moulding-boards used in concrete construction. This method was in reality bringing the principle of the printing-press to bear upon the ornamentation of a building, and had its practical as well as its artistic side, by substituting letters for ornamental designs. Where permanent advertisements or records were required, or where it was desired to preserve an account of the origin or purpose or any building, why should not such account be printed in the solid wall in concrete, and be made to form part of the structure and design of the building? Could we not, in fact, in this respect, often advantageously follow the example of Assyria and Egypt, and, without going back to cuneiform characters or hieroglyphics, still usefully record on our buildings the purposes for which they were erected? It was also shown how, by the same method, a veneer of tiles, marble, or plaques of a particular shape, might be bedded on the surface of the wall, and how the stone and flint panelled work of Essex and Suffolk might, in the same way, be readily done in concrete. Plaster decorations and *sgraffito* were then referred to as being eminently suitable for the decoration of concrete; and the authorities of the South Kensington Museum were said to have rendered good service to the English public by giving practical illustrations of the beauty that might be obtained by this mode of decoration at the back of the Science and Art Schools at Kensington, and at the National Training School for Music, adjoining the Albert Hall. The author concluded by giving examples of the methods suggested for the employment of concrete, and by showing how they might be advantageously applied to domes, vaults, and other structures.

DISCUSSION.

Mr. Charles Barry said he had not used concrete at all, except for foundations, and he confessed that he should have great hesitation either in using it or in permitting its use in the methods treated of in the paper,—not on account of any doubt as to its strength, for he should have every confidence in its being used scientifically and substantially, especially if the construction of the building were to be superintended by one so conversant with the subject as the reader of the paper appeared to be. One of the most valuable of the many suggestions contained in the paper was that of using iron as a framework. Indeed the Improved Industrial Dwellings Company, of which Sir Sydney Waterlow was chairman, had for several years past used iron in combination with cement concrete with very good effect, especially for such purposes as steps, landings, and lintels, which were rendered enormously strong by embedding small pieces of iron in concrete. But although concrete building, when thoroughly well done, was possessed of great strength and durability, yet if employed by inexperienced or unscrupulous builders, it was a material which offered greater opportunities for "scamping" than stone or brick, either by the use of bad materials, or by insufficiency of labour in mixing, &c. It should be remembered that a badly-constructed concrete house was likely to fall much more suddenly than a badly-built brick one. A brick building generally gave sufficient warning of its intention to fall, but bad concrete buildings collapsed without having previously exhibited the slightest indication of instability. The suggestions made by Mr. Payne as to the ornamentation of concrete buildings by projections and indentations were very ingenious, but it was extremely questionable whether concrete buildings so ornamented would be cheaper than brick buildings with the same amount of ornamentation. It was to be regretted that Mr. Payne had not included in his paper some indication of the cost of producing anything like architectural effect with concrete as compared with brick or stone, but possibly sufficient experience had not been acquired in that direction to enable an accurate comparison to be drawn.

Mr. W. H. Lascelles, on the invitation of the president, then proceeded to describe the construction of his patent concrete slab cottages, &c. These erections, of one of which a considerable portion had been put up in the Institute meeting-room, consist of an inner framing of timber uprights, or studs, 3 ft.

apart. To these studs the concrete slabs are fixed. They are 1 in. thick, and are formed of Portland cement and coke-breeze, upon the principle patented by Mr. Matthew Allen, and used in the industrial dwellings built for Sir Sydney Materlow's company. The slabs are 3 ft. by 2 ft., and are moulded in wooden moulds, so as to present on the exterior surface the appearance of a number of hexagonal or other shaped tiles. The following is the mode of manufacture :—The mould is first well oiled, with any common oil ; then a thin layer of Portland cement, mixed with Spanish brown (for colour), is poured into the mould, and upon this the concrete, of the ingredients before named, is placed and after remaining for three or four days the slab can be turned out of the mould. The cost of each of these slabs, Mr. Lascelles went on to say, was only 1s. 6d., or 3d. per foot super. They were quite fire-proof and water-proof, and would permit a nail to be driven or a screw to be turned in them without cracking. It was not found that the vertical joints between the slabs admitted water. The inner surface of the slabs formed the inner surface of the wall, the wooden studs or uprights occurring every 3 ft., thus leaving the walls only 1 in. thick in the thinnest part. Notwithstanding this, Mr. Lascelles said that dwellings constructed in this manner were warmer, and generally more perfectly weather-proof, than houses built with walls of 9-in. brickwork. The wooden studs were left exposed, being stained or varnished, while the inner face of the slabs could be panelled or otherwise treated in colour. Mr. Lascelles also exhibited a sash-bar made of concrete, with a thin bar of iron embedded in it, and in another part of the room were erected the concrete mullions and transomes of a large oriel window constructed in the same manner for a house for Mr. Marcus Stone, from plans by Mr. Norman Shaw. Indeed, Mr. Lascelles said he had even gone so far as to make concrete joists (!) in the same manner, but found that they were more costly than wood. Mr. Lascelles also exhibited ceiling slabs (1 in. thick) of concrete, and combined floor-and-ceiling-slabs of the same material, the upper surface serving as the floor of one room, and the lower surface forming the ceiling of the room below. Mr. Lascelles stated that although the tiled slabs were three parts composed of coke-breeze, fire would not touch them, and they had, on this account, been patented as a material to be used in preference to iron for the fireproof double-doors required by the Metropolitan Building Act to be provided in the walls of warehouses beyond a certain cubical capacity. The concrete slab houses built by him on the principle described were 20 per cent. cheaper than houses built in the ordinary way with brick.

Mr. Redman said there was, no doubt, a great deal of force in the objections urged by Mr. Barry as to the hasty or indiscriminate use of such a material as concrete for building purposes ; but still, considering the great revolution which had taken place within the last twenty years by the introduction of concrete into engineering works, the experience which must have been gained from the experiments systematically carried out on a large scale on all works where concrete was largely employed, must have created a large fund of information available to those who would seek it. A palpable defect in concrete was the growing or enlargement of the mass due to the "blowing" of the imperfectly burnt lime or cement, and attention had been called to this in Mr. George Godwin's paper, already referred to. This was in reality the reason of the failure of Ranger's concrete, which was well known forty years ago, and of which several houses still stand at Northfleet and Rosherville, in Kent. It failed when applied to the purposes of a large river-wall in front of Woolwich Dockyard. It was absorbent, and flaked off by the action of the atmosphere. Mr. Stoney, of Dublin, had carried out, perhaps, the most extraordinary feat on record in the use of concrete : he had deposited blocks of concrete, for the base of a wall upon the shore of the Liffey, weighing 350 tons each.

Mr. Thomas Blashill said that the author of the paper proposed to use timber as well as iron in combination with concrete ; but how did he propose to provide for the expansion of the wood when the wet concrete came in contact with it, and for its subsequent shrinkage ? Another point upon which information was needed was as to the manner in which it was proposed to obviate the inconvenience and unpleasantness caused by the dripping from a concrete roof of the water condensed from a heated atmosphere. He remembered the late Mr. Charles Fowler describing the annoyance which he experienced from this cause, and the evil was only obviated by lining the roof with wood. With regard to the mode of building described by Mr. Lascelles, it was almost precisely similar to the weather-tiling so largely used in Kent and elsewhere, to which it was only to be preferred in the event of its being cheaper.

Mr. Edwin Nash said that, notwithstanding the immense antiquity of concrete, there was much yet to learn respecting it. He held in his hand a piece of what he termed "Nature's concrete," which, he supposed, was about thirteen thousand years old. It was from Beckenham, in Kent, from a large field in which all the gravel had been extracted. In digging out the gravel the men came to enormous masses of this concrete,—for such it was to all appearance—which they could not break up ; these masses were, therefore, left as they were found, and now that all the gravel was removed, the place presented somewhat the appearance of a field dotted with a number of haycocks. This hard substance, which was not to be distinguished from the concrete of the present day, belonged to the formation known to geologists as the Reading and Woolwich beds. It was very proper that architects should be cautious as to the use of concrete, and although he had seen some very good walls built with it, he had some misgivings as to their permanency, on account of their want of homogeneity. Now, concrete itself was a most homogeneous material under certain conditions, and homogeneity was one of the first requisites of a good building ; it was doubtful, however, whether the embedding of iron in concrete would tend to promote that homogeneity, for he had found from observation that concrete, although it swelled in setting, afterwards gradually shrank if placed above ground. There was a long sea-wall built in concrete at Bognor, Sussex, in which, at nearly regular intervals of from 70 ft. to 100 ft., there were perpendicular fissures all the way up from the bottom to the top of the wall. Possibly the fissures would be found to cease in the portion of the wall underground, or in contact with moisture. This was not the only instance of the kind which could be cited.

Mr. Banks said he had some little experience of concrete building in the North of England, and he must candidly confess that the more he knew of it the less he liked it. He thought its use was not to be justified when other materials as good and as cheap (or nearly so) were available, except when some special reason, such as the utilisation of slag or other refuse, rendered it advisable. He could corroborate what Mr. Nash had said as to shrinkage, for he had built a church and schools at Whiteheaven which now showed various fissures which could only be due to shrinkage of the material. The question of utilising blast-furnace slag for concrete was not yet solved. The blast furnaces were continually discharging immense quantities of extremely valuable waste, if the expression might be allowed, and he firmly believed that hæmatite slag, when properly prepared, was better than Portland cement.

Mr. Cunningham (representing the Broomhall Tile Company) said for two or three years past his firm had been supplying slabs for facing concrete made from the refuse of blast furnaces.

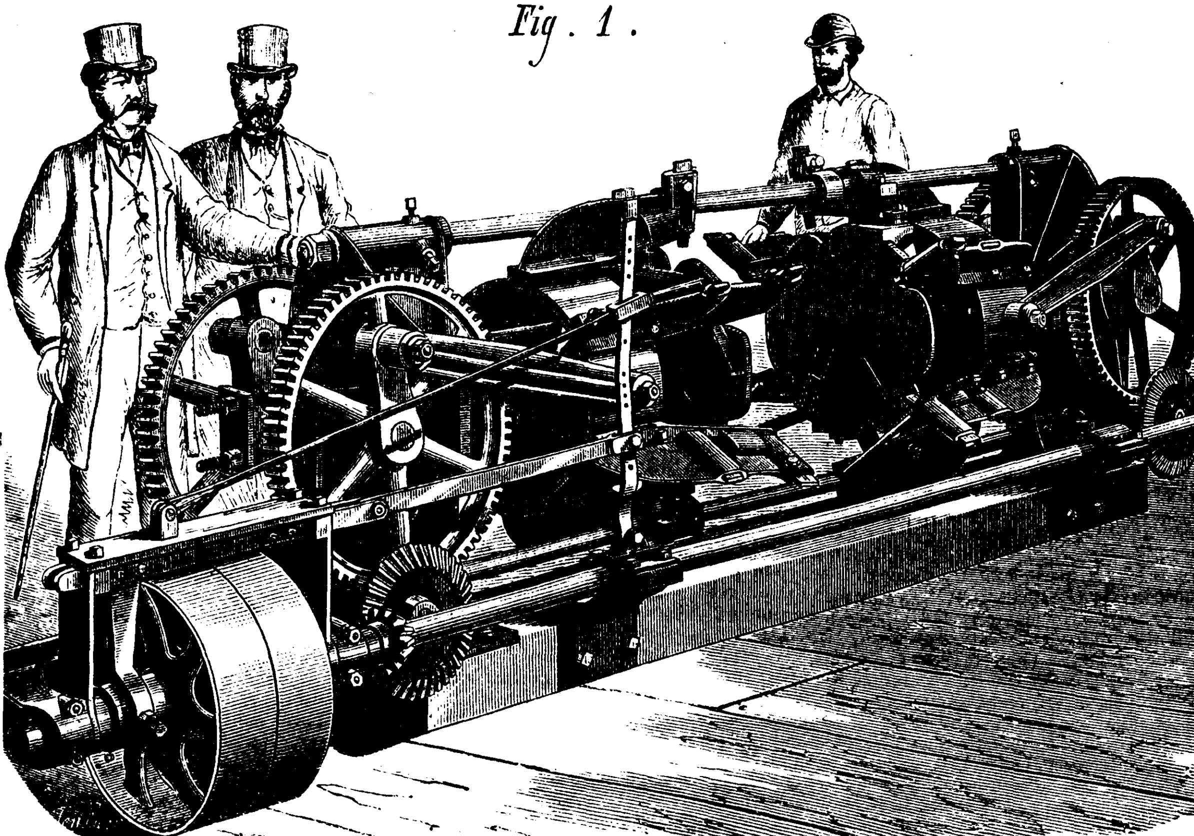
Mr. Thomas Broughton, at the request of the President, then described his patented appliances for concrete buildings, which were exhibited in the room. These appliances consist principally of slotted tubular iron standards, the weight of which is reduced to a minimum consistent with the requisite strength. Mr. Broughton also claims that after the timber has been used for the casings for concrete buildings, it can be converted and used for the interior woodwork. Old building plant and materials, such as scaffold boards, joists, slating-boards, ledged doors, &c., may be used with the same facility as new timber ; also the old panels of existing apparatus, whether made in the form of ledged doors, framed wood, or iron. With a sufficient supply of boards any height of building can be carried up per day.

Mr. Giles said that as an engineer he had been a little startled at some of the propositions as to concrete building made by Mr. Payne. He thought that, as a rule, the use of bond-timbers was exploded long ago ; but yet Mr. Payne was proposing to use what really amounted to the same thing, though in another form. He had used concrete largely in engineering works, and could confirm what had been said by Mr. Nash as to fissures or cracks. Another thing was that he had never found concrete to be really water-tight. Its economy, as compared with brickwork was very questionable when complicated moulds or dies were used for giving it an effective appearance. The slab cottages described by Mr. Lascelles could hardly be called concrete ; they were mere variations of weather-tiling.

Noise in Sea Shells.—There are few who do not remember the childish wonder we once felt at hearing the resonance produced by placing a sea-shell to the ear—an effect which fancy has likened to "the roar of the sea." This is caused by the hollow form of the shell, and its polished surface enabling it to receive and return the beatings of all sounds that chance to be trembling in the air.

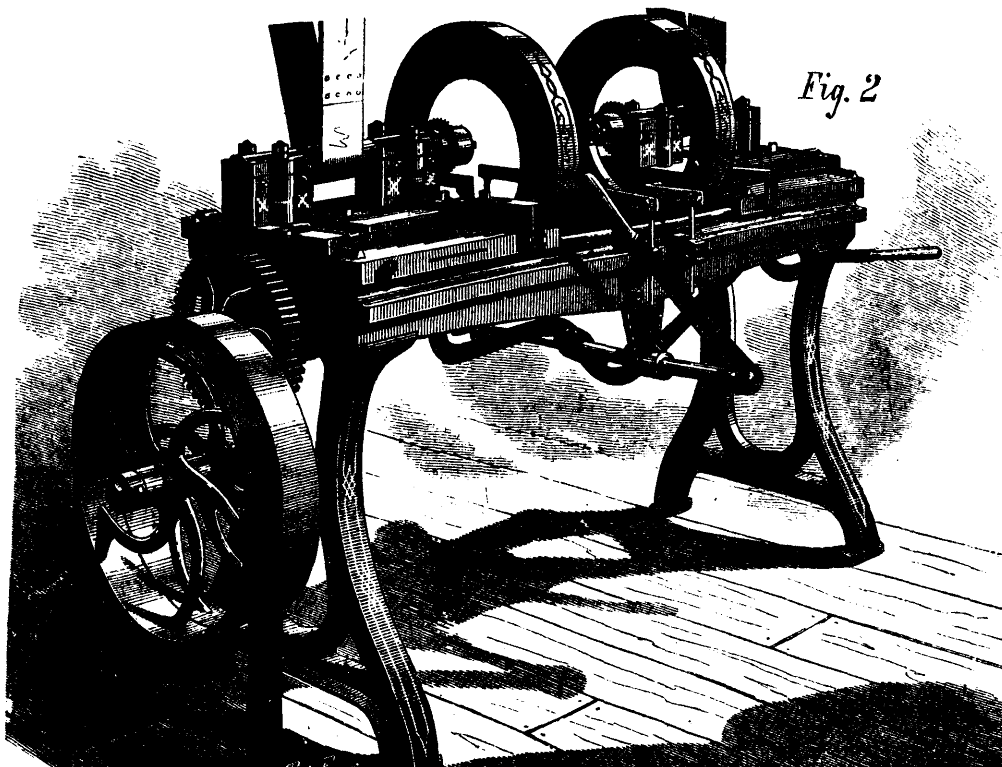
IMPROVED KEG AND BARREL MACHINERY.

Fig. 1.



MACHINE FOR LEVELING AND TRUSSING SLACK BARRELS.

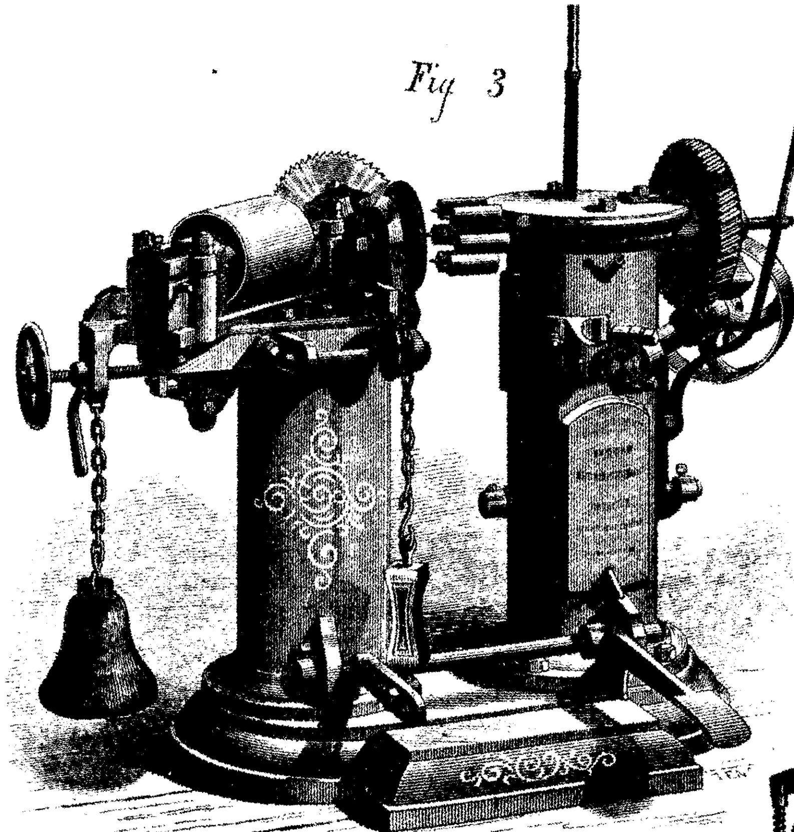
Fig. 2



BARREL CHAMFERING, HOWELING, AND CROZING MACHINE.

