Technical and Bibliographic Notes / Notes techniques et bibliographiques

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

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

- [ ] Coloured covers/ Couverture de couleur
- [ ] Covers damaged/ Couverture endommagée
- [ ] Covers restored and/or laminated/ Couverture restaurée et/ou pelliculée
- [ ] Cover title missing/ Le titre de couverture manque
- [ ] Coloured maps/ Cartes géographiques en couleur
- [ ] Coloured ink (i.e. other than blue or black)/ Encre de couleur (i.e. autre que bleue ou noire)
- [ ] Coloured plates and/or illustrations/ Planches et/ou illustrations en couleur
- [x] Bound with other material/ Relié avec d'autres documents
- [x] Tight binding may cause shadows or distortion along interior margin/ La reliure serrée peut causer de l'ombre ou de la distorsion le long de la marge intérieure
- [ ] Blank leaves added during restoration may appear within the text. Whenever possible, these have been omitted from filming/ Il se peut que certaines pages blanches ajoutées lors d'une restauration apparaissent dans le texte, mais, lorsque cela était possible, ces pages n'ont pas été filmées.

- [ ] Coloured pages/ Pages de couleur
- [ ] Pages damaged/ Pages endommagées
- [ ] Pages restored and/or laminated/ Pages restaurées et/ou pelliculées
- [x] Pages discoloured, stained or foxed/ Pages décolorées, tachetées ou piquées
- [ ] Pages detached/ Pages détachées
- [x] Showthrough/ Transparence
- [x] Quality of print varies/ Qualité inégale de l'impression
- [x] Continuous pagination/ Pagination continue
- [ ] Includes index(es)/ Comprend un (des) index

Title on header taken from:/ Le titre de l'en-tête provient:

- [ ] Title page of issue/ Page de titre de la livraison
- [ ] Caption of issue/ Titre de départ de la livraison
- [ ] Masthead/ Générique (périodiques) de la livraison

- [ ] Additional comments:/ Commentaires supplémentaires:

This item is filmed at the reduction ratio checked below/
Ce document est filmé au taux de réduction indiqué ci-dessous.

10X	12X	14X	16X	18X	20X	22X	24X	26X	28X	30X	32X
								✓			

The Canadian Patent Office Record and Mechanics' Magazine

Vol. 3. OCTOBER, 1875. No. 10.

AN ADDRESS TO

OUR FRIENDS AND SUPPORTERS.

In tendering our best thanks to the public for the kind support hitherto received, we have much pleasure in stating that in order to carry out more effectually our original intentions of making its pages the record of all that would prove useful to Canadians in the various branches of Science, Engineering, Architecture, Mechanics, Manufactories, Cabinet-making, &c., &c., including Lumbering, Mining, Public Works, Natural Resources of the country, and all departments of Home Industry, we are about to add useful information and practical instruction to the Home Circle, and a few pages of elementary education for the young Mechanic. The youth who commences with the present number, and continues hereafter to be a subscriber, will obtain, at a trifling cost, a thorough mechanical education through the subjects for study now and hereafter to be afforded.

Our subject matter will to some extent be re-arranged and of a more varied description, as it is our most earnest desire to devote its columns to the advancement of mechanical knowledge in the Dominion, and by initiating improvement and chronicling progress, to emulate, in this respect, the most prosperous of our contemporaries. The field for our Magazine is rapidly increasing, and its future destiny is likely to be one of great service to all classes of mechanics, and as a valuable record of discoveries and improvements in the Dominion, and abroad. When indexed and bound, it will be a useful book of reference, particularly to mechanics residing in the country, who, isolated from public libraries, have not access to scientific works.

As yet the field of scientific improvement in this country is too small to form sufficient interesting and instructive matter to fill our pages, we must therefore, for some time to come, draw from the prolific sources of talented articles to be found in the pages of our contemporaries, such information and illustrations of machinery, &c., as will prove of practical utility in promoting the extension of knowledge to the Canadian mechanic.

In the department of the "Patent Office Record," the claims of Inventors, and the official diagrams, will continue to be presented; we particularly commend to our readers an examination of these patents, as much will be found in them of great utility for mechanical and other purposes.

A large portion of our space will be devoted to original articles written by practical authorities on subjects of permanent interest; and we particularly court communications from all sections of the Arts and Trades on any subject within the widely comprehensive scope of our field. Facts of what is doing, what has been done, or what ought to be done, or is intended to be done, will be of great use to us; whether they emanate from the study, the warehouse, the factory, or the shop; and these, in however rough-and-ready a form, we earnestly solicit from all classes of our readers and subscribers. A paper that seeks worthily to represent any class should be furnished with full and abundant information, it should be fresh, and up to the period, and not only represent the latest theories but give information concerning the latest facts. The editor is too often left to chance for obtaining information respecting the great improvement of the age, for the public very feebly second his efforts; however, no exertions shall be wanting on our part to obtain this information, and we shall endeavour always to keep our readers well posted up in the progress of all trades abroad; in whatever phase scientific inquiry or research has a bearing upon the materials or machinery they employ, their preparations and uses, we shall strive to duly chronicle.

We have for some time past felt that the education of the great bulk of the artizans of the Dominion has been sadly deficient from causes beyond their control to obviate, and as a consequence much natural ability has lain dormant; we purpose therefore commencing a series of elementary instruction to young mechanics who have not enjoyed the advantage of a mathematical and mechanical education; and we feel assured that none of our readers will object to a few columns of this Magazine being devoted to so laudable a purpose. Any youth possessing average ability, intelligence, and perseverance, can, if the means are afforded to him, become self-educated. We have recorded facts of men, who gifted from birth with genius and talent, have often, by self-denial and self-education, pushed their way through the crowd, and gained the foremost place; yea, have risen to the pinnacle of fame; and although these cases are few, still the instances of those who have gained eminence, and whose usefulness as a body has been of incalculable service to the world, are indeed numerous.

With respect to our intention of affording in our pages some pleasing instructive reading to the Home Circle, it is like sowing seed in fertile ground and keeping down the weeds that often grow from idle habits contracted from the want of something useful to employ the mind. There is no reason why the columns of a Scientific Magazine should be made so dryly instructive as to afford no interesting and practical information to the wives and children of a mechanics family. On the contrary it is particularly desirable that it should be otherwise. Under the head "Domestic," will be found a few pages of family reading, consisting of useful hints, and pleasing instruction for wives and daughters; nor will the boys be neglected, for in the future we shall endeavour to supply them with description of scientific amusements and manly pastimes; in fact we hope to make the CANADIAN MECHANICS' MAGAZINE always a welcome visitor to the home of the artizan.

We have much pleasure in stating that we have obtained the assistance of Mr. Boxer, Architect, in the Editorship of the Magazine, and who will assist in its general management. His professional experience and knowledge of the description of information suitable for the columns of a periodical devoted to the education and improvement of the Mechanics of Canada, renders this appointment one very congenial to their interests. This gentleman during five year's residence in the New England States, visited the greater portion of their Manufactories, and attributes to a great extent the prosperity of those States to the facilities their children possess for obtaining a thorough mechanical Education. Every mechanic there subscribes for one or more scientific papers, and, consequently, is well informed in all the new improvements in machinery, &c., which are therein mentioned and illustrated, of which they are always ready to turn to some profitable account. Thus it is we so frequently read in their Scientific papers the biography of so many opulent manufacturers and self made men, who have risen to wealth and position from humble means by their mechanical talent. We have no doubt whatever that any publication tending to better educate our own Artizans in the proper use and knowledge of Mechanical Art, &c., will stimulate many young men to greater industry and awaken latent talent, and also will contribute greatly to increase the comforts and well doing of a large class in the Community, and even do something more than this, for by the perfecting of Machinery they will, with greater facility, be able to turn to more profitable account the natural products of the country. Such being then the object of the publishers, we trust that as Mr. Boxer will soon make a tour of the Dominion in our interest he will meet with a cordial support from every one to whom, mechanical knowledge and general information, is of value.

G. B. BURLAND,
General Manager.
The Burland-Desbarats Litho. Co.

THE PROVINCIAL EXHIBITION AT OTTAWA.

We give an illustration on page 296 of the Provincial Exhibition at Ottawa. In our November number, however, we shall furnish full particulars of the building and its arrangements, and afford as many illustrations as possible. Exhibitors, however, who are desirous of making known their inventions or improvements in machinery, would do well to make early application to the Editor.

We regret that the Exhibition took place too late in the month to give sufficient time for noticing in this number of the Magazine the meritorious and useful machines, &c., there exhibited.

BURSTING OF WATER SUPPLY PIPES IN WINTER.

BY MR. W. H. BAI[illegible] *

Every winter in this country there are many fatal accidents caused by the explosion of what are known as circulating or bath boilers; there is also a great amount of damage done to house property, and some domestic misery created by the bursting of water pipes, caused by the water freezing in them.