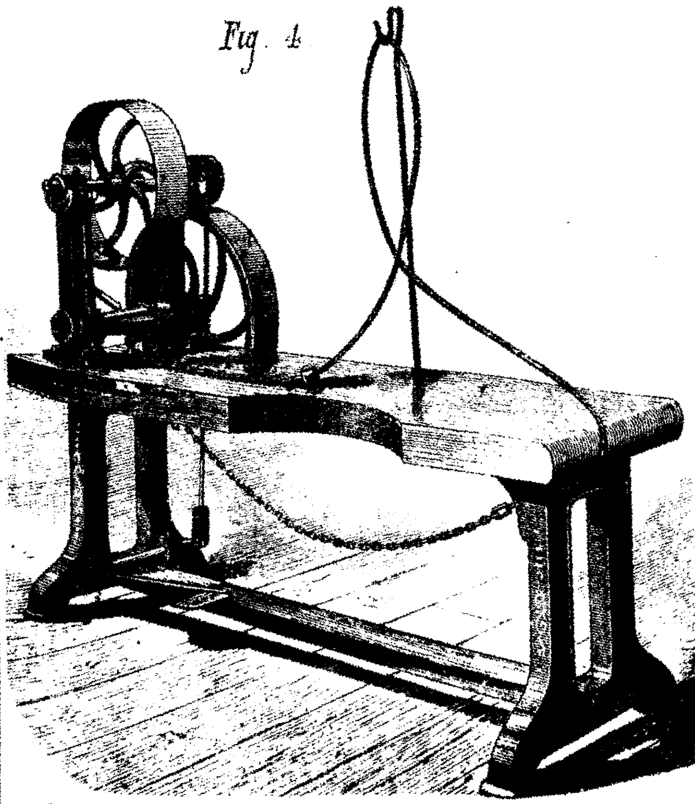
IMPROVED KEG AND BARREL MACHINERY.

Fig. 3



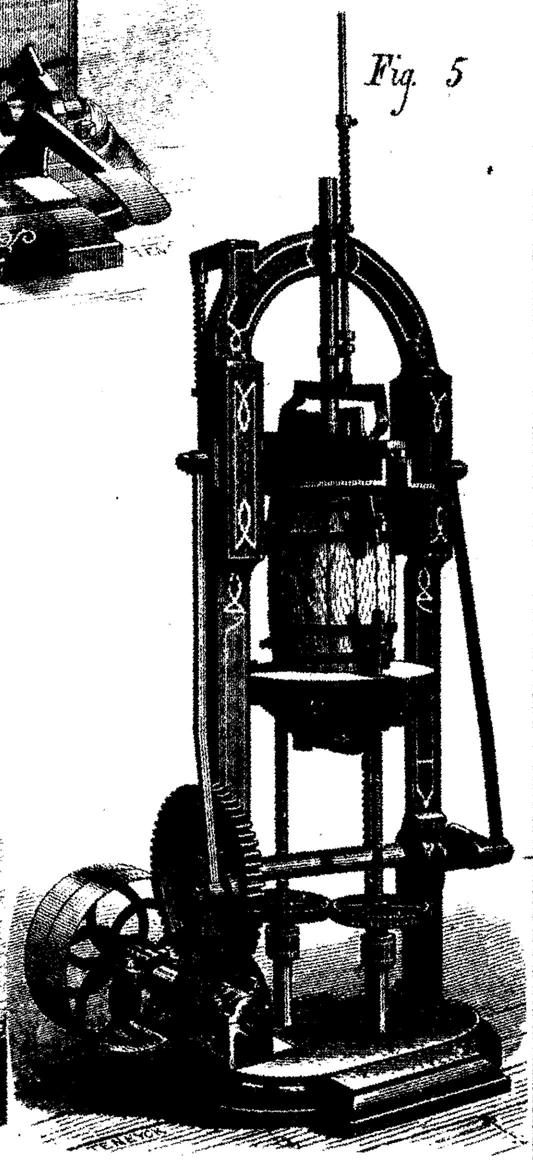
MACHINE FOR ROUNDING BARREL HEADS.

Fig. 4



WINDLASS FOR DRAWING BARREL STAVES TOGETHER.

Fig. 5



MACHINE FOR LEVELING AND TRUSSING KEGS.

IMPROVED KEG AND BARREL MACHINERY.

In Fig. 1 is represented an entirely new machine for leveling and then trussing slack barrels. It is constructed with an iron frame upon which are placed two leveling plates upon slides or guides, which plates are operated by cams. There are also two other plates placed upon slides and operated at each end by cranks. Upon these plates are hoop drivers, for driving all the truss hoops upon a barrel at one and the same time. The leveling plates are first moved toward each other and against the ends of the barrel by cams. The barrel is thus leveled and held in position while the hoop drivers force all the truss hoops to their places. The leveling plates and drivers then recede, and one barrel is discharged from the machine by the introduction of another. The apparatus is so rapid in its operation that, by the help of one man, from 4,000 to 5,000 barrels can be trussed per day.

Fig. 2 is a machine for chamfering, doweling, and crozing kegs and small casks. It is adapted for finishing the ends of kegs or small casks of all sizes, from small kegs to half barrels, ready to receive the heads. It finishes both ends of the keg at she same time with great accuracy. The keg is placed on the machine and forced into chuck rings, which are caused to revolve by teeth, upon their outer edge, engaging with pinions upon a common rotating shaft. Rotary cutters are brought in contact with the ends of the keg, which are finished by a single revolution. The machine is easily altered from one size to another by changing the chuck rings. Its capacity is from 2,000 to 3,000 kegs per day.

In Fig. 3 (see next page) is represented a machine for rounding heads of all sizes for kegs and barrels. This is so constructed that every size of heads for kegs, small casks, and barrels can be made upon it for both tight and slack work, and the change from one size to another is easily and quickly accomplished. The saw and cutters are brought in contact and passed through the wood on such lines as to prevent the tearing, splitting, and slivering of the material used, and to give a smooth finish to the work done. No more set is required in the saw than is necessary in a common circular saw. The machine is made with a strong iron frame, on which is placed a clamp for holding the head. There are, besides, a swing frame, carrying a concave saw and cutters for rounding and chamfering the head, and an automatic apparatus for discharging it when finished.

In operating the machine, the blank is placed between the clamps, and at the same time the foot treadle is pressed. This clamps the blanks, and also brings the concave saw and cutters in contact with it, and holds them there until the head is finished, when 'the latter is released through the automatic action.

In the following engraving, Fig. 4, is exhibited a power windlass for kegs and slack barrels. This is for drawing up or together the ends of staves of a keg or barrel, ready to receive the head truss hoop, after they have been set up in the setting-up form with their other ends in the other head truss hoop. The machine is constructed with a frame upon which is planted a windlass supplied with a rope, which windlass is operated by friction wheels.

After the barrel or keg has been set up with the ends of the staves in one head truss hoop, it is placed in the machine, and the rope is placed around the flaring ends of the staves. The friction wheels are then brought in contact with each other, when the windlass is set in motion, drawing up the staves, by the aid of the rope, ready to receive the other end or head truss hoop. This apparatus is very rapid in its operation, and will windlass from 2,000 to 2,500 kegs or barrels per day.

Fig. 5 is a machine for leveling and trussing kegs and small casks, from the smallest kegs to half barrels, and can be easily and quickly adjusted. The truss hoop drivers are attached to two plates, one of which is stationary and adjustable, and the other is moved to and from it perpendicularly by cranks and pitmans. The drivers move automatically in and out, to allow the reception and discharge of the keg into and from the machine. The plates level and the drivers drive the truss hoops at one end and the same operation upon the keg, by the movable plate being brought in contact with the upper end of the keg by the action of the cranks and pitmans, the two cranks being on the same shaft. The machine works rapidly, and will level and drive the truss hoops upon from 4,000 to 5,000 kegs per day.

This subject will be resumed in our next issue.

CAMPHORATED oil is highly recommended as a furniture polish. This is simply sweet oil in which gum camphor is dissolved. The camphor serves an additional purpose of driving away moths.

AMERICAN PATENTS.

In the United States, during the year 1875, there were no less than 16,288 patents applied for, as against 13,599 issued in 1874. Of these 16,000 odd, there were issued to citizens of the United States 15,698, of Canada 150; to other subjects, of Great Britain 221, of France 91, of other foreign countries 128, being 590 to subjects of foreign States, against 15,698 to those of the United States. An analysis of the patents granted according to the geographical distribution of inventors shows that to the six New England States there were issued 3188 patents, being one to every 1094 people ; to the seven Middle States (including Delaware, Maryland and West Virginia) 7905, or one to every 1623 people ; to the nine Western States (including Missouri) 3076, or one to every 3360 people ; to the twelve Southern States 814, or one to every 13,279 people ; to the three Pacific States 437, or one to every 1699 people ; to nine Territories, 59, or one to every 12,303 people ; and to the District of Columbia, 214, or one to every 615 of population, being the highest ratio in the Union.

All the States and Territories have held their own, or made gains over 1874 in the number of their patents, save the following, which show losses : — Alabama, Arkansas, Florida, Georgia, Kansas, Mississippi, Nebraska, Oregon, Vermont, and Dakota, Utah, Washington and Wyoming Territories. New Hampshire and Nevada remained stationary, the former having 127, the latter, 16 patents, the same as in 1874. The principal increase was made in the following States,—New York, 986 ; Pensylvania, 390 ; Massachusetts, 340 ; Illinois, 164 ; California 98 ; and the District of Columbia, 69.

THE CENTENNIAL EXHIBITION—THE GREAT CORLISS ENGINES.

(See page 216.)

In the annexed engraving are represented the great Corliss engines, which furnish a part of the power to the mechanism diplayed in Machinery Hall. It is expected that other engines exhibited will also be geared to shafting and thus put to useful work. The frame is A-shaped, the beam center being at the vertex with the cylinders and main shaft located at the base angles. The various parts of the frame are in the hollow or box form, and the corners are flattened, giving an almost octagonal section. A very curious effect is gained by abolishing straight lines in the working parts and substituting curves and S-pieces, an innovation the value of which engineers are somewhat disposed to question. The cylinders are 40 inches in diameter, 10 feet stroke, and are rated at 1,400 horse-power. The single shaft to which they are connected carries a magnificent gear wheel, of 30 feet in diameter, 24 inches face, and having 216 teeth cut with a pitch of 5·183 inches. This is probably the largest cut iron gear ever made. It weighs 86 tuns, and its periphery travels at the rate of over 42 miles per hour. The crank shaft carrying this wheel is 19 inches in diameter, and is made of the best hammered iron. The bearings are 18 inches in diameter and 27 inches long. The cranks, of gun metal (iron), are polished all over except in the recesses on the back, and weigh over 5 tuns each. The beams are 9 feet wide in the center, 27 feet long and weigh each about 11 tuns ; they are also of quite novel form. The connecting rods, now that they are in place, have the appearance of being rather light ; but this comes no doubt from the massive look of the beams, which have a more ponderous appearance than is their due, on account of their unusual depth at the center. In order to have these connecting rods of as perfect material as possible, they were built up entirely of worn-out horseshoes, of which there were used in their construction no less than 10,000. They are 25 feet long. The piston rods are steel, and are $6\frac{1}{4}$ inches in diameter.

The Corliss valves and valve gear are too well known to need description here. One of the principal modifications is a substitution of an S lever for the usual disk which operates the valves. The weight of the entire machine, with its shafts, is over 700 tuns. —*Scientific American.*

THE INTENDED CHURCH ON MONTMARTRE.

(See page 204.)

We copy from the London *Builder* in our present number an interior view of the proposed church of the "Sacré-Cœur," now being built on the summit of the hill of Montmartre, and which was some little time ago the subject of a large competition of architects. The style of the selected design might be described as founded on the North Italian or Lombar Gothic, with modern French treatment of some of the detail, and not without reminiscences in the exterior design of Byzantine feeling.

PUBLISHING THE ENGLISH PATENTS.

The London Patent Office is about to adopt the Patent Office system of Canada and the United States, of producing copies of drawings of patents by the photo-lithographic process, in place of the large lithographic sheets which now accompany the printed specifications of all English patents. Considerable opposition to this change was made by the London patent agents; but we believe it only arose from abhorrence of change, which is the national characteristic of the Englishman. But the British public will soon find our mode of producing copies far better than their old plan of lithography.

TRADE MARK DECISION.

In a recent application for trademark registration for the use of the words "Star Oil," the Commissioner of Patents refused registration, because a prior registration had been obtained, by other parties, for the use of the figure of a star in connection with the word oil, thus: " Oil." The Commissioner held that, in cases where parties used a brand containing the figure of an object, the mere substitution, by a new applicant, of the same word of that figure, would not entitle such applicant to registration.

PRACTICAL HINTS.

Oil Gilding.—Gilding with leaf gold will be found the best process to employ for ordinary-sized frames. The following materials are necessary :—Japanner's gold size, oil varnish, cotton wool, a gilder's cushion, knife, tip, thick and short camel's hair brush, and several books of gold leaf. Books of gold leaf contain twenty-five leaves, and the ordinary quantity to purchase are four books, as the leaves are rated at so much a hundred. Gold leaf varies in color from the darkest red gold to the palest yellow, and the medium color is generally selected. The size of the leaves are a 3in. square. The knife is a sharp palette knife, and the cushion a piece of wood covered tightly with wash leather, with an upright piece of parchment fixed round two of its sides to catch any gold leaf that is straying away. The gold size must be the best. Commence by painting over the surface of the frames with the japanner's gold size from left to right, perfectly smoothly and evenly, and leaving no corner or spot untouched, as the gold leaf will only adhere where the size has been. Then wait until the size is in a condition to receive the gilding. This will depend upon the amount of absorption in the wooden frame, and therefore no exact time can be given; half an hour is the shortest time. After that the size must be watched. It is ready for use when on touching the size it feels clammy and sticky, and has no appearance of running. If left too long, so that it is no longer sticky but dry and hard, it must be resized, as it is of no use. The gold leaf is then shaken out on to the cushion near the parchment end, and one leaf is taken from the heap and laid perfectly flat upon the cushion by the knife; the tip is then taken up and brushed through the hair of the operator to acquire a little softness and greasiness, so that the gold leaf may readily adhere to it. Raise the leaf with this tip, and lay it on the size, and lay on leaf after leaf until the frame is covered, each leaf slightly overlapping the preceding one. Cut one of the leaves into small squares, and fill up every cranny and nook with these, so that not a morsel of space is left ungilded. Then take the cotton wool and press the gold leaf very firmly to the frame, so that all should be stuck, and a flat surface free from air bubbles attained, brush off with the cotton wool all pieces of gold leaf not adhering, and preserve them either for future use in small spaces, or for sale to gold beaters. When quite dry rub up with wash leather, and size with common white size, and varnish over with oil varnish or mastic varnish diluted with a little turpentine.

Or, use the best carpenter's glue, fit each piece carefully, taking pains that no glue gets between the joints, weigh each piece as glued and when all is done cut down with a plough.

Or, damp the veneer glue with thin hot glue lay in position if possible, rubbing gently backwards and forwards, press hard with thin part of the hammer, wipe off surplus glue with hot wet cloth, and proceed as before until all is laid. If possible, put a caul over the lot (*i. e.*, a piece of zinc or wood screwed tight with thumb screws.) If this cannot be done, go over each foot as laid with a warm iron.

Engraving on Iron and Steel.—As the result of very many experiments, Professor Kick recommends the following solution for engraving iron and steel, to show the grain, &c. :—Equal parts of hydrochloric acid and water, with a trace of antimonial chloride.

Wood for Carving.—Yellow deal, teak, oak, Honduras mahogany, birch, beech, or for superior work, ebony and rosewood.

Cement for Marble and Alabaster.—Mix 12 parts of Portland cement, 6 parts of slacked lime, 6 parts of fine sand, and 1 part of infusorial earth, and make up into a thick paste with silicate of soda. The object to be cemented does not require to be heated. It sets in 24 hours, and the fracture can not readily be found.

Loose Screws.—It is a common thing when a screw or staple becomes loose to draw it out, plug up with wood and re-insert. But screws and staples so secured soon come out again. It has been found that a much better way is to fill up the holes tightly with cork. Screws and irons so secured will remain perfectly tight as long as when put into new wood.

Bronzing on Metal.—The article must be chemically cleaned up, brushing with a mixture of fine pumice in dilute sulphuric acid, rinsed in plain water and dried. The bronze liquor must be applied quickly and evenly with a camel's hair brush, having first heated the article, just so as it can be held without burning the fingers.

Varnishing Fretwork.—Use white hard spirit varnish; it requires no size, but must be used in a warm room, "or it will turn the wood white just like milk." It is used for various nick-nacks, and it answers well.

Or, fill in the grain of the wood with glue size, and varnish with brown hard varnish.

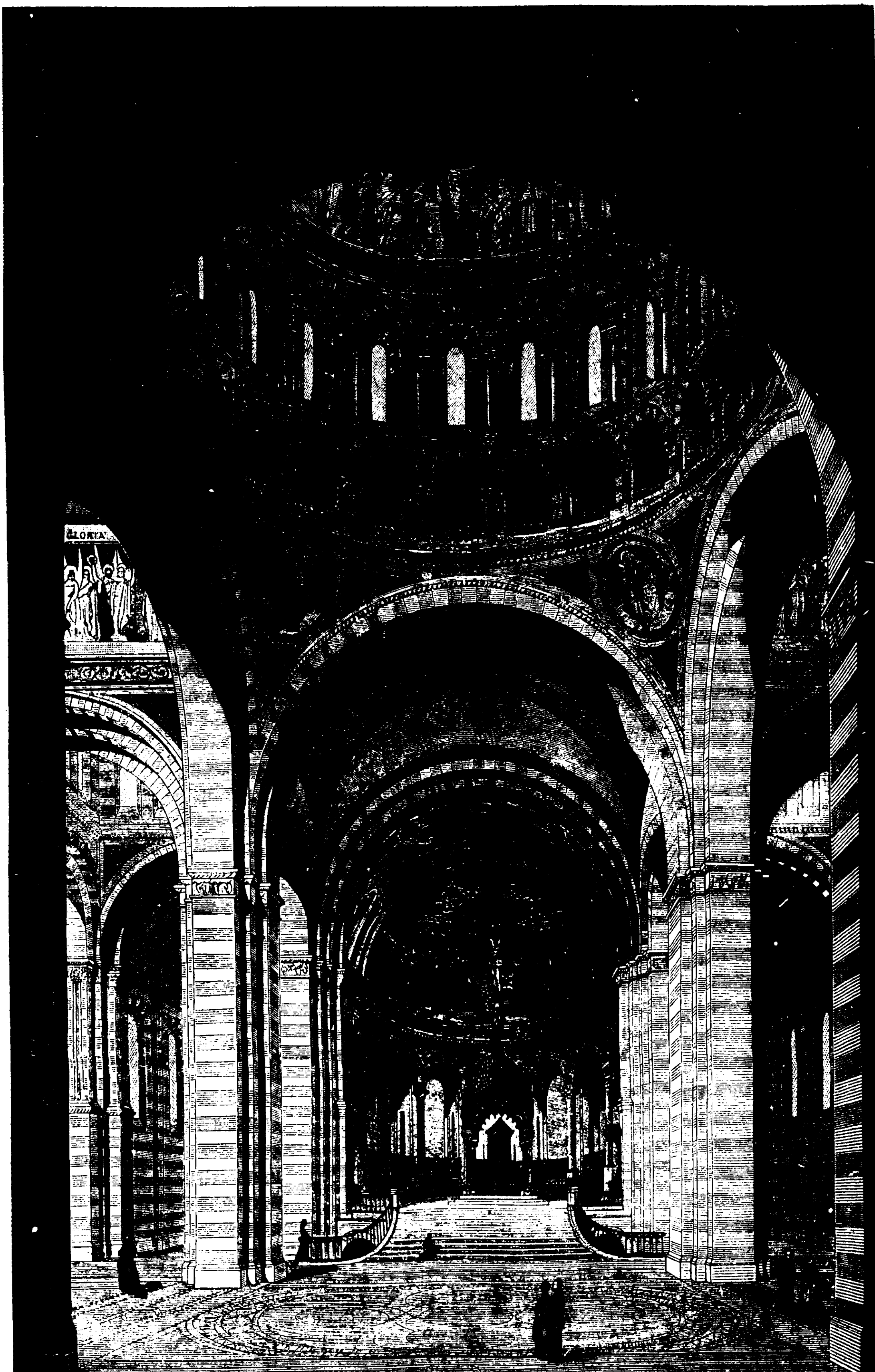
Using Hard Water for Steam.—When boilers are ordinarily fed with hard water, it is worth while to save the drippings of the exhaust pipe, the condensation of the safety valve blow-off and that from the cylinder, and use the water thus obtained to fill the boiler after blowing off. The result will be surprising in effect in loosening scale. So says the *Scientific American*.

An Artificial Material for Turning can be made as follows: Mix gypsum with 4 per cent of marsh mallow root ground, which will harden in about one hour, and can be sawed, cut, or turned for making dice, dominoes, and fancy goods. With 8 per cent of marsh mallow the hardness is increased, and it can be rolled out into thin plates and painted or polished. It admits of great variation in utility, as it can be used for ornamentation in lieu of plaster work, etc.

A new printing ink is prepared by first dissolving iron in sulphuric, hydro-chloric, or acetic acid. Half the solution is oxidized by means of nitric acid, after which the two halves are mixed, and precipitation is produced by oxide of iron. The precipitate is filtered, washed, and mixed equal parts of tannic and gallic acid, which produces a black bordering on blue. The black is washed and dried, then mixed with linseed oil; and the ink obtained is suitable for either letter-press printing or lithography.

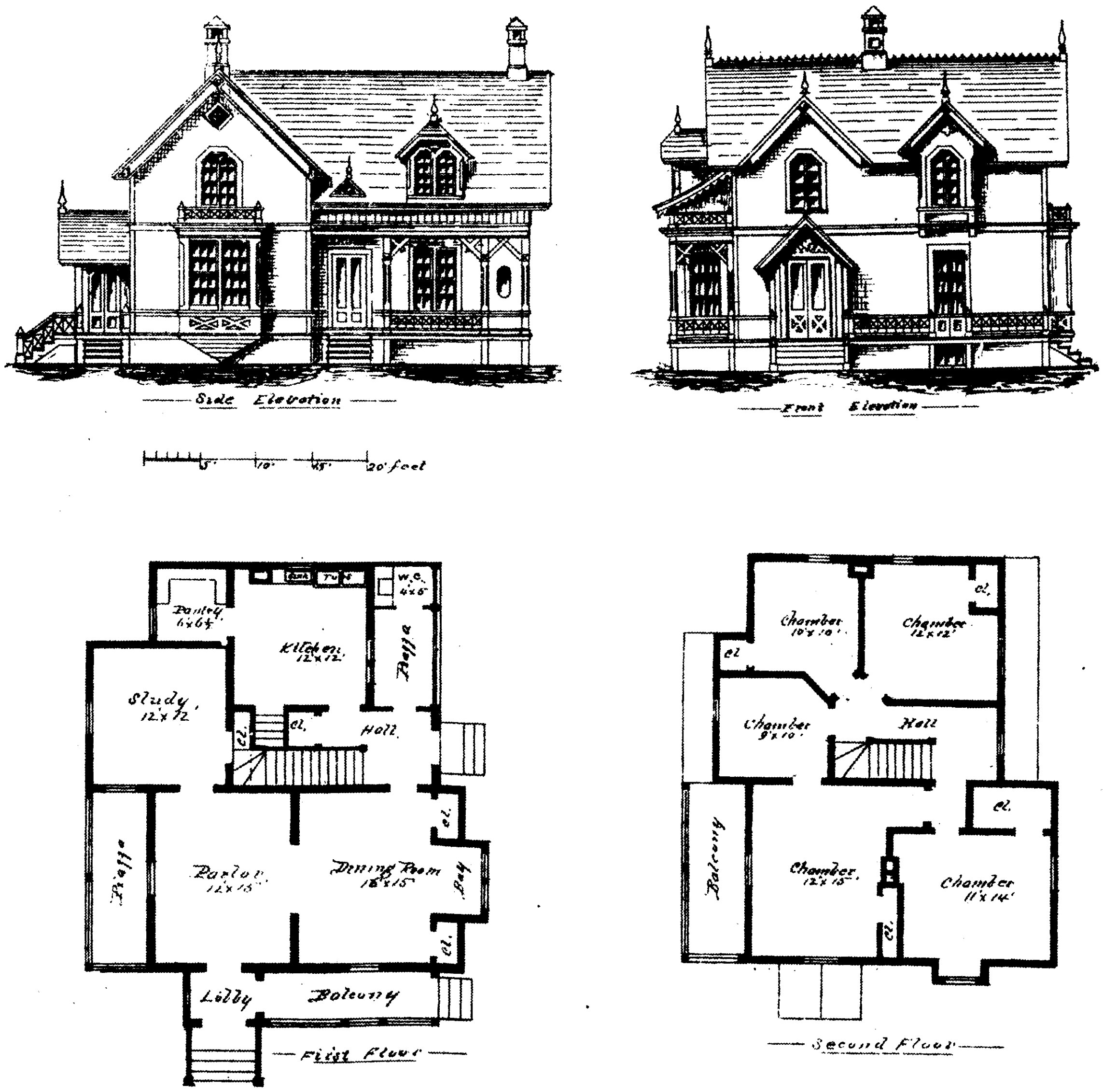
A Curious Phenomenon frequently met with in the Indian ocean, the real cause of which has not yet been ascertained, is the existence off Malabar, and in certain spots along the Coromandel coast, of vast mud-banks, and of tracks of mud suspended in the sea, wherein many kinds of fish find abundance of food, immunity from much disturbance in the surrounding element, and a locality in which to breed. The exact cause of the existence of these large tracts of sea wherein mud remains in solution is still a mystery; but at any rate the ocean is so smooth that, even during the height of the south-west monsoon, vessels can run for shelter into their midst, and once there are as safe as when inside a breakwater.

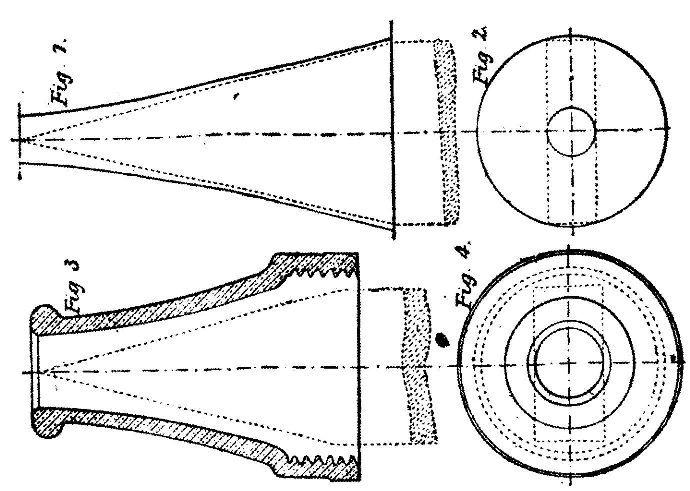
Managing Belts.—A mechanic gives the following directions for managing belts. He says: "I have for the last twenty-five years on every Saturday evening turned the inner side of my engine-belt outside, let the engine run slowly, and wash the belt well with warm water and soda, applied with cotton waste. Next I take a piece of sheet-metal and scrape the belt well, then wash with clean warm water and dry off. I collect the waste oil from the shafting and apply as much of it to the belt as possible. The washing must be done as quickly as possible, so as not to dissolve the glued parts. I let the belt stand on the pulleys till Monday, then give another scraping and turn the belt as before. I keep the pulleys very clean. I have long been surprised at the economy I have effected within the last ten years. There is an engine near me 14 inches by 36 inches (mine is 12 inches by 36 inches). I have nearly double the shafting and belt, and my neighbor cannot run with less than thirty-eight pounds of steam when all the belts are on the loose pulleys. Mine will run at full speed with five pounds."



PROPOSED CHURCH.—MONTMARTRE, PARIS.

MODERN AMERICAN HOMESTEADS.





BORING CURVED NOZZLES.

MODERN AMERICAN HOMESTEADS.

We give an illustration on page 205 of a very pretty story and a half cottage copied from Atwood's Modern American Homesteads. The design is one particularly suitable for a suburban residence to those who desire to have an inexpensive but solidly constructed house, without too much decorative appearance, which in too many instances detract rather than add to the beauty of an edifice.

The cottage consists of 9 rooms, is commodious, convenient of access, snug in its arrangement, and tastefully finished, both externally and internally.

The work above alluded to, which we have just obtained, we can highly recommend to young architects as one from which they can obtain many valuable suggestions. It is illustrated with forty-six plates, and as a publication in style and finish, reflects great credit on its publishers, Messrs. A. J. Bicknell & Co., of New York. The work can be obtained, on application, through the Burland-Desbarats Lithographic Co., 7, Bleury St., Montreal.

MARBLEIZED MARBLE.

Marbleized fancy colored marble is becoming every day more popular and is being brought to great perfection in imitation of foreign and domestic marbles, and is produced at less than 50 per cent of the genuine article. For many purposes it is decidedly preferable to marble, and it retains its freshness and gloss for years. It can now be manufactured for table tops, wash stands, and for every variety of cabinet work. For mantel pieces and other ornamental architectural work, rich most beautiful designs can be made from a combination of various imitations of rich colored marbles. F. N. Boxer & Son, 45 St. Sacrament St., Montreal, are the agents for Messrs. Litchfield & Co., Vermont.

A Lightning Box Machine.—The following is a description of a box machine which turns out boxes directly from the paper pulp. The inventor is from Sherbrooke, Canada. The pulp, when prepared, is received into a hollow cylinder, where it assumes the box form; it passes thence into a press, where its whole interior and exterior surface is subjected to a pressure of four tons to the square inch. From the press it comes out firm and hard as the best cardboard, but still damp; it is put into a drying rack and completely dried; then it is carried to a finishing machine, which by further pressure, finishes it in any desired style, plain or embossed. The latter process is executed by the machine without outside attendance, and does not add to the expense of the box. From the moment the pulp leaves the "pulping engine" to the moment when the box is ready to be dried, the whole of the work is done automatically, without being touched by a workman's hand. In the whole operation of converting the pulp into the box ready for sale, only two boys or girls are employed—the one to arrange the damp boxes in the drying rack, the other to feed them to the finishing machine. Collar boxes, four inches in diameter, and two and one-half inches in depth, are turned out at the rate of 350 an hour.

A New Gun.—The Indianapolis *Sentinel* says: A stock company is now being organized in this city, to provide for placing upon the markets of the world a military machine that is capable of firing over a thousand shots per minute, and can sweep the field from right to left, or *vice versa*, without having the position of the carriage shifted. There are six barrels (as with the Gatling gun), but they revolve and are discharged by the turning of a crank which propels the hammer. The cartridges are strung on a strap, 75 on each. When one is exhausted it can be replaced by simply slipping a hook. But one man is needed to operate the murderous weapon, and if perchance the enemy should storm the works, and the operator should see that he could not destroy or delay the advancing columns until re-inforced, he could disable the gun by simply taking out the lock and putting it in his pocket as he fled the field. This would prevent his own gun being turned upon him—a decided improvement over the common cannons, which have to be spiked. The inventor is Mr. T. L. Bailey, late of Shelby county. He has letters patent from Washington on the gun, and a special patent on the lock, and has applied to the great powers of Europe for patents.

M. I. Pierie calculates that, in a life of sixty years, an apple tree removes from the soil 60 lb. of nitrogen, equal to 11,500 lb. of farmyard dung. To maintain the soil in condition, therefore, about 175 lbs. of dung ought to be annually given per tree during the fifty years that it is in bearing.

SUBMARINE ENGINEERING APPARATUS.

(See page 208.)

A more or less complete system of submarine engineering has been elaborated by M. Toselli, of Paris, an engineer who was formerly an officer in the *corps de génie*. This system comprises three principal apparatus, the *talpa murina*, or explorer, the upright cylinder shown at the left at the foot of fig. 1, the grapnel, sketched in fig. 2, and the air-chain shown in action in fig. 1. The first of these we pass over, merely stating that it is a sort of portable submarine observatory, holding one or two persons, and capable of lowering itself to any spot which it is desired to explore. It is solidly made in iron and bronze, and is fitted with thick crystal eye pieces. In its neighbourhood is a submarine lamp, which sheds an electric light over the sea bottom. The explorer is a marvellously ingenious instrument, which ascends or descends in water exactly as a balloon does in air by the differences effected in its comparative gravity, water being admitted or pumped out as may be required for making it heavier or lighter than the surrounding element. Oxygen is stored in it in a compressed form, and the carbonic acid produced by the lungs of the operator is taken up by a layer of chemicals under his feet. The inventor has remained in it beneath the water more than an hour and a half at a time, without suffering so much as a headache. Electric communication with the vessel accompanying it is of course provided for.

The automatic grapnel, which is illustrated in fig. 2, is an implement the simplicity of which permits the greatest solidity in construction, so that its strength is directly proportional to its size. While fitted for heavy work and for raising considerable weights from the bed of the sea, its grip is as sudden and sensitive as that of the octopus.

The apparatus shown in fig. 2 is but one of many modifications of the principle adopted. The arms, which work freely on pivots, are provided at their tail ends with projecting studs. When fitted for action the arms are raised up so as to bring these studs parallel with the central stem passing through the collar on which the arms are hinged. The ring which the central stem carries at its upper end fits upon these studs and keeps the arms expanded. The lower end of the stem is weighted with a bob sufficiently heavy to keep the ring in position and secure the arms. As the apparatus descends the arms are elevated considerably above the bob, and this reaches the object to be raised before any other part of the apparatus touches it. On being lowered upon it the bob raises the ring, which, being raised, releases the arms, and the latter fall round the object to be raised, grasping it in the manner shown in the drawing.

It will be easily understood that many modifications of this apparatus are possible. Such as have presented themselves to the mind of the inventor, and they are numerous, have been patented. Thus, the upper ends of the arms are pivoted to the shank of the apparatus and held apart or suspended by the attraction of two electro-magnets, actuated from a battery on board the vessel in waiting. Then, a tubular wire passes down the grapnel rope, and the ring is released by pressure of a column of water, or, on the other hand, by exhausting air. The arms, too, are modified so as to become knives suitable for sponge cutting, or they are reduced to a single pair, carrying hollow hemispheres at their ends. On being released these come together, and enclose whatever lies between them, serving as very efficient sounding instruments. Or the arms may be fitted with palms at their superior or inferior part, the pressure of the water upwards or downwards opening or shutting them. With so many varieties of implements at his command the dredger can do a great variety of work. The inventor has brought up uninjured a delicate piece of silver-plate from a deep well, and from the bottom of Marseilles harbour a big boat laden with ingots of lead.—*Iron*.

Another Wire Railroad.—At the last session of the Board of Supervisors there was passed to print a grant of a franchise to construct the California Street wire cable railroad, to commence at Montgomery street and extend as far as First avenue. The movers of the project are Leland Stanford, Mark Hopkins, David Porter, Isaac Wormser, P. H. Canavan, E. B. Pond, Robert M. Graves, John H. Redington, Michael Reese, Louis Sloss, B. Adolph Becker, Charles Crocker, D. D. Colton and others. In the event of no unexpected obstacles being encountered, the promoters promise that work shall be commenced within six months, and the road completed within two years thereafter. All the owners of property along the route who have been consulted on the subject are claimed to be in favor of the project, and ready to contribute substantial aid.

HOW TO CURE A COLD IN THE HEAD.

By David Ferrier, M.D.., Assistant Physician to King's College Hospital, U.S.

Though a cold in the head gives rise to much discomfort and uneasiness, it is not usually considered grave enough to necessitate professional advice; and the unfortunate victim of nasal catarrh, with watery eyes, running nostrils, sneezing, and nasal speech, is more often regarded as a subject of ridicule rather than of sympathy or commiseration.

Being occasionally liable to severe nasal catarrh, often of prolonged duration, and having a lively sense of the inconvenience and discomfort attaching to it, and being threatened with a cold in the head one evening lately, with prospect of serious inconvenience to public speaking next day, I endeavored to devise some plan of treatment more speedy and efficacious than the usual one of "sodorifics and lying in bed." Having succeeded almost beyond my expectations, and having since found the method equally successful in the case of others to whom I have recommended the treatment, I offer it in the hope that it may prove equally efficacious in the hands of others. As the local symptoms of cold in the head are the chief source of annoyance and discomfort, local treatment seems the most rational.

The symptoms being those of acute catarrh of the nasal mucous membrane, the treatment which seemed to me most likely to succeed was that which I have always found most efficacious in acute catarrh of the gastric mucous membranes. In the acute catarrh of alcoholism accompanied with profuse secretion of mucous, which is often vomited up in large quantities almost without effort, as well as in the more chronic forms of gastric catarrh, bismuth alone, or in combination with morphia, acts almost like a specific.

On the same principle the topical application of bismuth to the nasal mucous membrane seemed to me the plan most likely to be followed by beneficial results. I do not know whether the plan is absolutely original, but I am not aware of its having been adopted previously. This, however, is of no importance compared with the question of its efficacy.

On the evening in question I began to suffer with the symptoms of cold in the head—irritation of the nostrils, sneezing, watering of the eyes, and commencing flow of the mucous secretion. Having some trisnitrate of bismuth at hand, I took repeated pinches of it in the form of snuff, inhaling it strongly, so as to carry it well into the interior of the nostrils. In a short time the tickling in the nostrils and sneezing ceased, and next morning all traces of coryza had completely disappeared.