I have paid a little attention to these two subjects, which are somewhat of a kindred nature, and when I was honoured by a request from your society to read a short paper on them, I gladly acceded to it, knowing the wide-spread influence of your members, and feeling that some good would be done to society if I could only lay before you certain facts as they appear to me. I feel very diffident of my ability to do this, and hope you will bear with me if I appear tedious in describing things which may be familiar to many of you, but without doing which I might render myself obscure to those acquainted with them.

There seems to be among many people an impression that domestic boilers often explode through a difficient water supply. I believe that is not the case, and I think it will be very difficult indeed to demonstrate that any accidents have occurred through this cause. A great number of boilers burst every year which are unreported, because not attended with fatal results. Of those which have been reported during the past six or seven years, half appeared to have exploded through stoppage of the circulating pipes by ice, and the remaining half have been caused by the fixing of stop taps in those pipes.

A few years ago circulating boilers were only in existence in comparatively few large houses and hotels, but now nearly all new houses of the value of $120 per annum or more built in this country have bath boilers, and unfortunately, the great majority are of cast iron, of the very worst form for resisting pressure. There are two slightly different modes of fixing these in this district, which I will endeavour to describe.

The ordinary and cheap way of fixing and supplying kitchen boilers is illustrated by Fig. 1. The supply of cold water is received in a cistern at the top of the house, and conducted by the "down pipe" into the boiler; having passed through this, and having become hot, and therefore of less specific gravity, it ascends what is called the "up pipe" to the hot water cistern, from which it is drawn as required for use.

It will be seen that the pressure the boiler has to sustain when filled with water depends upon the height of the supply cistern above it; 2ft 3 in of water in column being equal to a pressure of 1 lb. on the square inch, therefore 60ft. high will give a pressure of 27 lb. per square inch on the boiler. As, however, most boilers are only about 30ft, or 40ft. below the cistern, we may consider that the average pressure at which they work will be about 15 lb on the square inch.

In good houses in this district copper cylinders are fixed in connection with the boiler, in order to give an abundant supply of hot water, and for preventing and rendering explosions impossible; that is, if we are to believe what is told us by more than one respectable tradesman of this district. So much has been said about copper cylinders preventing explosions by men whose business it is to know better, that I will refer to it a little latter on.

Fig. 2 represents the arrangement when the hot-water cylinder is used It differs slightly from the plan I have already described the hot-water cistern being dispensed with, and a large cylinder, generally of copper, being placed in the up pipe instead. A pipe is taken from the top of this cylinder, called the air pipe, which is open to the atmosphere, and in which water ascends to the level of the cold water supply cistern. The great advantage in using these cylinders is obvious, as the constant circulation which is always taking place causes the water when cool to descend into the boiler, and, when hot, up again in the cylinder, absorbing all the heat possible for the boiler to give it, which is not the case in the simpler and less expensive mode of fixing. Sometimes the hot water is drawn from the top of the cylinder, and sometimes from the air pipe. In both these systems of fixing it will be seen that the boilers are always full of water, and that, supposing the supply of water to cease, it would not be possible to drain them dry, causing the fire to make them

* Read before the Society of Municipal Sanitary Engineers. London.

red-hot, and thus create danger. The source of danger and death is to be found in the direction to which I have alluded; and if there is one thing at all that creates astonishment in my mind, it is the fact that I stand here in this city of Manchester and state that it is unsafe to work a boiler under pressure which has not safety-valve fitted to it.

With the best intentions many boilers have taps fitted in the up and down pipes, as shown on the model and drawing Fig. 1, so that if any accident occur to the boiler it may be repaired or removed without fear of inundation. These taps have caused many fatal accidents in summer as well as in winter. If these taps are by any means closed when the boiler is at work, the water is sealed in the boiler, and nothing can prevent pressure accumulating unless the fire be put out. Only a few days ago I talked the matter over with an architect of no mean reputation in this district, who informed me that he would not think of permitting a good house to be fitted with a boiler which had not these taps fixed. He had ordered several houses to be fitted with taps under the copper cylinders, as represented on Fig. 2, A A. I am glad to say he altered his opinion when I explained to him the facility which he thus gave to ignorant or careless people for creating a magazine of destruction. A destructive explosion was created in the house of Mr. Pease, of Darlington, by their means some short time since; and on the 9th October last, at a newly-erected West End club in London, a serious explosion was caused by them. To quote Mr. Lavington E. Fletcher, chief engineer of the Manchester Steam User's Association, who has kindly rendered me valuable assistance in giving me some facts in connection with these subjects, the boiler was of the ordinary circulating class, connected to a cistern by two circulating pipes. Between the boiler and overhead cistern were two stop-taps; the hand hole in the boiler had been leaking, and a mechanic having been sent for to make matters right, on examining the boiler he shut off the taps. He then left the job, taking the precaution, however, to write over the fire-place—"This fire must not be lighted." Unfortunately, this warning was neglected. The fire was lighted at ten o'clock on the following morning; and as the outlets were both closed, the boiler burst about two hours afterwards, when the front was blown out, and the whole range shot forward into the kitchen. Fortunately, only one man was slightly injured, there being no one else in the kitchen at the time.

The fixing of these stop taps caused the death of a young woman in January of this year. This is known as the Eccles New-road accident. As it occurred in my own neighbourhood, and in Seedley Ward, which I have the honour to represent in the Town Council of Salford, I took more than an ordinary interest in it. I was the foreman of the jury convened to inquire into the cause of death. It appeared that the proprietor of the house, actuated by a proper desire to make his house safe from inundation, consulted a plumber, who informed him that the best way was to fix two taps, one in the up pipe and one in the down pipe of the bath boiler. These were placed in the bath room, immediately under the cisterns, the boiler not having a copper cylinder. They were fixed where any mischievous lad could have turned them at any time. A leakage during the thaw of entirely different pipes caused the proprietor to turn these taps off, and having done this he ordered the fire out. A plumber was sent for, and told to make all right; the leaking pipe was soldered, he reported all correct, but omitted to turn the taps on again. The result was that an explosion took place which removed the ranges of the house and the one next door, making a breach in the division wall sufficiently large for any one to walk through. The window was blown out, and the poor woman was blown half-way through it. No one was in the kitchen of the other house, or the consequences might have been more serious. The boiler, Fig. 3, which is on the table, measures 12½in. long, 10in. broad, and is 10½in. high. The top and front were blown out in one piece; the area of this gives 240in., which, if multiplied with the 250 lb. pressure required to burst a similar boiler, gives a total pressure of more than 25 tons. The new boiler, Fig. 4, on the table has been burst by me, by means of hydraulic pressure, by the little test pump attached to it.

I could give more details of similar accidents caused by these taps, but I think it scarcely requisite to occupy your time with them, having, I hope, proved how dangerous the practice is.

I will now proceed to those accidents caused through the stoppage of the circulation by the freezing of the water in the up and down pipes. These accidents appear to occur chiefly when houses are entered upon by the tenants in the winter time, everything being cold, the water in the pipes being frozen. A fire is put under the boiler by the new tenant, and an explosion takes place. In very severe weather pipes have been known to accumulate ice in one night, those boilers fixed without copper cylinders being most dangerous. Not far from the scene of the Eccles New-road accident, about two years ago, a Mrs. Cowie was killed by an explosion from this cause. The water in the boiler had longer time than usual to cool on the Saturday night, and Mrs. Cowie having got up late on the Sunday morning, after the fire had been lighted a short time, the boiler burst, and she was blown across the kitchen and down the cellar steps and killed. Another accident from a similar cause occurred near Brunswick-street, Manchester, in January this year, which nearly killed a young woman, and I believe now she lies on a sick bed through the effects. At the same date the copper cylinder bottom (Fig. 6) which is on the table was blown out in a house in Pendleton; there was no one in the kitchen at the time, or they might have been scalded to death. There was another accident to copper cylinder at Gilda Brook, near Eccles; and in the same week the boiler that was fixed to replace the one that killed Mrs. Cowie burst with an accumulation of ice, the house being empty. One occurred at Glasgow on the 25th of December, which seriously injured a man; one at Burnley; one at Chorley, which killed a little girl, on the 23rd of December. In this case the tenant had only just entered, and a fire having been put under the boiler, it burst, with the sad result I have named. On December 28th an explosion of a circulating boiler took place at Foolwood Workhouse, near Preston, which killed one man and injured two others. December 30th one at Bradford, one at Delph December 8th, one at Ashton-on-Mersey on the 7th December, one at Bolton on the same day, and one at Hyde about the same time. There are a great many of these accidents unreported, because unattended with death. I have found that in the neighbourhood of Seedley, where the woman was killed in January, that no less than five bursts took place about the same time.

Having endeavoured to show the two chief causes of these explosions, the natural question is what is the remedy? what will prevent this destruction of life and property? I have no hesitation in saying that if safety valves had been fixed that every one of the accidents would have been prevented. And as the ordinary lever safety valve would possibly become inoperative in course of time, a little pendulous safety valve of the Cowburn type, Fig. 7, has been recommended, as not likely to get out of order, by Mr. Fletcher, of the Steam Users' Association. If safety valves were fixed on the boiler, I think there is no great objection to the use of taps in the circulating pipes, as they are undoubtedly useful in case of accident. Weak plates of white metal, Fig. 8 D, have been recommended instead of safety valves, which would burst at a low pressure. I have made extensive experiments on these plates, and have burst a great number by actual steam pressure; but I found that I never could get two alike out of the same mixture of metal. There are also many other objections to them which I will not occupy your time with.

A word about copper cylinders for preventing explosions. Circulars have been issued by ironmongers in which it is distinctly stated that these things render an explosion impossible. This delusion, which has such a firm hold in the minds of many people, demands some attention. A copper cylinder fixed to a boiler makes it safer from those explosions which are caused by ice in the pipes. It is just possible that the death of Mrs. Cowie, which was caused by the water freezing in one night, would have been prevented by one, as the hot water in the cylinder makes it a storage of heat, which resist the attacks of cold for a longer time than a small pipe full will do when fixed as Fig. 1. A copper cylinder only delays the danger a few hours at most in severe winters, and its utility ends at that for preventing explosions. The bottom of the cylinder on the table for preventing explosions. The bottom of the cylinder on the table was blown out through one night's frost, and anyone having a cylinder who wishes to have an explosion in winter can have a hot bath late at night when the servants have gone to bed, he then can empty all the hot water out, which will be replaced with cold, and by this simple means reduce the power of its resistance to the effects of cold and thus cause great danger. A cotton broker

BURSTING OF WATER SUPPLY PIPES IN WINTER.

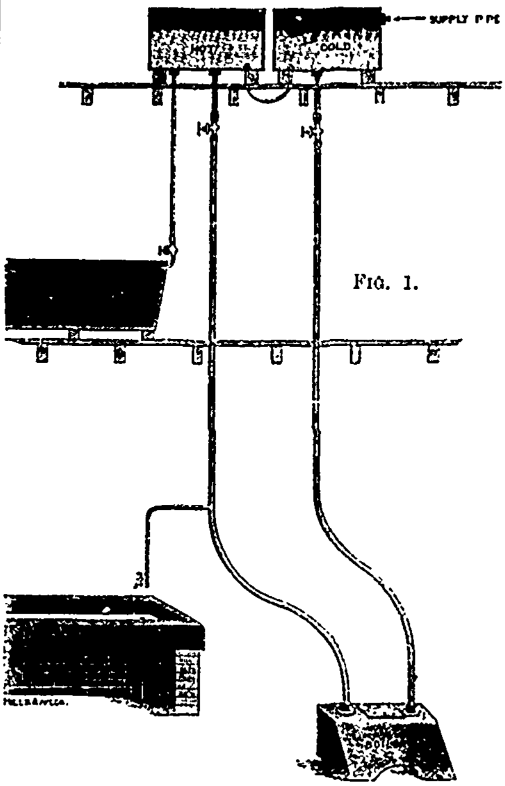


FIG. 1.

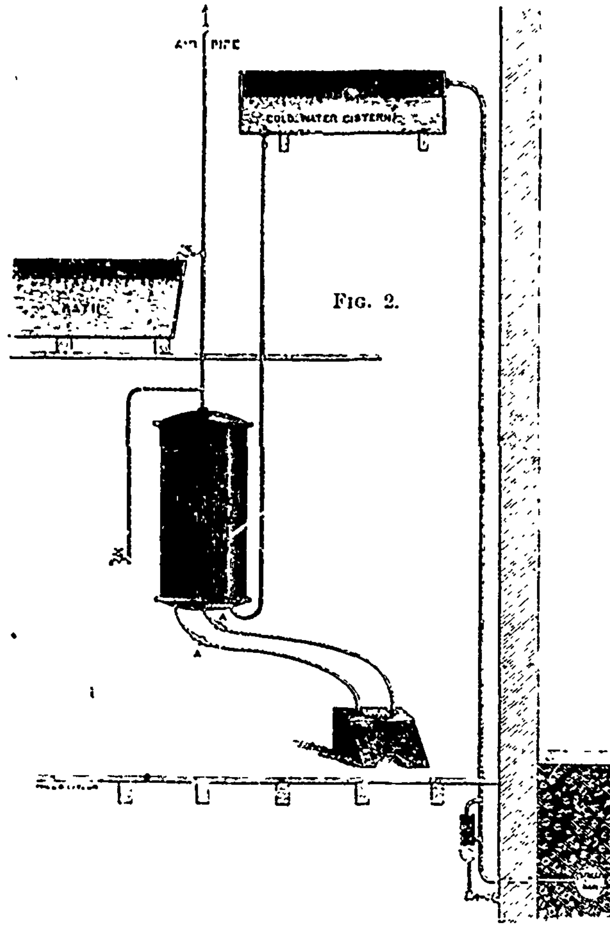


FIG. 2.

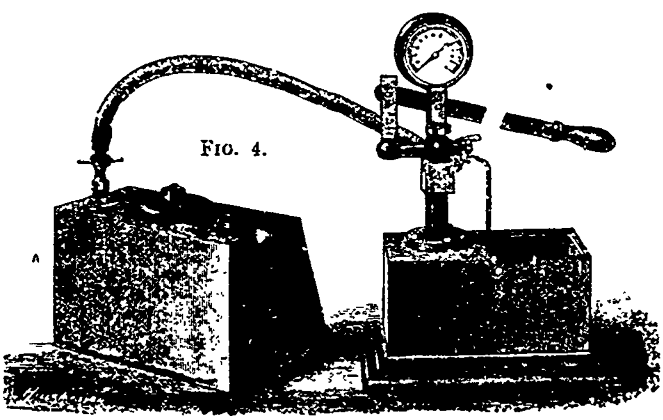


FIG. 4.

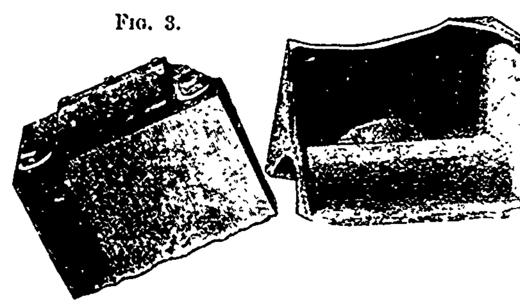


FIG. 3.

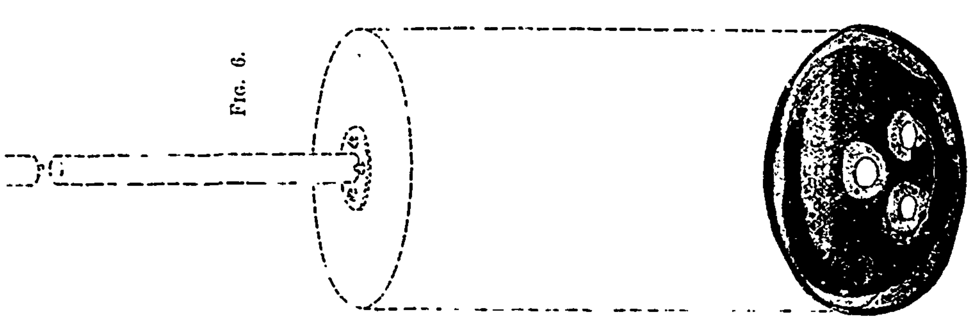
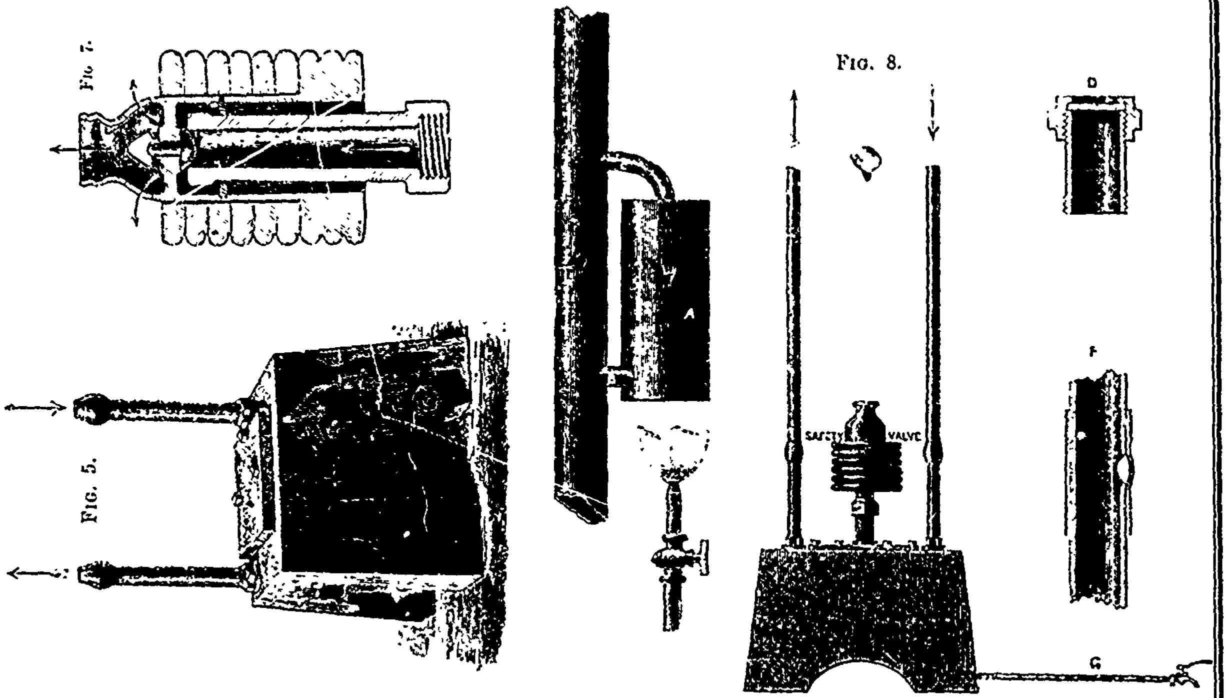


FIG. 6.