Bismuth alone, therefore, proved quite successful, but it is better in combination with the ingredients in the following formula. Bismuth by itself is rather heavy, and not easily inhaled, and it is, moreover, necessary that it should form a coating on the mucous membrane. It is, therefore, advisable to combine it with puv. acaciæ, which renders the bulk larger and the powder more easily inhaled, while the secretion of the nostrils causes the formation of an adherent mucilaginous coating, of itself a great sedative of an irritated surface. The sedative effect is greatly strengthened by the addition of a small quantity of hydro chlorate of morphia, which speedily allays the feeling of irritation and aids in putting a stop to the reflex secretion of tears.

The formula which I find on the whole the most suitable combination of the ingredients of the snuff is as follows: Hydrochlorate of morphia, two grains; acacia powder, two drachms; trisnitrate of bismuth, six drachms. As this is neither an errhine nor a sternutatory, but rather the opposite, it may be termed an anti-errhine or anti-sternutatory powder. Of this powder one-quart to one-half may be taken as snuff in the course of twenty-four hours. The inhalations ought to be commenced as soon as the symptoms of coryza begin to show themselves, and should be used frequently at first, so as to keep the interior of the nostrils constantly well coated. Each time the nostrils are cleared another pinch should be taken. It may be taken in the ordinary manner from between the thumb and fore-finger, but a much more efficacious and less wasteful method is to use a small gutter of paper, or a "snuff spoon," placing it just within the nostril and sniffing up forcibly so as to carry it well within. Some of the snuff usually finds its ways into the pharynx, and acts as a good topical application there, should there be also pharyngeal catarrh. The powder causes scarcely any perceptible sensation. A slight smarting may occur if the mucous membrane is much irritated and inflamed, but it rapidly disappears. After a few sniffs of the powder, a perceptible amelioration of the symptoms ensues, and in the course of a few hours, the powder being inhaled from time to time, all the symptoms may have entirely disappeared.

I am writing this note cured of a cold in the head, which I began to manifest in a very decided manner last night, viz.: weight in the frontal sinuses, tickling of the nostrils, sneezing, watering of the eyes, and commencing flow of the nasal mucous.

I commenced taking the snuff, continuing at intervals for about two hours, thoroughly coating the interior of the nostrils with it. Next morning I found myself entirely free from catarrh. The effects in my own case have been twice so rapid and beneficial that I look with comparative indifference on future colds. In the case of others to whom I have recommended the same treatment, equally rapid and beneficial results have followed. One of my students in King's College Hospital described the effects as quite magical and unexpected, having in this way got rid of a cold in one evening. The other day one of the officials in King's College asked me if I could do anything to check a dreadful cold in the head, which he had just caught. I gave him the above prescription, asking him to note the results. A day or two after he came and told me that I had given him very marvellous stuff, as he had not taken more than one-eighth part before he had got rid of all his uneasiness and discomfort. Though I have not yet had very many opportunities of trying this method of cure, the success so far has been such as to warrant my recommending it as a rapid and efficacious treatment of nasal catarrh.—*London Lancet.—Am. Med. Weekly.*

BUSINESS COURTESY.

Nothing is ever lost by the exercise of courtesy, whether in social or business relations.

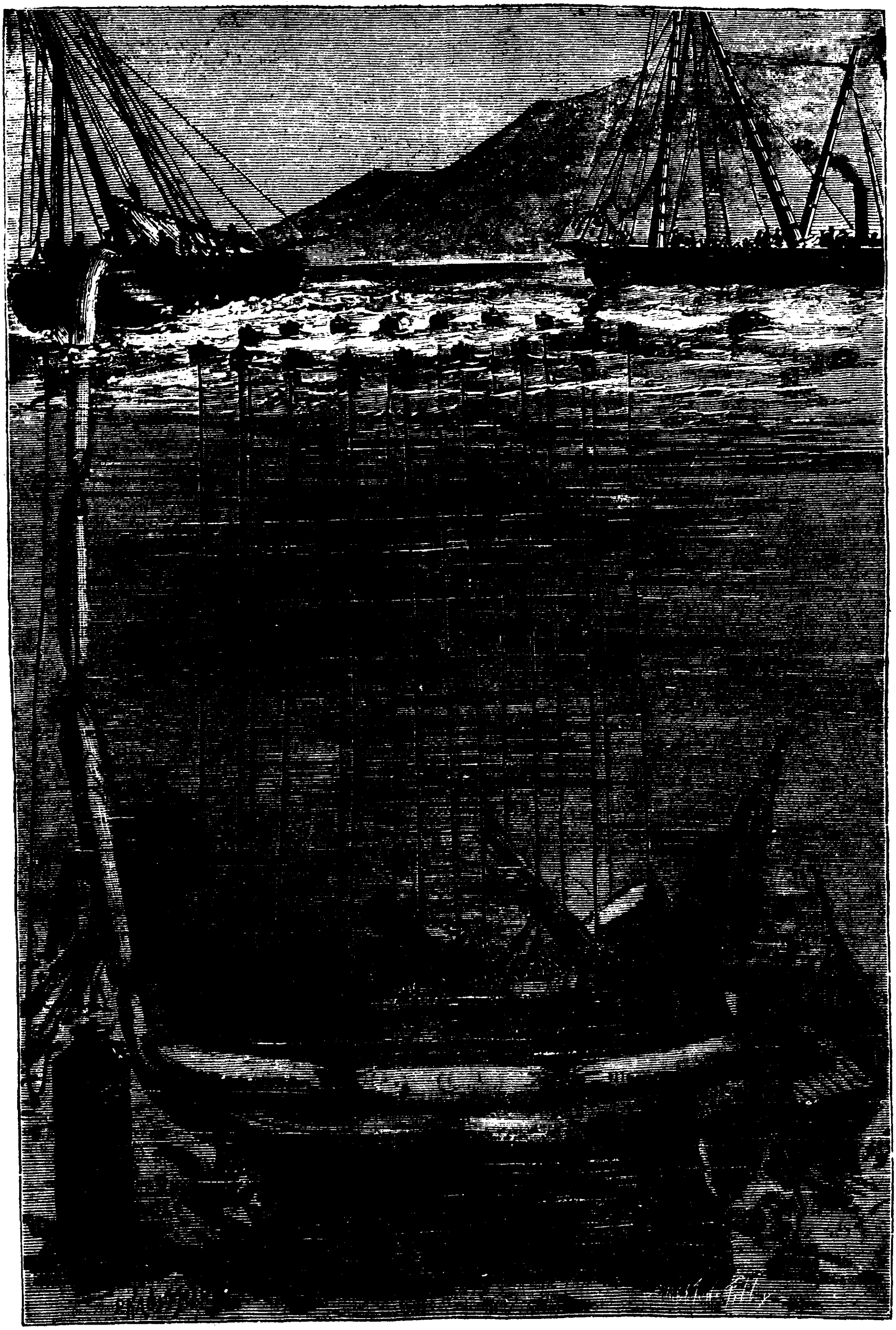
And in no place does it show more agreeably than in the matter of attending to the payment of accounts. Men sell goods with a reasonable expectation of receiving at a certain time their pay therefor. They base their own payments upon these calculations. If such obligations are met, everything moves along smoothly.

Inability to meet bills at the time prescribed when the goods are bought is a weakness which nearly all men are forced to indulge in at one time or another. A man is not a scamp because he fails to come to time promptly at the call. He who needs no indulgence in this regard is happily fortunate, and is certainly a *rara avis.*

But what we wish to speak of particularly in this article is the lack of courtesy upon the part of the debtor at such times. The creditor, as we have said, looks ahead at his prospective receipts, and decides how such receipts shall be applied to the liquidation of his own debts. He *depends* upon them. He notifies his debtor that, providing he hears nothing to the contrary, he shall draw upon him on a certain day. No response is made and the draft is sent in due course. If it is honored, well and good; but if it is returned unpaid, the drawer of the draft is disappointed, and possibly subjected to much inconvenience.

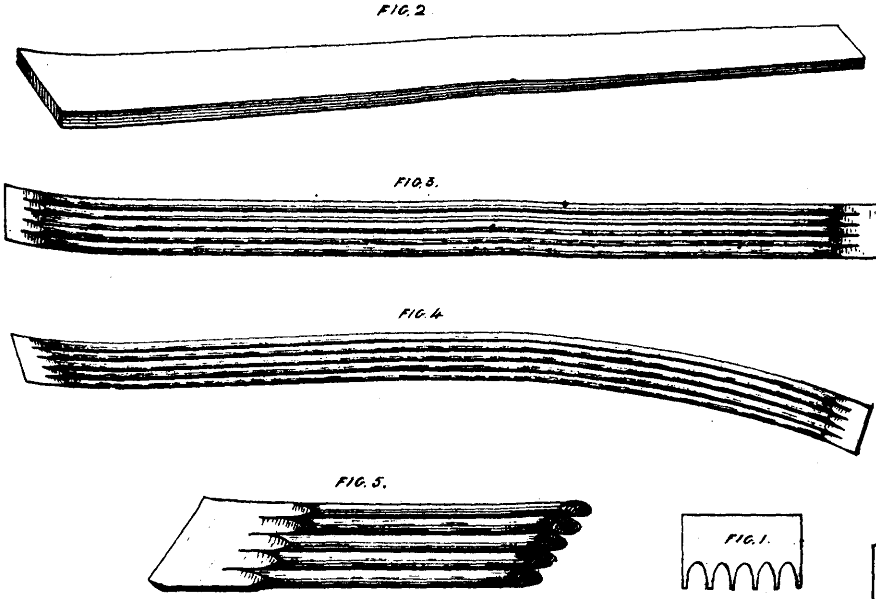
It is the failure of the debtor to comply with the simple request of his creditor that we condemn. How simple the task to say by "postal," "I cannot take care of your draft at the time mentioned." Then the creditor has time to make other plans and avoid the inconvenience. Gentlemen, we say this because we hear it complained of upon every side. It is a very common occurrence. It is vexatious, annoying, inconvenient, and discourteous to the man who has trusted you. It is so easily corrected there is no excuse for its happening, and we trust that gentlemen will remove the cause for the complaint. It will take but a moment, and need cost but a penny, to exercise courtesy in this regard.

Trade affairs do not improve in the United States. In consequence of the overstocked condition of the Eastern market, at the close of navigation, the Philadelphia and Reading Coal and Iron Company have stopped thirty of their forty collieries. The remaining ten, having a producing capacity of 40,000 tons daily, will continue to supply the furnaces and railways about Pottsville. About 5000 men and boys are thus thrown out of work. Twenty-five individual collieries have also suspended during one week, and it was thought that by June 15 the suspension would be general, and over 10,000 people be thrown out of employment in the Schuylkill region. Fears are entertained that work will not be resumed until next spring. Orders have been issued by the Reading Coal and Iron Company to stop work at their various ore mines where 600 men are now employed. It is claimed that enough ore has been mined and stocked, ready for shipping, to supply all demands until spring.

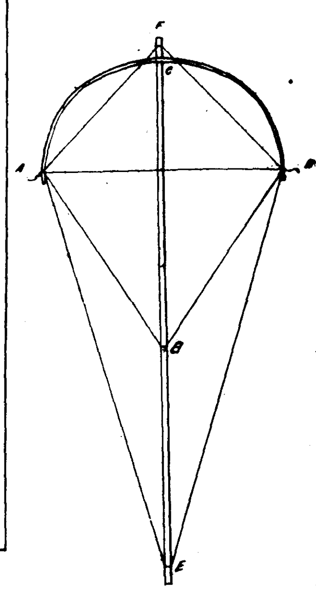


SUBMARINE ENGINEERING APPARATUS.

SUBMARINE ENGINEERING APPARATUS.



KELSEY'S & MULTER'S GRAIN CRADLE-FINGERS.



LECTURES TO LITTLE FOLK.

THE KITE.

FURNITURE DESIGNS.

From the *American* (Boston, Mass.,) *Cabinet-Maker.*

(See page 212.)

We furnish a few designs of a style of Patent Bed-room Furniture which is coming very much into use in large cities in the United States, where families find it not only expensive but difficult to obtain a suite of rooms.

The first two illustrations represent an "Adjustable Chamber" suitable for large halls, hotel, corridors, &c. When closed, projecting about 20 inches from the wall. When open, a Room with Bed and Washstand, a space for the wardrobe, and room to dress in.

The size when open will be 7 feet by 6 feet; the whole thing when closed occupies no more room than a Wardrobe and room to dress in.

The Sofa Bedstead is easily changed from a Sofa to a Bedstead, or *vice versa*, and when up, a convenient Sofa, with box to contain bed clothes, &c., when down a Double Bedstead with Spring Mattress, &c. The advertiser manufactures the frames for the trade.

The last two illustrations represent a Folding Bedstead convenient for use and simple in construction. When closed projecting about 10 inches from the wall, with space inclosed for bed clothing, &c.

When open it makes a full-sized bed suitable for parlors and private sitting-rooms.

DISEASE GERMS.

Mothers know too well what is meant by the word "thrush" or "sprew," that mouth malady which is so common with little children. To the profession it is known as an aphthous ulceration of the tongue, aphtha being the name of the disease, and signifying a burning. The tongue "is swollen, tender and furred." There are excoriated spots, sometimes true ulcers, varying in size, perhaps, from that of a pin's head to that of half a pea, and these are severally capped with a white, curd-like mass. However diminutive these pustules may be, they are in truth hammocks of tiny plants, for each one contains many thousands of parasitic fungi, often called *torula*. These fungi attach themselves to the mucous membrane, and burrow among the epithelial cells. They are "composed of threads matted together like felt," whose basal ends interwine among the epithelia, like the hair in the prepared mortar of the plasterer. At a recent meeting of the Academy of Natural Sciences, Prof. Leidy exhibited a mouse with little curdy patches on its ears, face and nose. Mr. Indifference would have passed the matter by as a stupid trifle; and a spurt of insapience escaped one of the wise men, who wished to know "what the muss was." However, little *Muss musculus* was regarded as an abnormal case, and a proper subject of scientific inquiry. The query was now, "What ailed the little fellow, and where had he been?" At this juncture the microscope spoke out in meeting, declaring with authority that the white spots were colonies of a parasitic fungus; and, strange to tell, they were as much like the thrush fungus as one pea is like its fellow in the same pod. The truth told, Mousie was captured in the children's department of Blockley hospital, where he had picked up the crumbs that had fallen from the mouth of a child patient. The diagnosis now seemed natural and direct. Mousie had been and got it—namely, the thrush—and, strange to say, he had got it bad, for it was on his ears and nose and face. Soon, in all probability, it would have entered the mouth, even if it had not already. A minute portion of one of these white spots was subjected by skilled hands to a lens of very high power, and lo! there were the morbid parasites, tiny sporular bodies, some single, some double, and others "in chains of a dozen or more." The fungus was pronounced to be a *torula* or *oidium*, like that found in the disease known as thrush or aphtha. A drawing of it would be simply like a number of elongated beads strung together. But how diminutive these beads or cells were! A single one was 1-650 of a line in length, that is, it would take 7,800 of them in a line to make an inch.—*Prof. Samuel Lockwood, in Harper's Magazine for May.*

MINCEMEAT FRITTERS.—With half a pound mincemeat mix two ounces fine bread crumbs, or a tablespoonful flour, two eggs well beaten and the strained juice of half a small lemon. Mix these well and drop the fritters with a dessert spoon into plenty of pure lard; fry from seven to eight minutes, drain them in a napkin and send them very hot to the table. They should be quite small.

HOLIDAY PASTIMES.

SWIMMING.

We published last year, in the October and November Numbers, the excellent article on this useful acquirement from Cassell's Popular Educator. We feel sure that to the youthful portion of our New Subscribers, the republication of the article, in full, with illustrations, will be most acceptable to them. We trust it will be the means of teaching the necessary art to many.

Swimming may be ranked both as a pastime and as a purely gymnastic exercise, but it has a still higher claim. It is one of the most essential features in physical education; and it should never be left to the choice of youth to acquire the art, but its practice should be inculcated as an absolute duty. It is strange that this branch of bodily training should have been hitherto so much neglected, even among the classes whose lives are passed chiefly on the waters. But in England a change is in progress, and at some of the public schools the rule has been very properly adopted, that no youth shall be allowed to practise rowing until he has been certificated as a swimmer.

We would have all our readers cultivate this most useful art not only for the benefit it may possibly be in delivering them at some time from danger, but also as at all times one of the most healthy and vigorating physical pursuits. We shall give a few plain instructions, calculated to assist any youth in learning to swim; but we must advise him to have recourse at the outset, if he can, to the practical aid of some friend who acquired the art. His example and occasional help may inspire the learner at once with confidence in the water, which is the first thing to be acquired in swimming, and will make the rest come easy.

There is little difficulty, either in town or country, in obtaining access to the water. We believe all our large towns are now supplied with swimming baths, in which it is preferable that the beginner should practice, rather than that he should seek an open stream for the purpose. The baths should be attended by experienced persons, from whom lessons may be obtained if desired, or whose help may be useful in an emergency; and at such places the learner may also gain kindly hints and assistance from others who have recently experienced, and are ready to sympathise with, his difficulties. But if the beginner is the denizen of a rural locality which is destitute of such an advantage, he should exercise care in the selection of a spot in which to practise. Let him, in the first place, choose a stream the bottom of which slopes gradually from the bank, and ascertain its precise depth at various distances. Let him be very careful to select a place which is free from weeds, either attached to the bottom and scarcely seen from the bank, or floating freely on the surface. A clear stream, with a gravelly or sandy bottom, is by far the best. One with a muddy or rough and stony bottom should be avoided; and especially keep clear of water the bed of which is full of deep and sudden holes.

Bathing on the sea-shore can only be practised with safety when the beach is shelving, and its general features, as to freedom from rocks, etc., are well known. The novice should select still weather only for the purpose, or the sudden coming in of a wave may take him off his legs, and carry him helplessly out to sea.

The best time for practising is in the morning, an hour or two after sunrise; but bathing or swimming on an empty stomach is not advisable. A crust of bread, with the addition of a cup of coffee if practicable, is all, however, that will be necessary. Bathing either shortly before or shortly after a full meal is injurious, but the latter especially so. Take a brisk walk before you enter the water, that the body may be in a glow when you step in; then strip as quickly as possible, and take your plunge while the blood is still coursing freely through the veins. When you have learnt to swim, you will be able to enter by diving; but until you have, you must walk into the water, and in this latter case you should dip the upper part of the body in and out again, otherwise the blood will be driven too much to the head.

We must say a word as to the mechanical aids to Swimming, as the youth desirous of learning the art may, in the absence of all other help, think it necessary to have recourse to such assistance. Hardly any contrivance, however, yet devised is free from some objection; and we must not be understood as recommending the resort to either, if it can be avoided.