BURSTING OF WATER SUPPLY PIPES IN WINTER.



of Liverpool bought a small house at Southport, and went into it in the winter time. He was a widower, and required only one servant. He hired one at Southport. After putting her in his new house he went to his business in Liverpool. On his return he found part of the boiler in his little back garden, and part of the gable end of the house blown out. He informed me that the girl was n t injured, being in another part of the house at the time. A copper cylinder would not have prevented this accident; a safety valve, at a cost of 8s. or 10s., would have done.

I think that owners of house property would do well to have stop taps fixed in the bottoms of bath boilers, Fig. 8 G, to enable the water to run out when the houses are not tenanted. I have been informed of several that have been cracked by the accumulation of ice inside the boiler this last winter in empty houses. The one, Fig. 5, on the table is one taken out of a house in West High-street, Pendleton; three others were cracked in the same street. When tenants leave in the winter time it is therefore desirable to empty the water out to prevent this loss.

Gentlemen, I hope I have made the subject as plain and as simple as it really is; I hope I have shown to you that this destruction of human life and property is not surrounded or obscurred by things which are difficult to understand; that it does not require profound scientific skill to prevent it; that we have it in our power to stop a great amount of mischief without evoking the aid of anything but the most ordinary means.

I am not here as the advocate of any new system of patented mysterious pipes, but simply to say that a safety valve in every case mentioned would have prevented accidents. If this be true, what is the duty of the municipal authorities? It seems to me to be very clear and straight before them.

Action of some sort is imperatively needed, either by the imperial municipal authorities, in order that these things may be fixed in a safe and proper manner.

Closely allied to the subject we have been considering is the bursting of water-supply pipes in frosty weather through the expansion of ice.

My paper has already exceeded the time allotted, and I will shortly endeavour to describe a little plan which is not patented, and which I think may be used with some benefit. The social misery, without mentioning the damage to property, which takes place every winter from this cause, is great, and needs no comment. Various remedies have been suggested, but I have not been able to find that any have been successful. Elastic diaphrams, rubber balls, Fig. 8 F, and many ways of creating more space in the pipes to allow the ice to expand, have been suggested, but without effect. Strong pipes will burst when water becomes ice. Hydraulic cylinders that will bear a pressure of five tons on the square inch have been cracked in Manchester warehouses by the water freezing in them. If this be so, it will be apparent that stronger pipes than those at present used will not prevent the evil; therefore, if we cannot get pipes of a material that will bear the pressure of ice, the next best thing is to prevent the ice accumulating.

This may, in some cases, be done by covering the pipes with felt and fixing them on inside walls. As, however, most water supply pipes are fixed on the inside of outer walls, and, therefore, very easy to become frozen up, it has occurred to me that if a little cylinder and gas jet be used, as illustrated at Fig. 8 A, it might keep the water warmer than freezing point, at a very small expenditure for gas. The cylinder may be about 6in. long and 3in. diameter, and might be fixed in the cellar at a point where the water enters the house, being connected by a small tube B and C, at each end to the water supply pipe of the house. Under this cylinder, during frosty weather, a very small jet of gas might be constantly kept burning, which would cause the water to ascend, and thus promote a slow circulation. If, however, a separate pipe, ½in. bore, were to be connected to the top of the cylinder, and then taken and connected to the highest and coldest part of the water main, it would be made more effective, as the circulation of warm water would be then complete.

Old Engraving, wood cuts, or printed matter, that have turned yellow, may be rendered white by first washing carefully in water containing a little hyposulphite of soda and then dipping for a minute in Javelle water. To prepare the latter put four pounds bicarbonate of soda in a kettle over a fire; add one gallon of boiling water, and let it boil for fifteen minutes. Then stir in one pound of pulverized chloride of lime. When cold, the liquid can be kept in a jug ready for use.

A non-drying cement of great tenacity, useful for fastening plates of glass so as to exclude air, but which may be easily separated, is formed by adding freshly slaked lime to double its weight of India rubber, and heating to about 400° Fah., when the rubber will be converted into a glutinous mass.

LONDON STREETS AND THEIR TRAVELLERS.

(Continued from page 262 last number.)

If the total length of the London streets (2,500 miles) is *astonishing*, the gross amount of traffic continually going on in them is absolutely astounding; and, even so, if the attempt to form a concrete conception of the aggregate number of inhabited houses in the metropolis somewhat confuses the mind, the endeavour to frame to ourselves an idea of the collective crowd of their inhabitants positively confounds it.

The entire number of houses ("inhabited, uninhabited, and building") which at the time of taking the last census, were concentrated within the 117¾ square miles forming the area of "London according to Act of Parliament," amounted to rather more than 455,000, so that, adding the average annual rate of domiciliary increase (7,500), there must be now some 30,000 more, or 485,000 dwellings altogether. *Hence, we shall be* not very wide of the truth if we say that, in round numbers, the metropolitan houses at the present time amount to nearly half a million; and that they are consequently sufficient, with an average frontage of five yards, to form, as has been already shown, one continuous row of buildings right round the island of Great Britain, from the Land's End to John o'Groat's (600 miles), from John o'Groat's to the North Foreland (540 miles), and from the North Foreland back again to the Land's End (320 miles) = 1,460 miles altogether. Now, according to the same Government authority, the population of the metropolis was a fraction more than two millions and three-quarters of "persons" *in 1861, and a little above three millions* and a quarter in 1871; and, therefore (the rate of increase being about half a million per decenniad), the number of people at present located within its legal boundaries, may be taken in round numbers, at three millions and a half of males and females in the aggregate.

But who can have an adequate notion of three and a half millions of souls "in the lump" Some ingenious *savant*, with a considerable amount of spare time on his hands, and no end of patience in his constitution, has counted the number of distinct *ova* in the milt of a codfish; others have summed up how *many millions* of pores there are in the hundreds of square inches of epidermis which go to make up the human skin; others, again, of an egotistic turn, have reckoned the gross number of *i*'s contained in the Bible; whilst others, may be, have gone so far as to estimate even the collective motes in a cubic foot of sunbeam. But, surely, all this is the very *delirium tremens* of statistical intoxication. *The* sense of magnitude and number is merely relative: an elephant is but a tiny sucking-pig in comparison with a mammoth; even as the myriads of decomposing animalcules, which are said to give rise to the phosphorescence of the sea on a summer's night, are little more than a knot of fireflies in proportion to the infinity of Suns composing the "star-dust" which be-spangles the Milky Way. Let us, then, give over grasping at the flimsy shadow of large numbers, and endeavour to seize the substance of solid facts which are more readily comprehensible by the mind.

Well, the population of London is the 1-210th part of that *of the entire world!* (which *Balbi*, in his "*Bilancia Politica del Globo*," estimates at about 736¾ millions of individuals;) it is, moreover, according to the data of the same authority, 1-111th of all the people in Asia, 1.65th of all those in Europe, 1-17th of all in Africa, and just about 1.11th of the aggregate population of the enormous continent of North and South America; whilst it is as nearly as possible treble the whole of the persons in the whole of Australia. Further, there are close upon the same number of individuals in the metropolis as there are in the entire Netherlands, almost half as many again as in the aggregate Republic of Switzerland, and rather *more than twice as many as in the kingdom of Denmark.*

Such, then, is the population of the metropolis proper, as compare with that of other territories. Let us now regard it relatively to that of other cities. Well, London is nearly twice as thickly peopled as Pekin (which is said to be one of the most densely populated capitals in the world); but then, on the other hand, it contains almost thrice as many persons as Jeddo, and just treble the number of males and females that are located in Paris; more than four times as many as there are in New York; nearly seven times as many as St Petersburg; eight times as many as Vienna, Madrid, or Berlin; nine times as many as Naples, Calcutta, Moscow, or Lyons; thirteen times as many as Lisbon, Grand Cairo, Amsterdam, or Marseilles, not less than twenty times as many as Hamburg, Mexico, Brussels, or Copenhagen; and very nearly thirty times as many as Dresden, Stockholm, Florence, or Frankfort.

Further, in comparison with our own large cities, it contains *nearly eight times as many people as the united towns of* Manchester and Salford, and the same proportion as regards Liverpool; nine times as many as Glasgow; twelve times as many as Birmingham; fourteen times as many as Dublin; and upwards of twenty times as many as Edinburgh; while compared with the four constituent portions of the United Kingdom, *the number of people located in the metropolis* is about one-sixth that of the entire population of England; two thirds that of Ireland; rather more than the aggregate population of Scotland; and nearly thrice as many as the whole of the people in the whole of Wales.

And now let us see by what simple means we can arrive at a sense of this immense crowd of human beings *collectively*, so that the mind may be able to take in the entire mass at a single glance, or, as it were, to have a bird's-eye view of the whole. Supposing, then, each person to occupy a space of 2 feet by 1½ feet, or 3 square feet of ground altogether, and every *half a dozen persons to be thus packed within the compass of* 2 square yards, we have the following simple proportion, viz. 6 : 2 : : 3, 500,000 : 1,166,666 66, for the entire number of square yards of ground which the gross population of London, under such circumstances, would cover. Now 1⅙ million of square yards = 241 acres, or upwards of one-third of a square *mile; so that it would require an area considerably larger* than that of the entire city and liberties of Westminster (216 acres) to contain the compressed multitude, and a district just about as large as that of St. George's-in-the-East (243 acres) to afford even standing-room for the whole of the immense crowd. Moreover, it was computed that on the day of *the Duke of Wellington's funeral* there were a million and a half of people out in the streets to witness the procession, and that they covered the pathways all along the line of route for a distance of three miles. Accordingly, it follows that, were the whole of the metropolitan population ever to be congregated in the public thoroughfares at one and the same time they would form a dense mass of human beings exactly seven miles long; for 1·5 : 3 : : 3 5 : 7. Or, to put the matter still more strikingly: if the entire people of the capital were to be drawn up in marching order, two and two, and each couple to be 2 ft. apart from the next, the aggregate length of the great army of Londoners would be not less than 662 miles, or long enough to reach from London to Inverness, while, supposing the file to move at the rate of three miles an hour, it would take more than nine days and nights for the aggregate troop of the metropolitan population to pass by. Who can wonder, then, that a babe is born within the London *boundaries every five minutes throughout the year? or that* very nearly 220 Londoners die every day in the course of each twelvemonth?

Maitland tells us that London, a century ago, had absorbed into its body one city, one borough, and forty-three villages; and yet the ravenous maw of the metropolis continues daily *devouring suburbs, and swallowing up green field after green* field; for the builders still go on raising houses where the market-gardeners, a little while back, raised only cabbages,—further house-room being required every year (what with the influx of "little strangers" and the accession of immigrants from the country and abroad) for half a hundred thousand new-comers at least. Hence the capital now embraces not only the county and episcopal city of London itself, as well as the episcopal city and liberties of Westminster; but it includes the two great boroughs of Southwark and Greenwich, besides the towns of Woolwich, Deptford, and Wandsworth, together with the *quondam* watering-places of Hampstead, Highgate, Islington, Acton, and Kilburn; the old fishing-town of Barking, the once-secluded and ancient villages of Ham, Hornsey, Sydenham, Lee, Kensington, Fulham, Lambeth, Clapham, Paddington, Hackney, Chelsea, Stoke Newington, Newington Butts, Plumstead, and many other places, which were once far away *in the country.* It comprises, moreover, the jurisdiction and lieutenancy of the Tower and Tower Hamlets, and of the Hospital of St. Katherine, as well as the lordship of the Duchy of Lancaster in Westminster. Well, therefore, might M. Horace Say, the celebrated French economist, exclaim,—*Londres n'est plus une ville: c'est une province couverte de mai-*

sons! Indeed, the monster metropolis comprehends at present within its boundaries, as regulated by law, the territories of what were formerly four Saxon commonwealths and Kingdoms,—viz., the dominions of the Middle Saxons, East Saxons, the South Rick, and the Kentwaras, who once ruled over its surface; while buried beneath the houses and the pavement are the remains of streams which are now made to do the duty of a common sewer, but which at one time were of sufficient capacity to be the scene of many a naval engagement. For Stowe, in his "Survey', records that at the beginning of the fourteenth century (35 Edw I), Henry Lacy, Earl of Lincoln, complained to the Parliament then holden at Carlisle, that "wher as in times past the course of water running at London, under Oldborne Bridge and Fleete Bridge, into the Thames, had been of such breadth that *ten or twelve ships' navies at once, with merchandise, were wont to come up to the aforesaid Bridge of Fleete, and some of them to Oldborne Bridge as well*, now the course, by reason of the filth from the tanners, as well as by diversion of the water made for the mills standing without Baynard's Castle, and from divers other impediments, is sore decayed; so that the ships cannot enter as they were wont, and they ought."

Having, then, given the reader as comprehensive a sense as possible, not only of the size and population, but also of the number of houses and the length of the streets composing this consummate capital of ours, we shall now proceed, in due order, to set forth the aggregate amount of traffic which is continually traversing its thoroughfares.

By a table given in the Police Returns published in 1872, it was shown that in the twenty-two years, from 1849-71, there were constructed annually on an average 11,000 new houses and fifty miles of new thoroughfares, consisting of 285 new streets and three new squares. It will also be found that the greatest number of new houses was built in the years 1862 64, when more than 17,500 were erected annually, and the smallest number in the years 1849-54, when only 8,148, or less than half that number, were constructed. And also that the greatest number of new streets was formed between 1867, and 1868, when the average number reached 491, and the average length of the new thoroughfares formed in the course of those years amounted to eighty-eight miles; whilst the fewest new streets were made between 1854 and 1862, when the average number was only 189 per annum; and the average length of the whole just upon thirty miles.

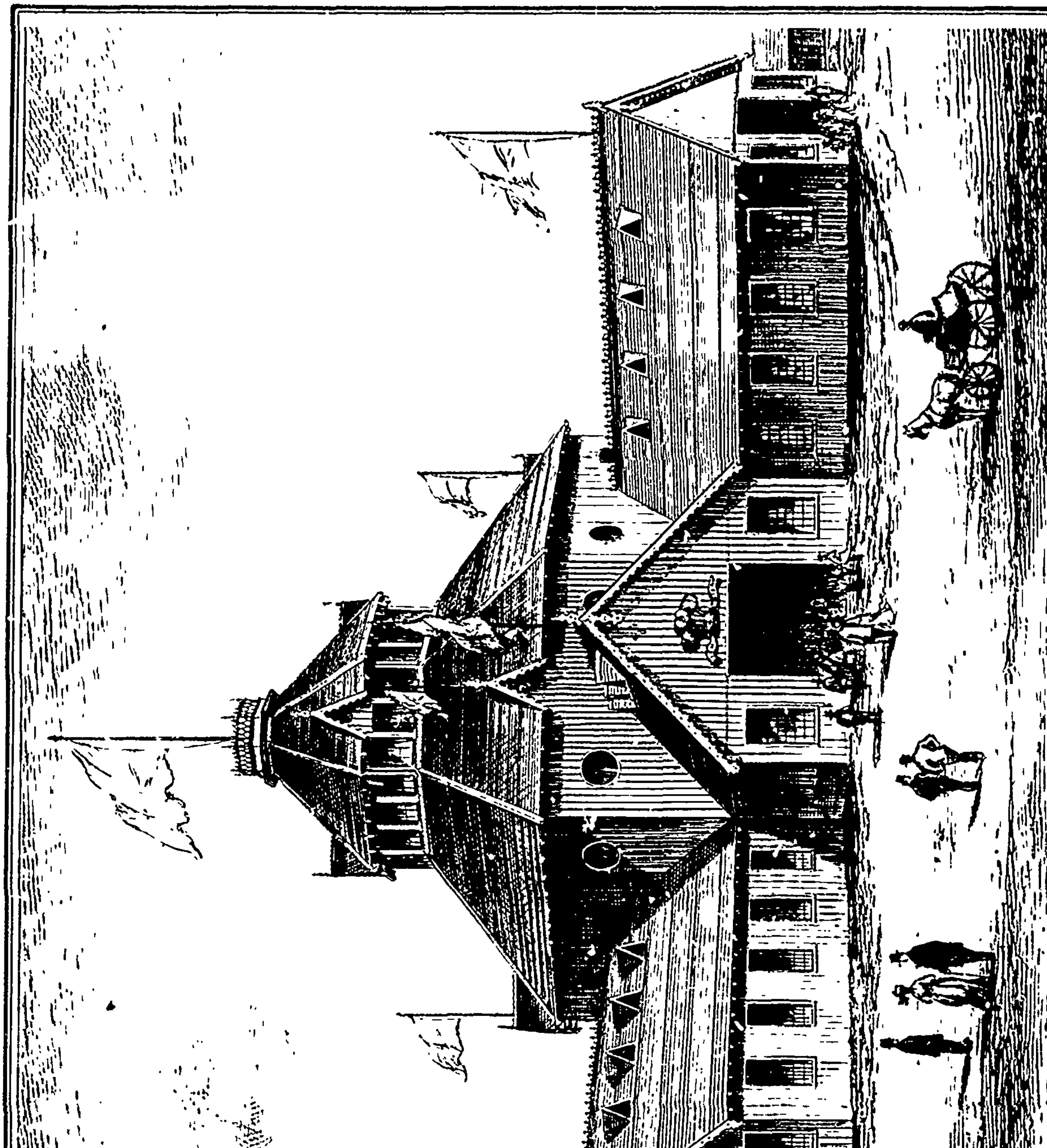
The streets of London are, assuredly, the grandest and most remarkable of all the sights that London contains. Not that this is due to their special architectural beauty, though at the West End, and even in some of the new parts of the City, there are highways which are long lines of palaces: nor yet is it owing to the magnificence of its shops, gorgeous, nevertheless, as some of them may be with the richest products of the world; neither is it referrible to the broad green fields of its prairie-like parks,—those vast aerial reservoirs (great sylvan tanks, as it were, of oxygen) for the supply of pure air, health, and spirits, to the walled-up multitude; neither, again, is it to be ascribed to the extent of its capacious docks at the East End, where the surrounding streets have all the maritime grotesqueness of an amphibious Dutch town from the intermingling of the many mast heads with the chimney pots, and where the sense of the aggregate wealth stored within the neighbouring warehouses is positively overpowering to contemplate. But these same London thoroughfares are, assuredly, the finest of all sights,—in the world, we m[ay s]ay,—on account of the never-ending and multiform varieties of life to be found in them at all hours of the day. Beyond doubt, the enormous multitude for ever sweeping along the principal metropolitan highways strikes the first deep impression upon the stranger's mind; and we ourselves never contemplate the roar of the mighty human tide without feeling that here lies the real grandeur of the colossal colony,—the one distinctive feature that gives a special sublimity to this giant town.