Among the most venerable and at the same time the most objectionable of these appliances, are the cork-floats or buoys, which may be seen in the shop of almost any cork-cutter. They usually consist of several circular pieces of cork, of various sizes, fastened together by a strap or thong of leather, the larger pieces in the centre, and the rest tapering off at top and bottom. Two of these floats are used by each person, and are fastened under the armpits, so that the chest rests upon them in swimming, and the head and shoulders are thus buoyed up in the water. But the contrivance is an awkward and cumbersome one; it hampers the free movement of the arms, and, even if it should lead to nothing worse, it causes the learner to contract a very clumsy and defective style of swimming. The floats, however, are liable also to slip from their position, and in this case they become worse than useless. The novice in this case feels his legs thrown upward instead of his head, and, the proper movement of his arms being checked, his supposed means of safety become a source of positive danger. Some fatal accidents have happened in this manner. The use of floats is, therefore, gradually being discarded, as their evils become more widely known.

Better by far, and perhaps best of all such aids, is a modern contrivance made of the same material, and known as the cork jacket. Stout strips of cork are attached together in such a fashion that they encircle the body completely round, and, being fastened by strings at top and bottom, leave the limbs comparatively free, while the necessary buoyancy is obtained from the light armour in which the chest and back are thus encased. This jacket was invented more particularly for the purpose of saving life at sea, but its obvious utility has commended it to the use of persons learning to swim, and it is likely to meet with wider favour as its merits become more generally known.

An ordinary life-belt, fastened round the waist, is sometimes used for the same purpose, and is far less objectionable than the cork floats; but it must be obvious to our readers that even such appliances as the jacket and the life-preserver leave less freedom of action to the body than is the case when they are dispensed with, and consequently that the learner who desires to swim with grace and ease is placed at a disadvantage by their use. Moreover, when such help has been habitually relied upon, it becomes a source of embarrassment to part with it suddenly; something has to be unlearned, and something more to be learned—namely, the power of the body to float by its own natural buoyancy while the limbs maintain a proper position.

Confidence, founded on a right comprehension of the principles involved in swimming, and self-command, or presence of mind in the water, are the first essentials in learning the art. If the learner could trust to theory only, confidence should come at once, for he has only to be told that the specific gravity of the body is less than that of water, and consequently that the body, if left to itself, with the limbs in a proper position, will float of its own accord. Benjamin Franklin's method of demonstrating this, by entering shallow water, and trying at once to dive in the direction of the shore, requires more nerve and coolness on the part of the novice that many are in possession of. All who can satisfy themselves of the buoyancy of the water without such a practical test, may be content to attempt the simple motions of swimming, and leave diving of every kind until they have become somewhat used to the water. Supposing, then, that the learner is about to make his first effort, without either personal or mechanical assistance, he must carry out into practice what we have already remarked as to the selection of a spot characterized by a shelving bottom, and having done this, walking into it until he is nearly breast high, turn round towards the shore, and try to reach it by swimming. The head must be held up and thrown backward, the chin being kept well clear of the surface of the water; the chest must lean, as it were, upon the water, being well inflated with air before the stroke is taken; and, while the chest is thrown well forward, the back should be hollowed, so that all the muscular power of the body may be exercised in the forward motion. These movements, the work of a second in execution, are preliminary to the stroke itself, which is performed in the following manner:—Bring the hands together a few inches below the surface, and a little in advance of the chin, the elbows being bent below the stomach; the fingers should be quite close together, and the palms slightly concave. Now extend the hands forward as far as possible, and, when the full distance is reached, separate them with the palms downward, and *sweep* the water backwards in a half circle. The elbows thus come back to the body, and the hands are brought quickly together as before, the edges only being presented to the water until the hands meet.

While the movements are being performed by the arms, the legs have their part to play as follows: At the moment when the learner's arms are first thrown forward, as described, he will find his legs rising towards the surface; the knees should then be bent forwards, so that the legs may presently be thrown well out behind; the feet should be kept apart, and the toes turned out. When the hands have made their sweep, the legs are thrown downwards and sideways by a vigorous effort, the stroke of the legs thus *alternating* with that of the arms, and the movement of both arms and legs being so timed that the legs are fully extended out behind at the moment when the arms are stretched straight forward. The movement of the legs is performed with more celerity than that of the arms, and you must time their action accordingly, remembering that, in preparing for each stroke, the legs and the arms are both drawn back towards the body at the same instant.

The illustrations given with the present paper will enable the learner to comprehend these instructions clearly. Fig. 1 shows the position of the swimmer in the water just before the stroke is made, and Fig. 2 the attitude when the limbs are fully extended, the arms being just about to make their sweep. The action of the stroke itself is shown so far as possible in the accompanying diagram (Fig. 3). The arms, gathered up at *a*, with the hands together, are then thrust forward to *b*, and swept round to *c*, when the elbows are bent inwards and the hands come back together as before described. The movement of the legs cannot be properly shown in the diagram, but will be at once understood by a comparison of their position in Fig. 1 before the stroke, and that after they are fully thrown out, in Fig. 3.

In the stroke of the legs, you should press against the water with the soles of the feet, not with the toes only; and in that of the hands, you should not only thrust or sweep the water *aside*, but press it *downward* also. By these combined movements, the resistance afforded by the water is turned to account both in propelling the body and keeping it on the surface. You rise with a rebound from the downward motion, and you are made to shoot forward by the backward impulse of the limbs.

The various movements thus described may be practised before the learner attempts to enter the water. He may take a stool or form, and, lying across it on his stomach, may go through the successive evolutions, so as to become familiar, to a certain extent, with the nature of the stroke, and to learn to time the action of his hands and legs. A little practice of this kind will be useful, by helping to give him the necessary self-possession when he first trusts himself to the open stream.

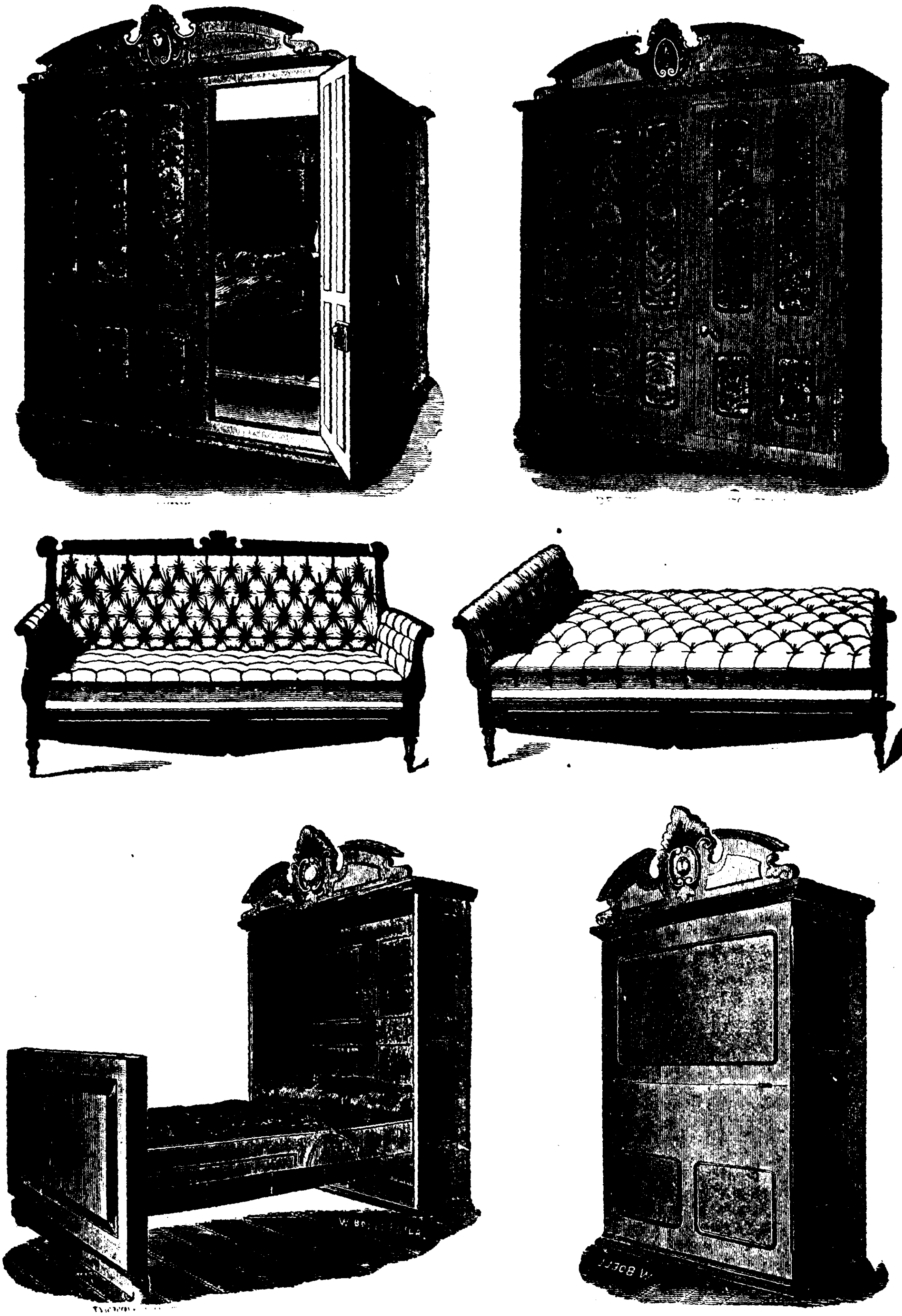
We will suppose our readers now to have become familiar with the practice as well as the principles of plain swimming, and will pass on to the necessary instructions in other departments of this useful art, a knowledge of which is essential to every one, but more especially necessary to those who are fond of yachting and rowing, to say nothing of sailors by profession, who have far more need of being able to swim well than landsmen.

In the first place, as to the manner of entering the water. When the learner has become somewhat familiar with the element and its buoyant power, and has learnt the proper use of his limbs in it according to the instructions previously given, he will look with some degree of contempt upon walking into the water. He will not be satisfied until he is able to *dive*; and in learning to do so he must practise with as much care as he displayed in his first lessons. He must use equal judgment in the selection of a suitable spot for his first attempts, for the water should not be too deep, even although he may have learnt the rudiments of swimming; and it is of more importance still that it should not be too shallow. "Taking a header" in water only a few feet in depth is a dangerous thing. It has sometimes been attempted, even by experienced swimmers, with fatal results. If the head comes first in contact with the water, the liquid has sufficient resisting power to render the concussion certainly injurious, and to peril the safety of the inexperienced diver to a very great degree. The hands must be placed together as when they are pushed forward in swimming prior to the stroke; and, when thus placed, they must be extended in front of the head, to cleave a passage for it before it reaches the water.

Supposing the water to be moderately deep—say ten feet or more—the position in which the diver should leave the bank is shown in our illustration (Fig. 4.) With the body thus bent, the diver enters the water with a plunge and a spring from the toes. After the spring he straightens his legs, and at the moment of total immersion he *swoops*, as it were, in an upward direction, when the buoyancy of the water assists the body in regaining the surface immediately. In completing the dive in deep water, the body assumes the position shown in the second figure (Fig. 5.)

When diving in shallow water, the relative position of the limbs is as shown in Fig. 4, but the body is not nearly so much bent, the whole plunge being taken, in fact, in a slanting

FURNITURE DESIGNS.



HOLIDAY PASTIMES—SWIMMING.

Fig. 1.—Before the Stroke.

Fig. 2.—After the Stroke.

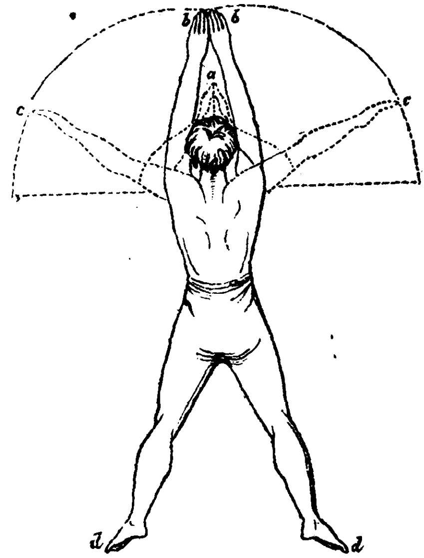


Fig. 3.—The Action of the Limbs.

Fig. 4.—The Dive.

Fig. 5.—The Header.

Fig. 6.—Floating.

Fig. 7.—Treading the Water.

direction, and the body itself being but little curved. The head dips but little below the surface, the back is but just covered, and the whole figure slants upwards again immediately.

Floating is a most useful branch of the swimmer's art, and its practice must be made one of his earliest studies. It is attended with no difficulty beyond the knack of getting readily into the proper position, and this is easily acquired. It is of utility as a relief from the active exertions required in swimming, enabling the swimmer to take a rest without leaving the water: and it may be of the greatest service in a time of danger, whether arising from cramp, from over fatigue, or from sudden immersion. All that it is necessary to do in order to float, is to lean back in the water, throwing the face well upward, and extending the arms as far as they will reach behind the head. The legs then come to the surface, and you may afterwards bring the arms round to the side, and float in the position shown in Fig. 6. But in floating you must remember to let the chest play its proper part, as a bladder inflated to the fullest possible extent; and in order to this you must inhale as much air as you can into the lungs, and when you expel the air in respiration, you must draw a deep breath again immediately.

Having assumed the position in Fig. 6, you are ready for *swimming on the back*, which is usually performed in the following manner:—Placing the hands on the hips, you draw up the knees, but at the same time depress the toes, so as to raise the knees out of the water. You then strike out the legs as in ordinary swimming, and you find yourself progressing with the head foremost. But it is possible to swim on the back without using the legs, and in the case of fatigue or cramp it may become necessary to do so. You then bring the hands towards the chest, and press back the water in the direction of the feet with a sweeping motion. By reversing this movement of the hands, and sweeping the water gently towards the chest instead of away from it, you are enabled to progress in the opposite direction—*i. e.*, feet foremost. The elbows in these movements should be kept near to the sides, only the fore-arm being used to give the hands their necessary action.

Swimming on the side is sometimes practised as a change from the ordinary mode of progression. Turning on either side, you throw out the undermost arm along the water, and, with the palm of your hand hollowed out for the purpose, you scoop or drag the water towards you. The action of the legs is much the same as in ordinary swimming, and the uppermost hand is used at the same time as the legs in pressing back the water. The stroke of the legs must exactly alternate with that of the foremost arm.

The *hand-over-hand* style of swimming consists in swinging the hands, one after the other, forward out of the water to get as great a reach as possible, then dragging the water backward to the hips, each leg striking out alternately, as soon as the arm on the same side has completed its movement. The whole movement of the arm describes an oval figure, of which the lower part is in and the other out of the water, while the shoulder forms the centre. After being thrown forward, the hand, as it reaches the surface of the water, is turned edgewise, so that it encounters little resistance on entering the water, but it is immediately aftarwards turned with the knuckles upward and the palm hollowed out, as in side-swimming.

Treading the water is accomplished by allowing the feet to fall from the floating or swimming position, and performing with the legs the same motion that is made in going up a flight of stairs. The feat is more easily achieved when the arms are employed to assist the legs by pressing the water with a downward motion, as shown in the illustration. (Fig. 7.)

Much the same position as this is maintained when *standing* in the water—or, as it is termed by some, *perpendicular floating*—only that the head is thrown back, with the nostrils elevated in the air, while the arms are either folded across the chest, which is arched well forward, or kept down close by the hips.

There are other styles of fancy swimming, such as the "dog-like style," swimming under the water, etc., which we do not think it necessary to notice here. We believe the instructions now given will be found sufficient for all purposes of general utility, and that practice in the modes described will suffice to make, not only a good, but a dexterous swimmer. Variations upon them will come easy when the groundwork has been well laid, and there is perfect familiarity with the water.

We must say a few words respecting *cramp*, and on this point we cannot do better than repeat Walker's instructions on the subject:—"Those chiefly are liable to it who plunge into the water when they are heated, who remain in it till they are benumbed with cold, or who exhaust themselves with violent exercise. Persons subject to this affection must be caretul with regard to the selection of the place where they bathe, if they are not sufficiently skilful in swimming to vary their attitudes, and dispense instantly with the use of the limb attacked by cramp. Even when this does occur, the skilful swimmer knows how to reach the shore by the aid of the limbs which are unaffected, while the uninstructed one is liable to be drowned. If attacked in this way in the leg, the swimmer must strike out the limb with all his strength, thrusting the heel downward, and drawing the toes upward, notwithstanding the momentary pain it may occasion; or he may immediately turn flat on his back, and jerk out the affected limb in the air, taking care not to elevate it so high as greatly to disturb the balance of the body. If this does not succeed, he must paddle ashore with his hands, or keep himself afloat by their aid until assistance reach him. Should he even be unable to float on his back, he must put himself in the upright position, and keep his head above the surface by merely striking the water downward with his hands at the hips, without any assistance from the legs." But besides this, it must be remarked that, although cramp is a dangerous thing, it is not so dangerous as the *fear* by which it is occasionally accompanied, and which sometimes leads to entire loss of self-possession, with the worst results. If attacked by cramp, therefore, act with calmness, recall to mind the foregoing instructions, and by adopting that method which is best suited to the nature of the seizure, you may maintain yourself safely in the water until the pain has gone, or assistance can reach you.

One more word of advice, as to attempting to save a drowning person. Never approach him from behind by the hair; and never allow him to grasp any part of your body if you can possibly prevent it. But if you should find yourself so seized, sink at once to the bottom, when the hold upon you will probably be relaxed, and you will be released from your perilous position. It is only a good swimmer who should make such an attempt in deep water, as for a novice to try to rescue a drowning man by his own unaided efforts, is greatly to imperil a second life without reasonable chance of saving the first. Better hasten to secure a rope or pole, which, thrown quickly to the person in danger, may assist him in regaining shallow water or the shore. Young swimmers should never go out bathing together without having such a means of assistance at hand in case of emergency.

The Largest Photographs in the World.—Mr. B. O. Holtermann, the well known gold miner, and one of the richest men in the colony, claims to have produced the largest photographic views in the world. He has two views of Sydney and harbor, each five feet by three feet two inches, and two of four feet six inches by three feet two inches. These photographs, Mr. Holtermann claims, are the largest ever produced from single negatives. They give a complete view of the city and harbor of Sydney from Garden Island to Long Nose. No. 1 negative, which is five feet by three feet two inches, takes in the space from Garden Island to Dawes' Point; the second, of the same size, embraces from Dawes' Point to Miller's Point; the two others, each four feet six inches, showing from Miller's Point to Long Nose. Apart from the size of the pictures, they are splendid specimens of the photographer's art, the outlines being sharp and clear and the various objects shown coming out prominently before the eye. The difficulty of producing pictures of such size can be best understood and appreciated by photographers.—*Sydney Evening News.*

Ferns for Mattrasses.—Every country neighborhood has hollows which are full of ferns and brakes, which usually die and go to seed without doing any good, save as a gratification to the sense of sight. The softer parts, if stripped from the stems and dried in the sun, retain their toughness and elasticity for a long time, and are said to be superior to straw and husks, and even to "excelsior," for stuffing mattrasses. The ticks, when filled, should be firmly stitched with a mattrass needle, using strong linen twine, and making the intervals between the stitches an eighth of a yard.