Travellers speak of the awful magnificence of the great torrent of Niagara, which is the broad unbroken fall of an entire river over a vertical precipice, and where the cataract of descending water is nearly 1,500 yards wide, and the average quantity of liquid for ever pouring over the rocks in one immense and terrific flood is said to amount to as much as 700,000 tons weight, or very nearly 157,000,000 gallons a minute. Still, what is even this enormous cascade in grandeur to the vast human flood, the stupendous living torrent of thousands upon thousands of restless souls, each quickened with some different purpose, and ever hurrying along the great thoroughfares of this "very great metropolis"? And if the roar of the precipated waters of Niagara at once bewilders and affrights the mind, assuredly the riot and immensity of the London traffic not only stun but appal the brain of those who hear it for the first time. There is no scene in the wide world which can impress the mind with such a sense of indomitable labour and perseverance as is inspired by the seemingly never-ending and never-tiring industry of the torrents of people and conveyances perpetually pouring along the metropolitan streets. If the Desert be the very intensity of the sublime from the almost-tragic feeling of loneliness which the scene induces,—the awful stillness and bareness of the vast arid ocean of desolation encompassing the traveller,—surely, this mighty modern Babylon is equally sublime,—though, for the opposite reason: from a sense of the infinite multitude of human beings with which we are continually being surrounded, and yet our comparative friendlessness and isolation in the midst of such a vast concourse of our fellow-creatures.

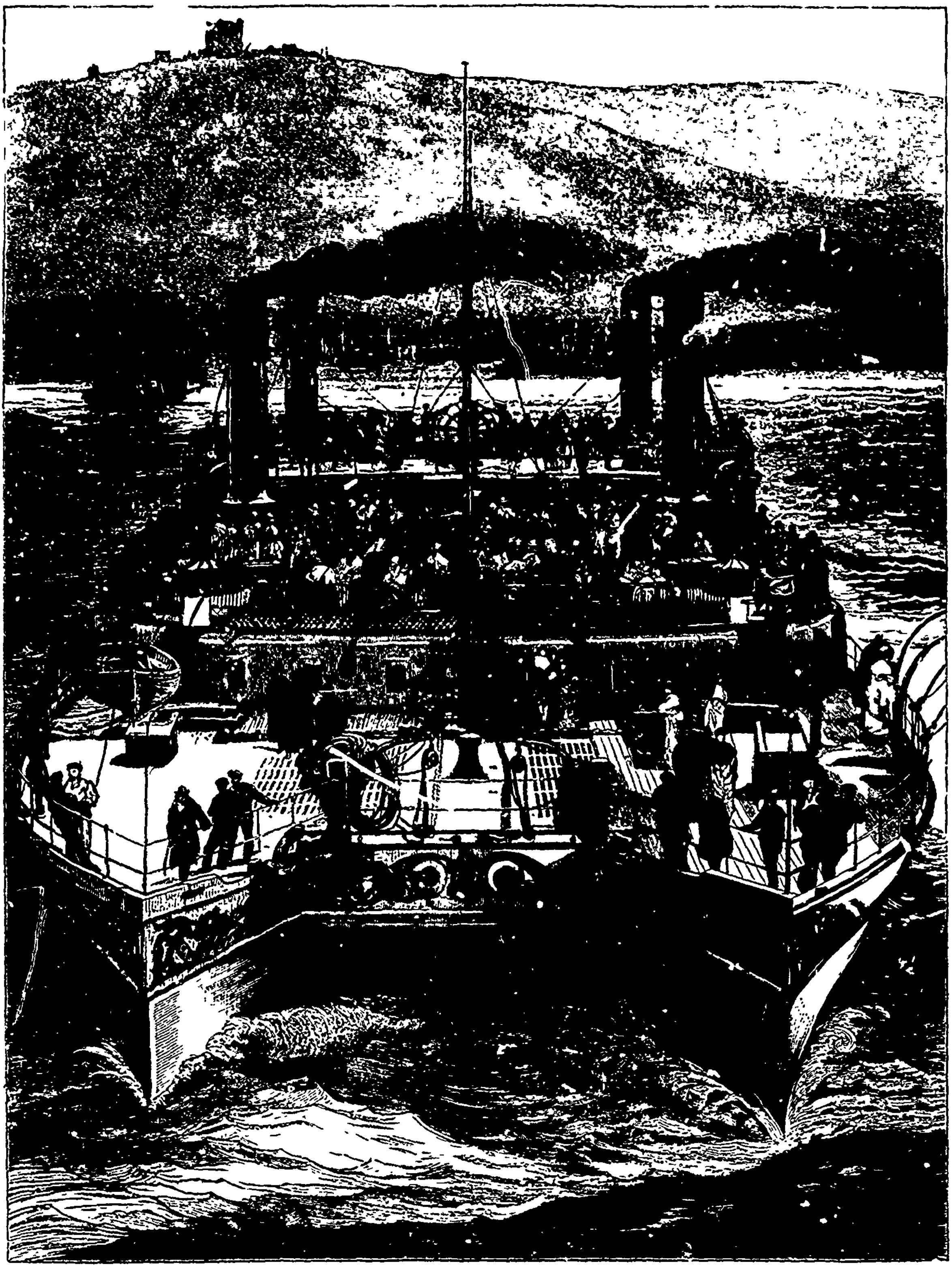
Let the visitor from some quiet country or foreign town behold the City, or even the Strand Oxford-street, Regent-street, or Piccadily, at five in the day, and see the people crowding the great lines of thoroughfare like a flock of sheep in some narrow rural lane, with the vehicles packed full of human beings and jammed as compactly together as the very stones of the pavement itself. (As many as 800 carriages are said to pass along Pall Mall, by her Majesty's Theatre, every hour of the day during the season) Let him find, moreover, that go which way he will through the City, there is the same long dense commercial train of human beings, cabs and omnibuses, carriages and carts flooding every one of the leading thoroughfares,—the same black throng of "bread-winners" (some hurrying in hot haste after the "nimble ninepence," and other plodding along steadily, but surely, in quest of the "slow shilling,") pervading each of the principal streets almost as far as he can travel before nightfall; let him find, too, every one of the great civic arteries pouring its life-stream into the mighty heart of London, each charged with its thousands of human globules, and all busy, as they circulate through the bricken ducts sustaining the vitality, energy, and well-being of the land; and assuredly he will allow that the word has no wonder, among the whole of its far-famed seven, in any way comparable to this.

Let us, however, descend to particulars, and endeavour to set forth the actual amount of traffic which daily goes on in these same woundrous streets of London. According to a return made by the Inland Revenue Office in 1850, when the mileage duty, as well as the tax on horses and carriages, was still in force, the number of horses at that time within the metropolis was upwards of 20,000, and consisted of 10,000 carriage, job, and cart horses, 5,700 cab horses, and 5 500 omnibus horses. But there were then not quite 3,000 cabs, and rather more than 1,300 omnibuses in London; whereas, according to the returns of the Metropolitan Police (who have had the licensing of these vehicles since the year 1870), the number of cabs in 1872 had increased to very nearly 8,000, whilst the number of omnibuses had declined from 1,350 to 1,289, so that reckoning two horses to each cab, the number of "hackney-carriage" horses cannot be less now than 16,000, and eight horses at least to each "short-stage" the number of omnibus horses must be upwards of 10,000, so that the gross total of such animals at present in the Metropolis (including the 10,000 private-carriage, job, and cart horses) must be rather more than 96,000, instead of 20 000 some quarter of a century ago. To this number, moreover, must be added the horses which come up to the Metropolis daily from the surrounding districts, and these are said to amount to as many as 3,000 or more. Consequently, the total of the London horses at the present time may be safely set down, in round numbers, at somewhere about forty thousand.

And now for the amount of "travel," as the 'bus-people term it, performed by this united cavalcade. The average journey of each omnibus is said to be six miles, and this length of ground is, in many cases, gone over as often as twelve times in the course of the day, or, as it is styled, "six journeys there and six back." Some 'buses, however, perform the journey only ten times, and some (though they form but a small minority of the whole) do so even less. Estimating, then, the average distance travelled by each of the London omnibuses at between sixty and seventy miles *per diem* (and this, we are assured, is rather under than over the usual



THE PROVINCIAL EXHIBITION AT OTTAWA.
(TAKEN BEFORE THE EXHIBITION.)



THE CHANNEL PASSAGE—THE TWIN STEAM-SHIP "CASTALIA" LEAVING DOVER FOR CALAIS.

amount), and computing the number of such vehicles running daily through the London streets at 1 200, we have an aggregate of 70 000 to 80,000 miles per diem, or upwards of twenty-five million miles *per annum*,—a distance which is more than one fourth of that of the earth from the sun. And that this estimate, large as it may seem, in no way exceeds the truth, is proved by the fact that the money paid for mileage duty by the 1,350 short stages, in the year 1849-50, averaged just about 10l. per 'bus per month, and amounted altogether to 162,000l.; so that this, at the rate of 1½d. per mile, would give a gross amount of annual mileage which is rather more than the total above mentioned.

The distance travelled by the collective cabs in London may be estimated as follows:—Each driver has to pay to the proprietor of the vehicle from 12s to 15s. per diem; so that, as there are just upon 8,000 cabs in all London, and these, one with another, may be said to go twenty miles each daily, in order to earn (what with long and short fares, extra persons, &c.) rather more than the sum the drivers have to take home to the owner for the hire of their conveyances, it follows that their aggregate daily travel must amount to 160,000 miles, or, in round numbers, to upwards of fifty-eight millions of miles in the year.

Thus, therefore, we arrive at the conclusion that the 25,000 omnibus and cab horses in London travel somewhere about 250,000 miles per diem! What distance the remaining 15 000 carriage and cart horses,—as well as those which come up from the country,—journey in the course of each day, there are no authentic records to enable one to form an accurate estimate. But, supposing each animal to go only five miles on an average, the total length of the ground travelled in the day by the whole of the remaining troop would amount to another 75,000 miles, so that we land at the following result, viz.: the gross amount of London traffic by the collective 40,000 London horses is at the very least 300 000 miles per diem, or about as far in the course of the year as it is from this globe to the sun!

The total length of the London streets we have already shown to be 2 500 miles; hence it is a simple rule of proportion sum to demonstrate that each mile of pavement through the metropolis must be traversed 120 times during the day, or about a thousand times a week, by some vehicle or other. Nor is this very wide of the truth; as, indeed, the observations which have been made as to the actual amount of traffic going on in different parts of the City at different periods of the daily working hours, tend indisputably to prove. For, according to an elaborate table prepared by Mr. Haywood, the well-known City surveyor, there appear to be two tides, as it were, of locomotion flowing daily through the great highways of the City,—the one coming to the flood, as it were, at eleven o'clock in the forenoon, up to which time the number of vehicles goes on gradually increasing, and that at so rapid a rate that there are nearly twice as many in the streets an hour before midday as there were at nine in the morning After eleven a.m., however, the tide of the City traffic begins to ebb, and the number of vehicles to decrease regularly from that time till two p.m., at which hour the sum total of the conveyances in the streets is about one-sixth less than it was three hours previously. Then, at two in the afternoon, another change sets in, and the crowd of omnibuses and cabs, carriages and carts, commences swelling again, and continues doing so till five in the evening, when there are some few hundreds more vehicles in the leading thoroughfares than there were at eleven in the morning. Finally, after five p.m., the locomotive current begins to ebb once more, nor does it attain its next flood till an hour before noon the next day. And so the mighty tide of traffic goes on, ebbing and flowing day after day, and wearing away the stones of London in its course,—the same as if it were the torrent of Niagara itself, pouring its 100,000 tons of water every minute over the rocks in its path.

Moreover, by the table before referred to we find that the total number of vehicles traversing the principal streets of the City in the course of twelve hours amounts to the prodigious sum of 125,000 or one-eighth of a million. Many of these, however, it must be borne in mind are reckoned more than once in the same return, nevertheless, if we take merely the number appearing in such distinct lines of thoroughfare as Holborn and Fleet street, Blackfriars Bridge and London Bridge, Leadenhall-street, Bishops-gate-street, and Finsbury-pavement, even then the amount of the City traffic reaches nearly 60,000 vehicles passing and repassing through the principal streets between the hours above mentioned

Still, the thoroughfares, within the City of London are only one-fifth the length of those without them; and as there are two distinct lines of streets traversing London from east to west, each six miles long, and four distinct highways stretching north and south, which are respectively five miles at least in length, it will be found that at five p m, when almost the whole of these main ducts may be said to be filled with the flood of the day's traffic, there is nearly one continuous stream of omnibuses, cabs, and carriages, carts, and vans, as well as foot-passengers, sweeping through London, at one and the same time, which is more than thirty miles long altogether.

THE TWIN STEAMSHIP "CASTALIA."

We give an illustration of the *Castalia* on page 297. The result of the public trial of this steamship, which took place between Dover and Calais and back, was on the whole fairly successful. As far as speed goes the trial proved her somewhat slow, while as to steadiness an opinion could scarcely be formed, the sea being at the time perfectly smooth. In one of her private trials, however, it is asserted that the *Castalia* met with some nasty weather and behaved exceedingly well, her steering qualities are excellent, and she can be brought alongside of a pier as easily as a small mail boat.

The *Castalia* is formed of two separate hulls, bridged over by one deck, the space between being occupied by the paddle wheels, in this way the rolling action of the waves will be neutralised, and the chances of sea-sickness reduced. Her extreme length is 290 feet, breadth of double hull 60 feet (only 4 feet more than the ordinary mail boat) while each hull is provided with separate engines and a rudder at each end, a second class saloon amidships, two ladies' saloons, and the usual compliment of private cabins.

SCIENTIFIC NEWS.

THE TALLEST CHIMNEY IN THE WORLD.—Mr. R. M. Bancroft, of the engineer's staff, Great Northern Railway, read a paper on the above subject at the last meeting of the Civil and Mechanical Engineer's Society, Westminster Chambers. Mr. Bancroft (the vice-president of the society) stated that the tallest chimney in the world is the well-known "Townsend chimney," Port Dundas, Glasgow. It was built by Robert Corbett, Esq., of Duke Street, Glasgow, for Joseph Townsend, Esq, of Crawford Street Chemical Works. The total height from foundation to top of coping is 468 feet, and from ground line to summit 454 feet; the outside diameter at foundation being 50 feet, at ground surface 32 feet, and at the top of coping 12 feet 8 inches The number of bricks used in the erection were as follow —Common bricks in chimney, 1,142,532; composition and fire bricks for inside cone 157,468; common bricks for flues, &c., 100,000; total, 1,400,000. The weight of bricks at 5 tons per 1000 is equal to 7000 tons. When within 5 feet of completion, the chimney was struck by a gale from the north-east, which caused it to sway 7 feet 9 inches off the perpendicular, and it stood several feet less in height than before it swayed. To bring back the shaft to its true vertical position, "sawing back" had to be resorted to, which was performed by Mr. Townsend's own men, ten working in relays, four at a time sawing, and two pouring water on the saws. The work was done from the inside on the original scaffolding, which had not been removed. Holes were first punched through the sides to admit the saws, which were wrought alternately in each direction at the same joint on the side opposite the inclination, so that the chimney was brought back in a slightly oscillating manner. This was done at twelve different heights, and the men discovered when they were gaining by the saws getting tightened by the superincumbent weight.

BRIGHT YELLOW STAIN. — 1. Brush over with the tincture of turmeric. 2 Warm the work, and brush it over with weak aquafortis varnish or oil as usual. 3. A very small bit of aloes put into the varnish will give a rich yellow color to the wood.

BIRMINGHAM INDUSTRIES.

WIRE-WORKING.—George Baker & Co's Works.

Wire Working is comparatively a modern industry, but it has rapidly grown into a very important trade, and its importance is increasing year by year. The variety of articles now produced in this branch of work is almost infinite, from splendid and magnificent rosaries to the common but useful dish-cover; from elegant epergnes and flower-sands to lanterns; from bird cages of the most pleasing and artistic shapes to the humble mouse-trap; from garden seats to garden fences; from trellis work to fire-guards — in a word, numberless articles of ornament and use are now made in wire.