A New System of Plastering. — Builders, owners and tenants of city houses will doubtless view with interest a new system of plastering, which is claimed to prevent the sudden and disastrous downfall of ceilings, so frequently occasioned by defects in the water pipes and consequent leakage and overflow. The invention consists of replacing the scratch coat and brown coat used in ordinary work by the combination of fibro-ligneous sheets with a cement composed of lime, sand and plaster. The sheets are of a fabric resembling coarse bagging which is secured to the lathing, and the cement is supplied in the ordinary way. A hard finish coating completes the work.

KING'S SAFETY LINK.

(See page 221.)

Fig. 1 shows the plate which receives and holds the link fast in a case of overwinding. It is supposed to be bolted on the top side of the head-gear oak-beams, which ought to be so securely fastened as to hold three times the weight to be carried, and set as far apart as the width of the top plate. A case of overwinding is shown in our fig. 2, representing a front view of top beam and plate, with the rope shackle disengaged or detached. Figs. 3 and 4 represent front views of the hook when in regular working order, the latter showing also the inside of the hook plates in dotted lines. From this last woodcut it will be seen, that when the hook is overwound it passes into the inner ring of the top plate. The extremities, C, C, of the two inner plates being of greater diameter than the forementioned ring, they evidently must become compressed in a case of overwinding, as these inner plates are made to swivel on a centre pin. When this compression takes place, the apparatus assumes the form shown in fig. 5 ; that is to say, the other side of each of these inner plates (shown partially in full and partially in dotted lines in fig. 5) become forced out, as at D, and E. The points, D, D, form the catches which retain the hook and cage suspended from the upper side of the plate, while the bulging out of the top parts of the inner link-plates allow the rope shackle to go free, by opening the shackle jaw. The usual safety pin for preventing the link to act at the wrong time is inserted at A, which is a small hole for a half-inch pin to be riveted in for holding the plates in their normal position when in work. In a case of overwinding, when the extremities, C, C, are forced inside the outer link plates, this pin becomes sheared in four places, and to facilitate the punching out of the sheared pin, an extra hole, B, serves as a driftway for holding the plates square.

These hooks are now made in three sizes, for raising six, eight, or ten tons weight. For working a load of six tons their weight is stated to be about 140 lb. The average time required for re-attaching the rope to the hook after overwinding is given as fifteen minutes, and we are informed by the inventor that whilst more than 800 of these links are in use, having saved over 100 lives, none of them have ever failed, which is certainly the most weighty recommendation which can be offered for this apparatus.—*Iron.*

A CERTAIN CURE FOR RHEUMATISM.

Judging from his article in the *Wiener Medizinische Presse*, Dr. Franz Zeller is an enthusiast in the administration of caustic ammonia in rheumatism. For several years he had been a sufferer from severe muscular rheumatism in the right shoulder: he had taken all the anti-rheumatic remedies, with but little alleviation, when he began to reason that in rheumatism, as in gout, there may be a uric acid diathesis ; he thought that *liquor ammoniæ*, on account of its rapid volatilization, would be the remedy most readily absorbed and the most prompt in action.

In almost the same moment in which he took one drop, diluted with water, he felt a complete relief from the pain, which had lasted for ten hours; he was now able to move freely the arm which, an instant before, he could scarcely bear to have touched. The remedy, he claims, has proved a positive cure in all recent cases of muscular rheumatism which have fallen under his observation ; he cites numerous cases in which relief, as instantaneous as his own, was experienced. He also observed its effects in several cases of acute articular rheumatism, in two of which six drops sufficed to subdue the pain and swelling within a period of twenty-four hours. In one case of chronic rheumatism of a finger joint, which had lasted for over half a year, the simple administration of the ammonia completely dispelled the inflammation and pain in the joint within two days.

He then discusses the mode of action of his remedy. "If we consider an excessive acidity as the cause of the rheumatism, we can scarcely claim, in the cases in which one drop will instantaneously relieve the pain in recent rheumatism, that one drop was sufficient to counteract the effects of the excess of uric or (according to Fuller) lactic acid.

"Nothing remains therefore but for us to seek for the source of rheumatism in a morbid nervous activity induced by disturbances of nutrition, and to believe that the ammonia acts as a nervine directly upon the nerves."

After the cure of one attack of rheumatism, our object should be to put the patient in such a condition as to prevent their recurrence. This, the writer thinks, can be done by building up the general system, and thus diminishing the nervous excitability. —*The Clinic.*

NEW SYSTEM OF ILLUMINATION BY REFLECTION.

We regret that we cannot afford space to reprint the article on this invention which appeared in the *Scientific American* of the 10th June last. We commend the reading of it to all scientists. It would appear from that paper that the same system was patented in the United States as a locomotive headlight in 1801, by C. S. Lee & W. M. Baldwin, of Troy, N. Y.

FOREIGN AND COLONIAL NOTES.

Bessemer Rails in the United States.—The production of Bessemer steel rails in the United States amounted in 1872 to 94,070 tons, while 149,786 tons were imported. In 1874, the production of Bessemer steel rails in the United States amounted to 144,944 tons, while the importation declined to 100,486 tons. The production of steel rails in the United States in 1875 is roughly estimated at 250,000 tons.

A Big Krupp Gun.—A monster cannon which Herr Krupp has constructed as a present for the Sultan of Turkey, will shortly arrive at Constantinople. It will be landed on the artillery esplanade at Tophanch for the inspection of his majesty, and will be subsequently sent to arm one of the forts of the Upper Bosphorus or the Dardanelles. The huge gun is estimated to cost about £20,000 sterling.

The American Coal Trade.—The imports of bituminous coal into the United States in 1875 amounted to 411,723 tons, of the value of 1,511,083 dols. The exports of bituminous coal from the United States in 1875 amounted to 285,060 tons, of the value of 767,586 dols., and 361,669 tons of other coal of the value of 2,039,259 dols.

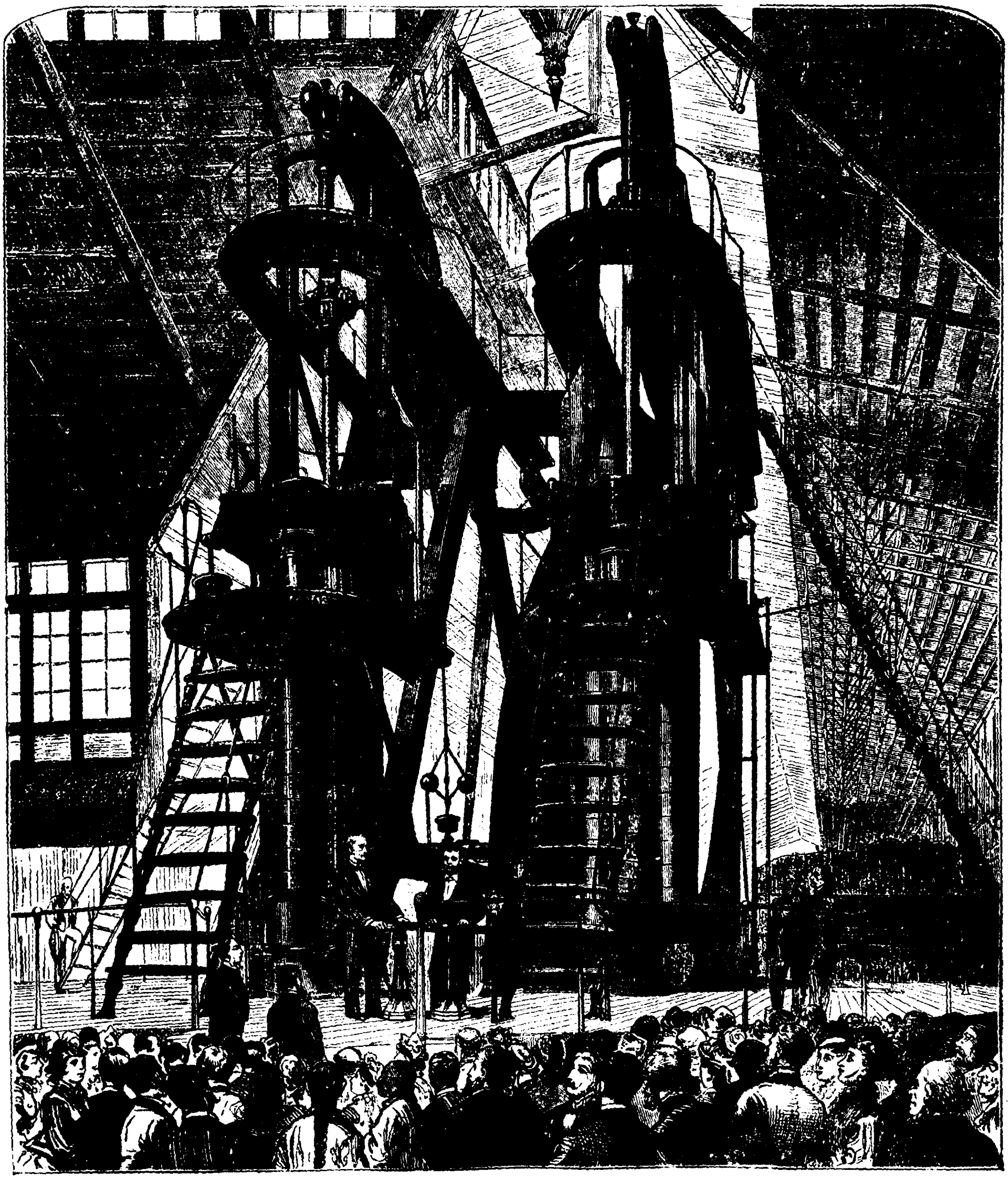
American Patents.—The House of Representatives of the United States has adopted a report of the Committee on Patents refusing an application for an extension of the four-motion feed patent owned by the Wheeler & Wilson Sewing Machine Company. The patent had continued 21 years, and protests against its extension were received from nearly 1,000,000 persons.

The Suez Canal.—The revenue of the Suez Canal in January amounted to 110,525*l.* The receipts of February were 101,818*l.* During the last five years the Company's revenue has made an extraordinary advance. Thus in January, 1870, the amount derived from the transit of vessels through the canal was 4145*l.*, and in February, 1870, 8687*l.*

Wages in Turkey.—We hear that in consequence of the non-payment of arrears of wages due to them, the English engineers and mechanics employed in the Turkish Imperial Arsenal at Hasskeni recently struck work. The poor fellows appear to have had some justification for the step which they thus took, five months' arrears of pay being due to them. Since the strike they have received one month's pay, but we have not yet heard that they have resumed work. Money is evidently a desperately scarce article just now with the Turkish Government.

Bounds of Microscopic Investigation.—H. E. Sorby, President of the Microscopic Society of London, says that with the most highly perfected instrument even the air is a too coarse medium to enable us to see the finest molecules of a substance. Prof. Helmholtz and other physicists claim that they are clearly able to distinguish lines separated from one another only 1-80,000 of an inch, and with the aid of photography and the blue light can depict lines removed 1-112,000 inch, but we are able to see how far short even such an instrument comes, when we consider the millions upon millions of molecules that exist in albumen and other substances, which only occupy a space of a thousandth of a cubic inch.

Typhoid Poison in Wells.—The *Journal of Chemistry* warns the drinkers of water of wells near dwellings to beware of the typhoid poison, sure to be found sooner or later in those reservoirs, if any of the house drainage can percolate them. The gelatinous matter often found upon the stones of a well is a poison to the human system, probably causing by its spores a fermentation of the blood, with abnormal heat or fever. Wholesome untainted water is always free from all color and odor. To test it thoroughly, place half a pint in a clear bottle, with a few grains of lump sugar, and expose it, uncovered, to sunlight in a window. If, even after an exposure of eight or ten days, the water becomes turbid, be sure that the water has been contaminated by sewage of some kind. If it remains perfectly clear, it is pure and safe.



THE CORLISS ENGINES AT THE CENTENNIAL EXHIBITION.

BALESTRIÈRI'S SYSTEM OF ILLUMINATION.

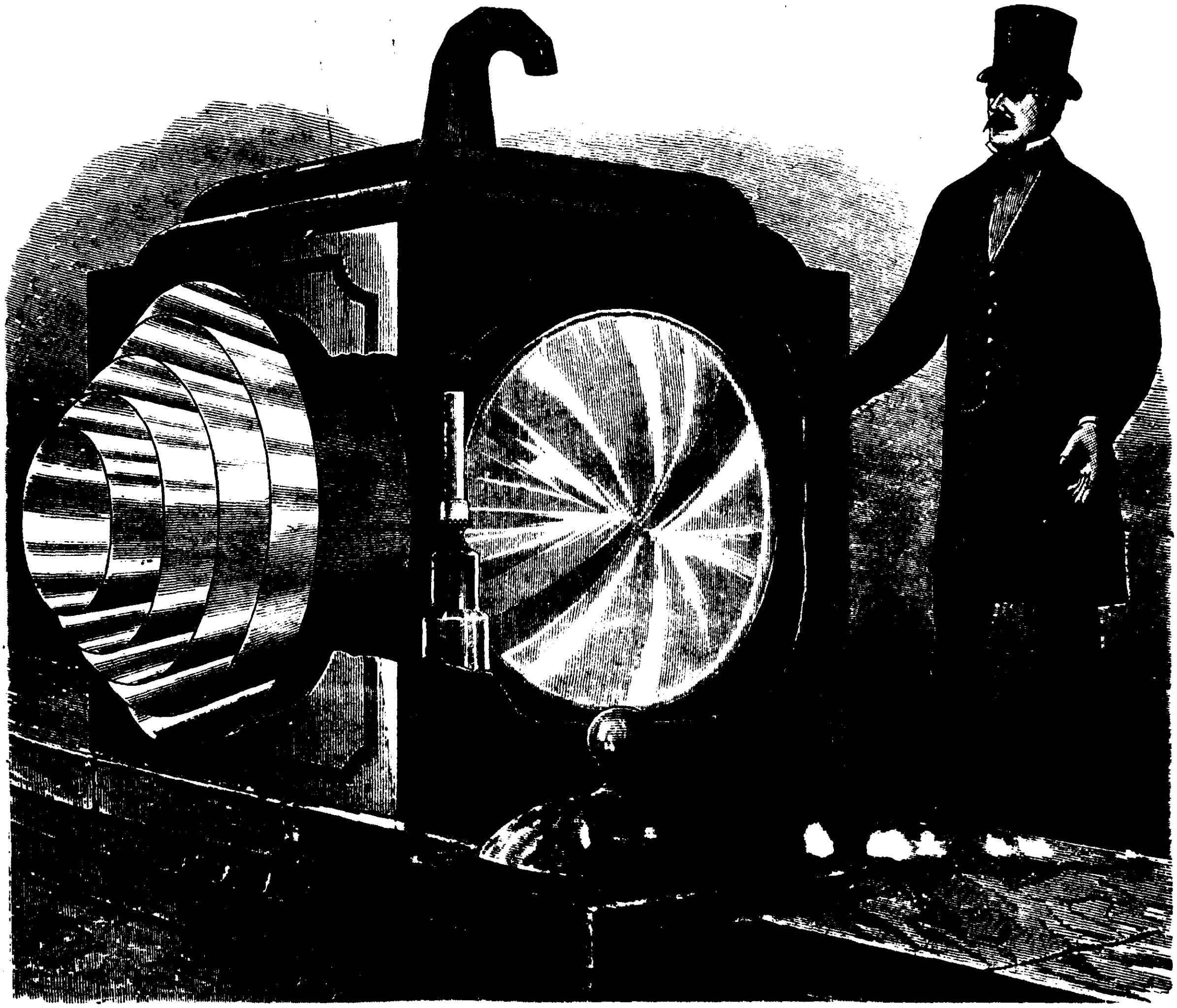
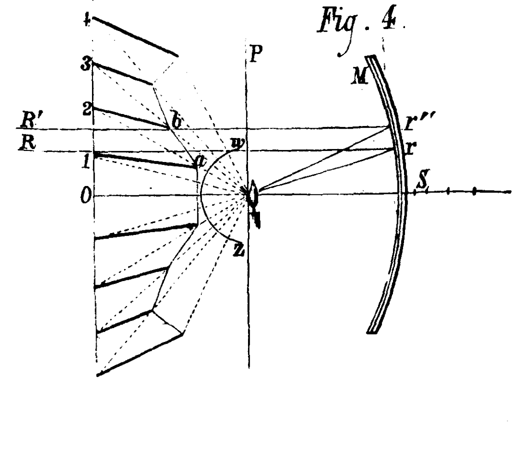


Fig. 4



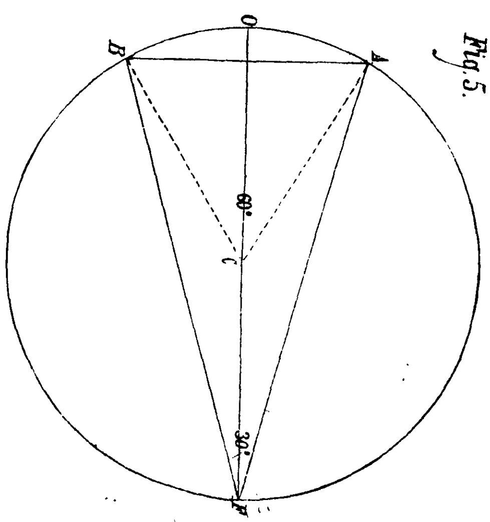


Fig. 5.

LECTURES TO LITTLE FOLKS.

Summer Sports ; The Kite.

Where is the boy who has not taken pleasure in flying a kite? In England it is quite a national pastime, and no healthier recreation is known for boys than that of flying kites in the breezy fields. Kites are made of different shapes, and in the toy shops, you may meet them in various and fastastic forms. Some have been made in the shape of a man, made out of linen cloth, cut, and painted for the purpose, and stretched on a light frame, so constructed as to resemble the outline of the human figure, dressed in a sort of jacket, its head covered with a cap, terminating in an angle, so as to favor its ascent. These kites were generally made 12 feet high, and folded in the middle by means of hinges adapted to the frame. Large as this kite may appear, it was capable of being raised with a slight wind five hundred feet, and when once raised, it could be maintained in the air by giving only a slight motion to the string, by which it acquired a kind of libration, like that of a man skating on the ice. Another description of kite is made in the form of a coffin lid, but we believe the figure commonly adopted is the best calculated for the purpose, and for obvious reasons ; the curvature of the bow enables it to escape the resistance of the air as it rises ; which after having struck it, slides off ; just as the current is more effectually turned aside by the gently curved prow, than by that which has a sharp outline; for the same reason the mast of ship, though it has a conical shape, is more easily drawn through the water with its broad, than with its narrow, end foremost ; for although the primary obstruction is, no doubt, greater in the former case, yet the water, heaped, as it were, on the front, is made to stream off with a slight divergency, and therefore does not hang on the sides of the mast, as it would in the latter case. The shape of the kite, moreover, presents the largest surface at the point upon which the wind can act with the greatest effect, while the whole is lightened by the removal of parts that would obstruct its action. The tail has also a greater control over a figure of such description.

The French call the kite a *cerf-volant*, or flying stag, though it never could have been constructed of that shape. The earliest notice of a kite is to be found in a dictionary published in the year 1690, where it is described under the name of *cerf-volant*. The invention is supposed to have come from the Chinese, in which country the pastime would seem to be of very ancient date, and from which it was probably introduced into Europe. In the present day, kite-flying is a very popular game among these extraordinary people, and they excell as well in the curious construction of their kites, as in the height to which they make them ascend. They also, by means of round holes, supplied with vibrating cords, make them produce a loud humming noise like a top.

As kites sold in the toy shops are made to sell, rather then to fly, we will give directions by which any handy boy can make one. Take a straight lath of clear pine, free from knots, about three-quarters of an inch wide, and less than a quarter of an inch thick, and about four feet in length ; this being nicely placed, and of equal thickness throughout, form the standard, or *back-bone* of the kite ; and now for the bow—take an unbent piece of ash or elm, as free from knots as possible, and not thicker than the lath, and observe that the length, of this bow does not exceed the length of the lath, pare it down a little at each end that it may bend more freely to the required shape. This having been accomplished, commence to form the frame of the kite by finding the central point of the bow, by balancing it on the forefinger, and affix that point by means of a string to the lath at *c*, (see figure,) about an inch and a-half from its upper extremity ; a notch must be next cut in the end of the hoop or bow at *a*, *d* ; having fixed ths string in the notch *a*, draw it through another *e*, previously cut in the bottom of the lath, and carry it to the opposite end of the bow *d* ; this completed, you have the skeleton of the usual form of kite.

The next point to consider is whether the two sides of the bow are in equilibrio, which is determined by balancing the lath on the finger, and observing whether it remains horizontal, or dips on either side. This adjustment completed, continue the string from *d*, across the skeleton to the opposite notch *a*, giving it one turn round the lath in its way ; from *a*, carry it to *f*, and wind it round the top of the lath, and then again fasten it at *d* ; from *d*, extend it rather more than midway down the lath, and having secured it at *l*, finally carry the string to the notch at *a*, and there secure it.

The next part of the process is to cover it with paper. The best kind should be employed for this purpose ; it should be thin and strong, and not tare readily ; paste a sufficient number of sheets together, letting the joints lap over about an inch, and lay the paper on a table, then place the frame of the kite upon it, and cut the paper to its size, leaving about three quarters of an inch of margin to lap over the string, but about 1¼ inch to lap over the bow. This part of the work having been completed, and a sufficient time allowed for the drying of the paste, proceed to fix the string called the *belly-band* ; for this purpose drill two holes in the lath, at equal distances from its edges ; the upper part a fifth part of the length of the kite from the top, the lower hole more than the same distance from its extremity.

The last and by far the most important point is to make the loop in the *belly-band*. If the kite be accurately constructed, its proper place may be easily found by extending the hand, right or left, on the surface of the kite, and then marking the string at a point which lies in a line drawn from one end of the bow to the other ; the loop must be made a little above such point. If the kite be now suspended by this loop, the two ends of the bow ought to preserve a balance, and the lower extremity should dip below the upper part of the kite. This should be done with great care, as the steady ascent of the kite in the air depends upon such accuracy, otherwise the kite will rise sideways, or *plunge*, as it is called.

An error in the construction of the tail may also cause, occasionally, such accident, but it is more generally referable to the position of the loop. If the kite *plunge*, you may conclude that the hoop is placed too high, and should it whirl round in the air, that it is placed too low.

The next operation is that of making the tail. This should never be less than 12 feet, and should it even amount to twenty times the length of the kite, its appearance in the air will be more graceful ; this, however, must be regulated by the weight of the string, and by the length and thickness of the pieces of paper of which the tail is composed. The length of each ought to be about three inches and a quarter, and an inch and a half in breadth, and it should be folded longitudinally; each of these *bobs*, as they are called, must be placed at regular intervals of three inches.

The last operation is that of putting on the wings. If the kite be well made there cannot be much advantage gained by such appendage, but as some boys prefer to have them, for their appearance, they should be formed of light shreds of paper tied in the form of tassels, and of equal weight, so as not to over-balance the kite.

We will now conclude this lecture on the kite, by giving a few instructions on the method of flying it. Let its point rest on the grass, and place its tail in a straight line in front of it, and it will rise of itself as soon as you begin to run,—now give it string, gently at first—keeping letting out cord as long as the kite rises vigourously and keeps it fully stretched, but wind it up the moment it relaxes. Boys in flying heavy kites should wear a glove, as the cord rapidly running out, will frequent burn the hand. After the kite has risen to a good height, if it is well made, the cord may be attached to a fence or tree, and will continue for a length of time enjoying its airing.

Now to come to the philosophy of the matter, and the causes of its ascent. When the wind is high its pressure against the kite, tending to blow it across the field, is resisted by the force of the string held in the hand, which preventing it from being carried forward in a direct line, causes it to have an upward motion. But when there is but little wind, by running with your kite against it, you strike the air, and thus produce a reaction, which is equal to the force of the blow given to it. The principle is the same which enables the bird to rise into the air by flapping its wings, and which constitutes the third law of motion, viz., that *action and re-action are equal;* that is to say, whenever one body exerts a force upon another, the second body opposes the first. A kite cannot ascend beyond a certain height, and when the weight of the string, added to that of the kite itself, becomes equal to the force of wind, acting upon the surface, a general balance or equilibrium of forces will be established, and the kite can no longer continue to ascend.

The kite has been applied to many useful purposes. By its means Dr. Franklin was enabled to demonstrate the identity of electricity and the cause of lightning, and thus to disclose one of the most awful mysteries of nature, which has since been turned to such important advantages to mankind. It was by means of a kite that some English sailors were enabled to fly a string over the top of Pompey's pillar, which was 100 feet high, and so smooth that there was no way of climbing to the top of it, even for sailors: so they flew their kite exactly over the pillar, and when it came down on the opposite side the string lay across the capital. By this means they pulled first a light rope over it, and then a stronger, until they were enabled to hoist a man up, so they hoisted the English flag on the top, drank a bowl of punch, and gave three cheers for English pluck. During the search for Captain Franklin in the Arctic regions, it was often used to draw sleighs over the snow; and Lord Byron frequently amused himself, when a boy, by allowing himself to be drawn across a lake whilst swimming on his back.

UNIVERSAL TOOL GRINDER.

(See page 220.)

CONSTRUCTED BY MESSRS. THOMSON, STERNE, AND CO., LIMITED, ENGINEERS, GLASGOW.

We annex an engraving of an exceedingly neat arrangement of emery grinder specially intended for sharpening tools and doing similar work. The machine we illustrate is provided with an emery wheel 14 in. in diameter by 2 in. broad, the spindle of this wheel being mounted in bearings at the top of a neat hollow pedestal, which also forms a water tank. At the back of the standard are the bearings for the countershaft, this being provided with fast and loose pulleys, so that the whole machine is complete in itself ready for fixing. The fast and loose pulleys are at one end of the countershaft, while at the other is a pulley from which the belt is led off to drive the emery wheel.

The emery wheel is provided with a cast-iron hood fitted at the front with a slide which can be adjusted so as just to touch the wheel. On the top of the hood is a small centrifugal pump which lifts the water from the hollow standard, and delivers it through an india-rubber connecting tube to an iron pipe arranged as shown in the engraving, this pipe being perforated so as to discharge the water on the edge and against the sides of the wheel. The pipe can be adjusted to suit the reduced diameter of the wheel as the latter wears, and the quantity of water supplied is regulated by a cock. The centrifugal pump is driven by a small belt from the emery wheel spindle, and its suction pipe is fitted with a foot valve, so that the pump remains charged when the machine is stopped. Any excess of water is caught by the tray and returned to the water-tank in the pedestal of the machine.

The wheel is driven so that its upper part turns towards the operator, and any tool being ground can thus be supported steadily on the rest provided at the front of the wheel. The latter grinds as well at its sides as on its edge, and any form of tool can thus be ground. The edge which the wheel imparts to tools is admirable, and from what we have seen of the operation of the machine we regard it as far preferable to ordinary grindstone foi tool sharpening even when these grindstones are in good condition.—*Engineering.*

IMPROVEMENT IN FASTENING PULLEYS AND WHEELS TO SHAFTS.

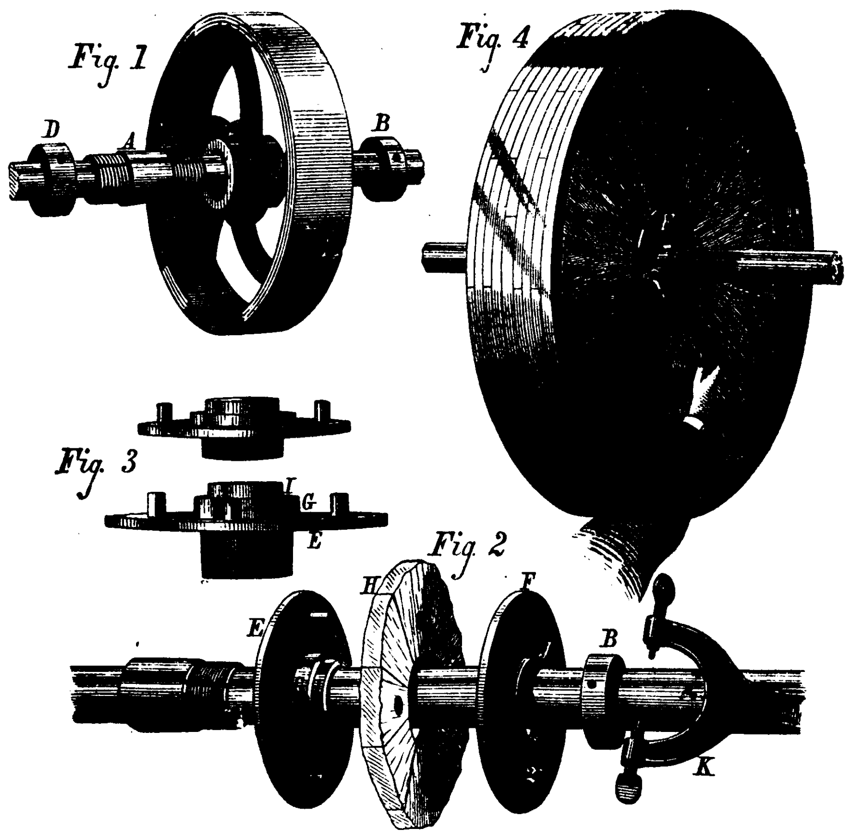
(*See page 220.*)

It is of the utmost importance that wheels and pulleys should be fastened upon their shafts perfectly concentrically, and at right angles. In case the wheels are movable upon the shafts, this often involves, if not some difficulty, at least uncertainty, and a method to accomplish this in a simple, sure, and correct manner is of course very valuable.

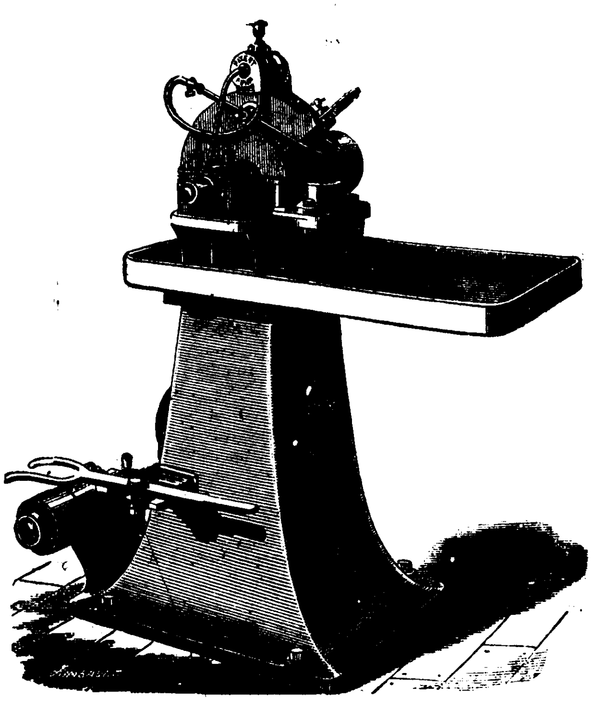
Such a method is the one illustrated in the adjoined engravings, and is manufactured by Messrs. A. B. Cook & Co., corner 13th and Peach streets, Erie, Pa. In Fig. 1, A is the holder, made of truncated conical form, with a cylindrical bore, and split open on one side from end to end. This closely encircles the shaft and extends through the hub, on the opposite side of which it is met by a nut B, which screws upon the thread cut on the smaller end C, of the sleeve. The nut crowds the pulley as far upon the holder as possible, besides contracting the latter against the shaft, thus securing the sleeve to the shaft as well as to the hub, and thereby fastening both hub and shaft tightly together. The hub is bored slightly tapering to fit the holder. As the pulley in Fig. 1, is supposed to be a very heavy one, the larger extremity of the holder A, has a right-hand screw thread, and is provided with a nut D, fitting the same. The object of the latter is to crowd the pulley off the sleeve without necessitating the use of a hammer or sledge. In moderately heavy and light pulleys, this last mentioned thread and nut are dispensed with (see sleeve in Fig. 2), a few blows on the hubs with a wooden mallet being sufficient to start the wheel off the sleeve in case it should stick after loosening the nut B.

Where the device is to be used in connection with a wooden pulley, or with one having no hub, an artificial hub is made by means of a pair of annular plates E, and F, Figs. 2, 3, and 4. The shoulder G, on plate E, is the centering shoulder or bearing on which the web of the pulley, shown (with the outer portion broken away) at H, fit. This shoulder is of the same size or diameter in all sizes of flanges, or for large and small shafts. This will be evident from Fig. 3, which also shows that where greater power is necessary, a corresponding bearing for the sleeve is given in the length of the hub.

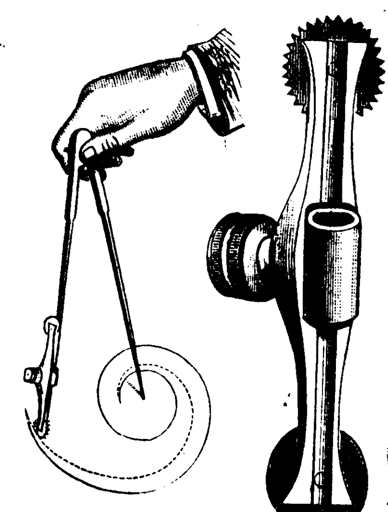
IMPROVEMENT IN FASTENING PULLEYS.



WHEEL FASTENER AND TAPER SLEEVE PULLEY.



IMPROVED EMERY GRINDER.



The Curve Scribe.

A NEW WAY TO DRAW CURVES.

(See page 220 for FIG. 1.)

KING'S SAFETY LINK.

FIG. 1.

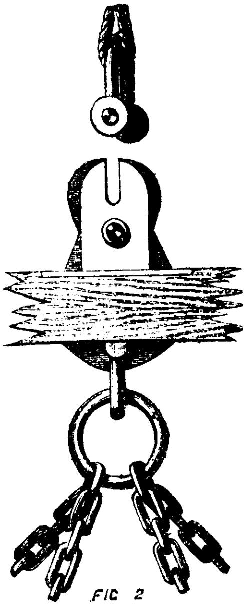


FIG 2

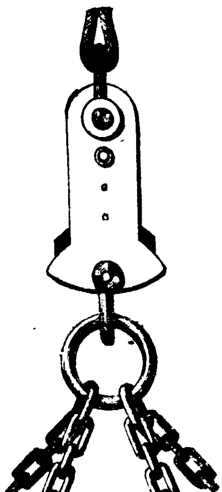


FIG 3

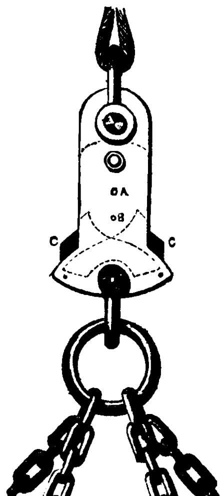


FIG. 4

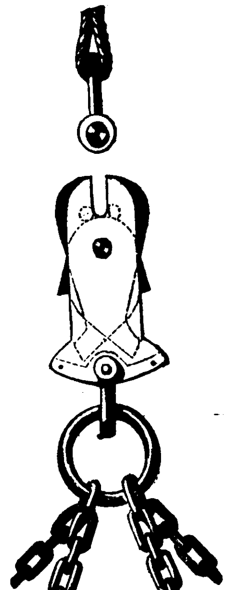
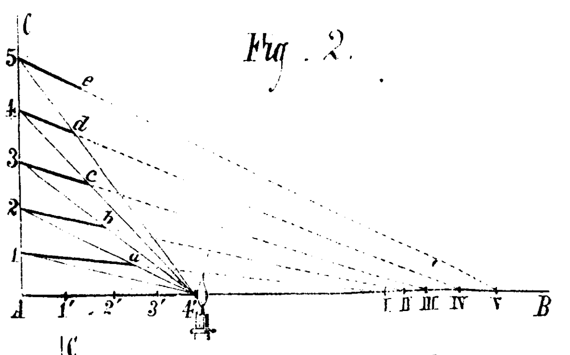
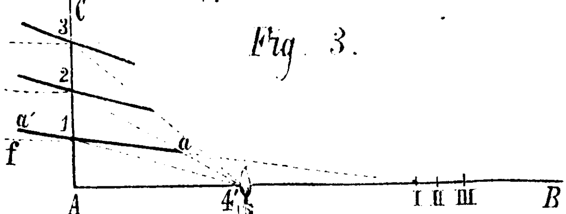
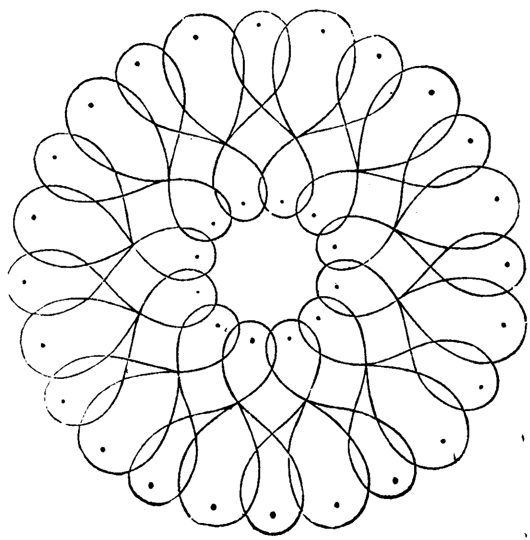


FIG. 5







Curve Drawn by the Scribe.

A NEW WAY TO DRAW CURVES.

(See page 220 for FIG. 1.)

The portion I, Fig. 2, is a centering shoulder for the aperture J, in the female flange F, and projects far enough through the web of the wooden pulley to enter the latter. The parts being brought together, the nut is set up on the holder, as already described, by means of the wrench K. This instrument, it will be seen, is adjustable through the whole range of ordinary line shafting. The final operation of setting up, with the wooden pulley in position, is represented in Fig. 4. The web of the pulley consists of any number of segmental pieces, in each of which the grain of the wood is in a radial line from center to circumference. In smaller pulleys the flanges have only two pins, but in larger ones four of the latter, as shown in Fig. 3, are employed.

PULPIT, ST. MARY'S CHURCH, SEYMOUR-STREET, EUSTON-SQUARE.

(See page 224.)

This pulpit is executed in Caen stone, with polished Devonshire marble shafts at the angles, and the shaft of the lower portion is of polished Cumberland alabaster. The niches are filled in with figures executed in Derbyshire alabaster; the centre contains Our Lord Jesus Christ as the Good Shepherd, and on either side the four Evangelists. The stairs are of oak, with metal-work.—*The Builder*.

BORING CURVED NOZZLES.

(See page 205.)

To bore curved nozzles with boring tools having perfectly straight outlines, and with a simple revolving motion and rectilineal feed, may perhaps appear at first thought to be an impossibility; but that it is a perfectly practicable matter has been shown by Mr. Edward Reynold, of Messrs. Vickers, Sons & Co., Sheffield, an engineer well-known for his aptitude in scheming neat mechanical devices. Mr. Reynolds' attention was first directed to this matter by his desiring to accurately bore some mouth-pieces for trumpets, and to do this he devised the very simple tool which we illustrate in the annexed diagrams.

THE New York *World* says:—"A new locomotive, recently completed in Philadelphia, under the direction of Mr. Weston, of Manchester, England, is about to psss over the Pennsylvania Railroad on a trial trip. It is claimed to possess greater power and to be run at less expense than any other engine, as it utilises both smoke and steam, and it will draw a heavily loaded train of 100 cars and can be stopped within its own length. The cab is on top of the boiler, and the smoke-stack is the size of a common stove pipe. Much interest is excited in the new invention."

THE following notes on Japanese iron are from *Le Constructeur*:—The blast-furnaces of Japan are small, and of very simple construction, although built on the same principle as those of Europe. The walls are built of fire-proof clay, mixed with a few stones. The blast furnaces are round, and have an opening at the side, closed by a band of clay; opposite are two other openings, through which comes a strong current of air, driven into the furnace by Chinese bellows worked by men. Before pouring the ore into the furnace they mix it with coal, and subject it to a previous calcination, so as to get rid of its carbonic acid and sulphur. The Japanese do not understand puddling as practised in the West; but the principle of their procedure is exactly the same. The fused iron, mixed with a little sand and pieces of iron, is again fused with charcoal in a second furnace, where it is left to cool for several days, until the whole mass has the appearance of fluid. The Japanese method of making steel is quite different from that practised in Europe. They mix a certain quantity of iron in pigs and iron in bars, cover the mixture with borax, and melt the whole for a week in a small fire-proof crucible. The borax serves to dissolve the impurities in the dross. When the metal is separated from the dross, which floats on the surface, and cooled, it is hammered hard, and alternately plunged into water or oil, after which it is cemented and tempered. The mode of cementing is as follows:—The steel, on coming from beneath the hammer, is covered with a mixture of clay, cinders, marl, and charcoal powder. When this plaster is dry, the whole is subjected to a red heat, and the steel is afterwards cooled very slowly in warm water, which is allowed to become tepid. Steel thus obtained is not very supple, but extremely hard, because it is not properly tempered or completely freed from its impurities. It would not do for making watch-springs, but is used by the Japanese for swords and sab·s, which are tempered as many as eleven times, and knives, which ·re tempered four times.

THE MINING AND SCIENTIFIC PRESS.

This excellent illustrated journal of mining, popular science and general news, published by Dewey & Co., patent solicitors, California, is a work of very great merit, and reflects credit on its publishers. There is scarcely any journal published in which we find so many well selected articles of general interest and instruction, and we thankfully acknowledge our indebtedness to this paper for many extracts therefrom of great interest to Canadian mechanics.

A NEW WAY TO DRAW CURVES.

(See page 221.)

The little instrument here represented may be of great aid to all such draughtsmen as have to draw various kinds of curves; it consists simply of a wheel which may be attached to the point of a compass, but instead of being fixed in a position at right angles to the radius with which a circle may be drawn, it is adapted for being set at various angles. When the compass is sufficiently loose in the joint, and pressure is brought to bear on the wheel, it will run forward at the angle it is set to, and cause the compass to open or close more, thus continually changing the length of the radius of the circle at a constant rate, depending on the angle at which the wheel is set; when set at 90°, it will move like a common compass, and describe a circle with a constant radius; as soon, however, as the wheel is set at an inclination, determined by a common protractor, the radius will vary constantly, and the result may be a spiral, if we continue revolving around the same center; or by shifting the center, we may obtain figures resembling ellipses, paraboles, cycloids, conchoids, &c.; why we say "resembling," any geometrician will at once see, as with this apparatus the curve depends on the magnitude of an angular function, which is not the case with the other curves referred to, but for all practical purposes the curves thus drawn are just as good as the others, and as graceful in form as can be desired.

In our figure the attachment to the compass is represented at the right side in full size; at the left, attached to the compass, and used to draw a spiral by hand. These pens are made by the Hartford Curve Scribe & Co., and can be obtained at their office at 294 Broadway, New York.—*Manufacturer and Builder*.

A GOOD WHITEWASH.—For whitewashing, a compound of glue dissolved in hot water and diluted with 4 gallons of water, to which is added 6 pounds of whiting, will be found to answer a better purpose than common lime. Wood-work can be washed with this glue size, and one coat of paint on it would last for years. A little chrome yellow would give a light, lemon-colored tint to the wash. A cheap paint for the floor can be made, which a strong, smart woman could apply to any floor, 5 pounds of French ochre, ¼ of a pound of glue, and a gallon of hot water. Dissolve the glue in a small quantity of hot water; when wholly melted add the rest of it, stirring it slowly until well mixed. Then stir in the ochre, and apply while hot, with a good-sized paint brush. When well dried apply one or two coats of boiling linseed oil. This paint dries very quickly, hardening in 15 to 24 hours.

AN immense excitement has lately broken out in Sacramento and elsewhere, over the report that tellurium in large quantities had been discovered on Rock Creek. Until this discovery was made, probably few of our readers ever heard of that strange mineral, of a silvery whitish colour, so scarce and highly prized as hardly to admit of any commercial value being placed upon it. This metal, it is said, is used by manufacturers in the United States of fine cutlery to give the keenest edge to engravers' tools, surgical instruments, razors, &c., it being supposed that the famous Damascus swords were edged with it; and as an instance of its great value, we are told that a manufacturing firm in San Francisco bought a single pound for which $600 was paid. A small mine in Siberia, one in Hungary, and another in Utah, are, we believe, the only sources from which this metal is at present obtained. The discovery on Rock Creek was made in a tunnel of the Bear River Mining Company, opened in their search for iron, and the mineral is supposed to be contained in the ore at the rate of six pounds or more to the ton—enough to make the mine of fabulous richness, should there be no mistake in the matter. Numerous claims have been staked off, notices posted, and stock is already selling at a lively rate. At least so says a California contemporary.

DOMESTIC READING.

HATCHING POULTRY.

Poultry Breeding.—Sitting hens and hatching chickens are even more in order now than earlier; by far the largest proportion of the yearly hatch being brought out during April.

Watch the sitters closely; see to their feed and water yourself. If they do not all come off to feed, take them off, and let them remain off half an hour. This is absolutely necessary for the successful hatching of eggs—giving them a regular airing—as well as for the health of the hens.

In sitting fresh hens, make their nests on the ground when possible; where this cannot be done, put two or three inches of earth in the bottom of the box, and cover slightly with clean straw or hay.

At this season, thirteen is the best number of eggs to place under an average-sized hen. Don't forget to examine them by candle-light (or lamp light), after the sixth day, and remove all the unfertile ones. About the eighteenth day take a vessel of water, heated in 105°, and put the eggs in it. After a few minutes, all the eggs which have live chicks in them will begin to bob about in the queerest way; the eggs may be left in water from twenty minutes to half an hour with beneficial results to the chicks. After ten minutes if any of the eggs show no motion, it may be safely assumed that the chick within is dead, and the egg may be thrown away.

If eggs are broken in the nests, take the hen carefully off, and wash the unbroken eggs in tepid water; then take the straw out, and put in afresh, and place the eggs under her again.

Should the hen leave the nest for any cause, and the eggs become cold, do not throw them away, even if the hen has been off twenty-four hours or more. Get a pan or pail of water heated to 105° Fahrenheit, and immerse the eggs in it. Leave them in until they are warmed through, perhaps half an hour, adding more warm water if necessary, then place them under a fresh hen. In the latter stages of incubation, after the eggs have passed the fourteenth day, they have been saved and hatched, after having been deserted over forty-eight hours.—*Poultry Bulletin, N. Y.*

RECEIPTS.

Bread-and-Milk Poultice.—Remove the crust from the part of a stale bread, and crumble the bread into a bowl. Pour on this enough sweet milk to cover it, and simmer over a fire, stirring it all the while until the bread becomes completely broken up. The poultice is now to be applied to the patient as warm as can be borne.

Poultices.—A poultice usually is only a desirable vehicle for imparting heat and moisture. By softening the tissues, poultices facilitate the passage of inflammatory products outward. The heat and moisture relax the tissues, and to that degree relieve the tension due to the inflammation, and to that extent relieve pain. The pain can further be eased by adding laudanum and such substances to the surface of contact of the poultice.

The materials best calculated to take up and give out the heat and moisture spoken of, are in common use. There must be enough of the mass to secure and retain enough heat to be of use, and therefore a poultice should be at least an inch thick. To prevent cooling in spreading, the cloth upon which the mass is to be spread should be laid out on a heated plate or dish, and the poultice, with not enough free liquid in it to "drip," rapidly and evenly spread over the muslin. A thin piece of quite old muslin should then be spread over the surface of the poultice, so the mass will not come into immediate contact with the skin. The spread area of the poultice should be just the size required; and the fabric upon which it is spread should extend beyond the edges of the poultice material, so the unspread selvage can be turned over the edges of the mass. This will keep the poultice from leaking away.

After having been applied as warm as can be borne, a piece of oiled silk—or even oiled paper might answer—should be spread outside to retain the moisture, and something outside of that again to keep in the other useful feature of the poultice—the heat.

Such applications must necessarily be removed and renewed every little while. If poulticing is to be done at all, it must be done well, and that is, properly. A few hours of poulticing applied every half hour, will do more good than many hours of poulticing done in the usual way.

Spice Plaster.—Take of powdered cayenne pepper, powdered cloves, powdered cinnamon and rye flour, equal quantities; mix them together on a plate, and add as much honey as will make a soft mass; spread upon a piece of muslin or other close fabric.

Whenever this plaster becomes dry, and begins to crumble off from the substance upon which it is spread, a fresh one should be made.

Yeast Poultice.—Mix a pound of linseed meal or oatmeal into half a pint of yeast. Then heat the mixture over a gentle fire, stirring carefully to keep from burning. When it becomes warmed through, it can be spread on linen like any other poultice.

Yeast poultices are often ordered by physicians when there is a fœtid discharge from ulceration, which it is supposed to correct.

Bread-and-Water Poultice.—Take a slice of stale bread, carefully pare away the hard brown crust which lies around the edge, and then dip it into a vessel of hot water; lift it out at once, and if not too hot, apply to the part where it should go.

Mustard Plaster.—Take mustard flour (which is ground mustard) and add to it an equal quantity of rye or wheat flour. The rye flour is usually preferred to wheat flour, because it is thought to remain moist for a longer time. Mix them together thoroughly on a plate, and add as much *cold water*, not vinegar, which impairs the usefulness of the mustard, as may be necessary to make a soft mass. Spread evenly over a piece of muslin, and to prevent the mustard from adhering to the skin, a piece of gauze or some such material should be spread over the surface of the material

If the plaster is intended for a child, it should be made at least half the strength by using one-half less of the mustard.

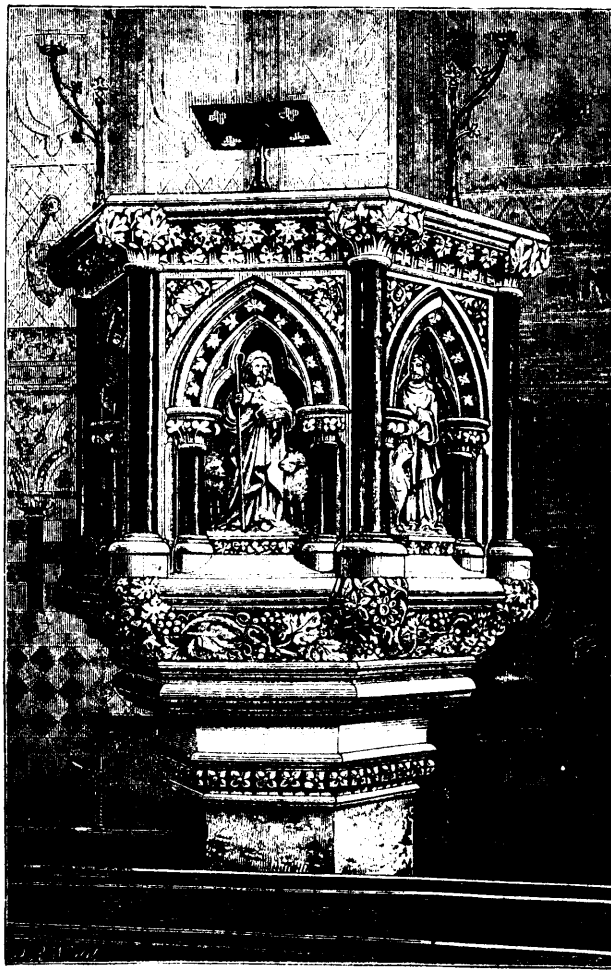
Whenever mustard plasters are used, the skin under it should always be looked at every few minutes, and the plaster removed as soon as *decided redness* is found. In no case must it be left on long enough to produce blisters; which are not only painful and more difficult to heal than blisters made by most other substances, but prevent the physician from applying other remedies to the part for the relief of the patient, should the mustard have not answered the purpose intended. A mustard plaster is one of the most valuable domestic remedies which can easily be obtained, but it should never be allowed to produce a blister. This is specially to be observed in the case of children or delicate persons.

Flaxseed Poultice.—Take of flaxseed meal a sufficient quantity, and pour on it, little by little, enough cold water to make of suitable thickness. Then heat the entire mass. A small piece of lard is sometimes added to keep it from adhering to the part.

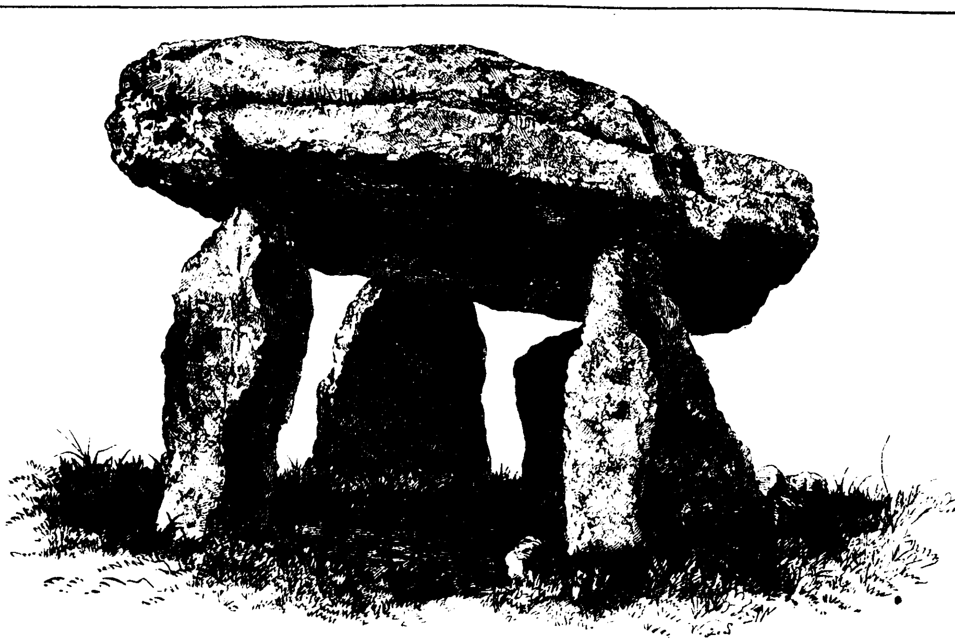
Slippery-Elm Poultice.—It is made like the above, only using ground slippery-elm instead of flaxseed meal.

Carrot Soup.—Take one and a half pounds of carrots which have been first brushed very clean, then boiled, until tender, in slightly salted water; mash them to a smooth paste, or rub them through a sieve; mix the paste with two quarts of boiling soup (strong beef broth will do); season this with pepper and salt, and add, before being finally boiled up, a small lump of sugar and a piece of butter. Serve with a dish of bread cut into small dice and fried in butter.

Split Pea Soup.—Take any bones of roast meat, lay them on a clean meat board, pound and break them, (a small hatchet carefully wiped clean is very good for this purpose). Put the bones and any trimming of cold meat into a soup kettle or a large saucepan, cover well with cold water, set it on the back of the stove, cover it closely. When it first bubbles, skim it well, cover it, and let it simmer slowly four hours. If necessary to prevent it from boiling hard, set a tin plate on a brick under the saucepan. At the end of four hours take the soup from the fire, pour off the liquor through a strainer or colander into a shallow pan, let it become cold, then remove every particle of fat from the surface, and strain the soup through a cloth. An hour before it is wanted, put it on the stove to heat. Allow for three pints of stock, a large coffee cupfull of split peas, which should be soaked if very old. Pour off those which rise to the top, put the others on the stove to boil for two or three hours, until they are perfectly soft. Then rub them through a colander, and when the stock is boiling add the peas, and a small piece of butter, and pepper and salt. This soup is good and nourishing, besides being very economical. Excellent broth and soup can be made of bones left from roast meat of any kind, and they should be saved for the purpose.



PULPIT, ST. MARY'S CHURCH, LONDON.



THE GREAT DOLWILYM CROMLECH, CARMARTHEN, WALES.