Rosaries (Fig. 1) are of various shapes and patterns, the design being first drawn on the floor, or on a large board. Then the frame is made, the various shapes being formed on taper blocks of wood, which vary according to pattern and size. The wires are then bent round pieces of iron in accordance with the pattern required. All the parts are made to scale, and the various parts are fastened together by nuts and bolts. For each kind of rosary the parts are all of the same length, and the great advantage of this method is that inexperienced persons can fix the rosary after it is made. The workman is always employed in making the same kind of article, so that the utmost skill is attained in his own peculiar branch. The labour is exceedingly interesting, and the greatest beauty in design and excellence of finish are secured. Garden arches in great variety are made in this department. Our illustration will give the reader a perfect conception of the elegance of outline and the generally graceful appearance of these triumphs of wire-working.

Our next example is the making of flower-stands. Flower stands were formerly made in pieces, but they are now made in parts for the convenience of packing. This elegant article is adaptable to three purposes. (1) A flower-stand; (2) a window-box for flowers; (3) a floral screen. The top of the stand can, without difficulty, be detached, although it stands quite firm, and then used as a window-box. Thus the same plants can be placed in the window during the day, and be removed into the stand in the evening; and this can be done without disturbing the most delicate plant or flower. Again, a wire panel can be placed in the stand, and then, if required, it can be used as an elegant floral screen for training ivy and other climbing plants upon for use within doors. By a skilful arrangement, a pan is fitted to these stands for catching the water, so that the contents of the room in which they are placed are entirely preserved from damp and from being soiled. This useful addition rather increases than detracts from the elegance of the stand, and is a boon which all our lady readers will readily appreciate. As in the case of the rosaries, the same workman is continually employed in constructing the same kind of stand. We give an illustration of this *speciality* (Fig. 5.)

One of the most interesting branches of work is that of making epergnes for cut flowers. In this elegant work the wires are bent round a tube giving the required shape; on the ends of the wire ornamental scrolls in metal are placed. The wire on these is then worked into the shape required by the pattern, and then soldered together. A variety of designs, such as lions, dolphins, dogs and other animals, are used for the feet. Then trumpet-shaped glasses, or dishes, are placed on for holding the flowers, and the epergne is complete. These articles are among the finest things manufactured in wire; and in the same department is made a large variety of baskets for cut flowers, fern-stands and aquariums. We give an illustration of this work (Fig. 8.)

In basket-making, the first part produced is the bottom, which is, of course, of various shapes, according to the kind of basket required. The wire is cut off to length and bent in the various shapes. It is then fitted together round the bottom, and afterwards tied to the top, and made firm. Several hundred patterns of baskets are produced, and one variety, called the "Kensington" flower-basket, has the specialty of a movable cup. By this simple and useful appliance, the "water-dropping from the plants is intercepted and prevented from soiling carpet or flooring. At the same time, the plant is properly drained without always standing in water, and the loose pan is removed without lifting the plant." Our illustration affords a clear view of this admirable arrangement (Fig. 7.)

Garden seats are made in wire and in wood. There is, however, nothing requiring special notice in their manufacture, and our illustration of this branch gives a clearer notion of the article produced than could be done in words (Figs 4.)

We now turn to other branches of wire-working, one of the most interesting is that of making bird-cages. In making a canary-cage, sheets of zinc of about five-eights of an inch in width are first cut into the required lengths. Two small holes are then pierced in the edges by a machine for the purpose of receiving the upright wires. The strip is then passed through a pair of rollers, which turns up the two edges and brings the pierced holes opposite to each other. Three of these bands are next placed parallel to each other on a wood frame, and the wires passed through the holes. Solder is then run down the centre of the bands, firmly fastening the wires. They are then bent up into the shape required. Ornamental zinc tops are placed on the frames of the cages, which are then ready for japanning. The same process is employed in making all canary-cages, but this bare statement can give no adequate notion of the wonderful variety and the exceeding elegance of the cages here produced. For this we must call in the art of the engraver, and give our readers an illustration of one of these bird homes which we saw made (Fig. 2.)

Great improvement has been introduced in making parrot-cages. These were formerly made of tinned wire, and the binding wire being very thin the bird pulled it off, thus rendering the cage useless. These cages are now made with iron wire, and the whole cage is passed through a tin bath, and is thus tinned all over, which makes it as strong as if it were one piece. A heavy man may stand on a cage thus made without bending it in the slightest degree. Another improvement has been effected by making the stand on which the cage is placed movable, so that it can be easily taken away for cleaning. These are made of ornamental japanned iron. Cage bottoms are made of tin, and the process is called "spinning." A tin disc is cut out in blank. It is then placed in a lathe, in the chisel of which is a mould of the pattern required. The workman then presses the revolving disc with various sized "burnishers," and so works it into the desired pattern and shape. This process is a very interesting one to watch.

Of culinary articles made in wire we will notice, first, dish-covers. These commence with the rim, which is in strips of tin soldered together. These are hammered over at the edge, in which a wire is inserted in order to give extra strength. Each rim is then passed through a pair of rollers, which by one process binds the wire in and flattens the tin. Several rims are then placed together, and bent in a mould of the shape required. It is there hammered until it properly fits. For the cover, a piece of wire gauze, woven in a loom, is cut to pattern, placed in the mould, and pressed by hand to the shape. It is then "tacked" round to the rim by soldering, so as to hold the gauze firmly in its place. This is the most important part of the work. A lining of tin is put inside the rim, the handle is put on, and the article is complete. In this department, beside dish-covers, meat-safes, lanterns and all kinds of tin goods are made. We give an illustration of a dish-cover and a meat-safe on page 300.

Lattice work is another branch of wire-working. This was formerly done by "interlacing straight wires by hand, and then tying the intersections with binding wire. This was a slow and tedious method, with the disadvantage after it was done of leaving a rough surface. Machinery, however, has here effected a great improvement, though the actual interlacing of the wire is still done by hand labour. A patent was taken out, some time since, for corrugating or indenting the wire used for this purpose by passing it between a pair of rollers having grooves cut on their surfaces corresponding with the wave it was required to give the wire. These wires were then employed for the production of the lattice, and a given number being arranged on a bench and kept in place simply by a block of wood placed on their ends, the girl [for the work is usually done by girls] takes another piece of the waved wire and places it at the required angle, alternately, between the wires already laid down, so that between every wire there is an indentation of the wire which crosses them. This is repeated, so that the result is a trellis that requires no tying at the intersections, the whole being well held together

WIRE WORKING.

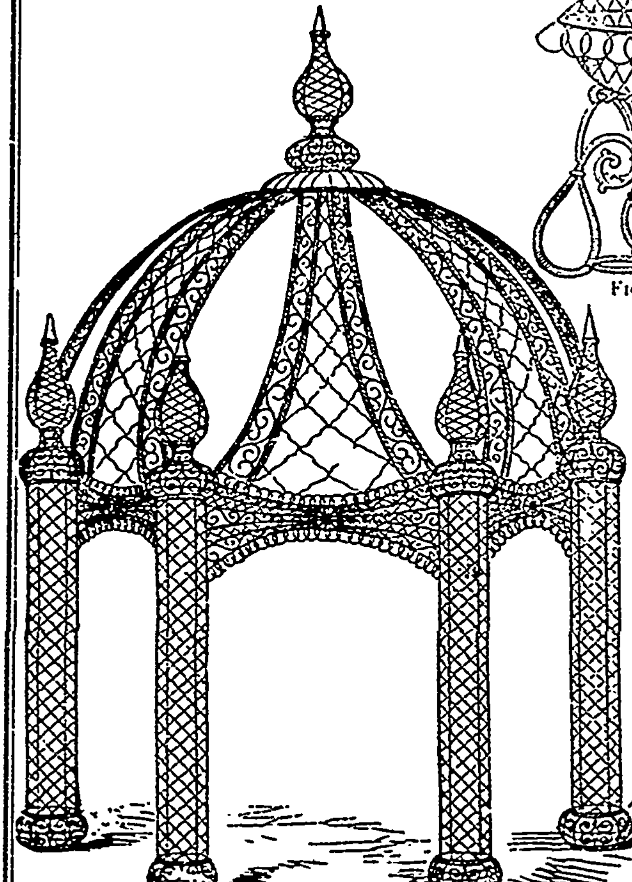


Fig. 1.

Fig. 8.

Fig. 2.

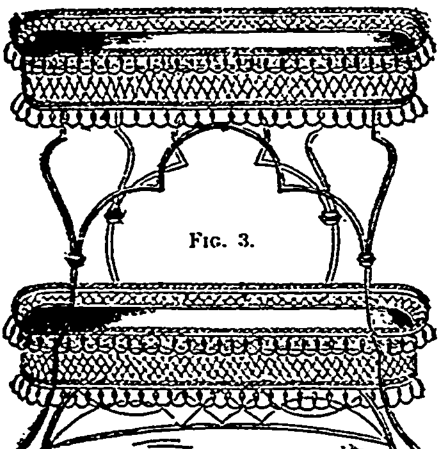


Fig. 3.

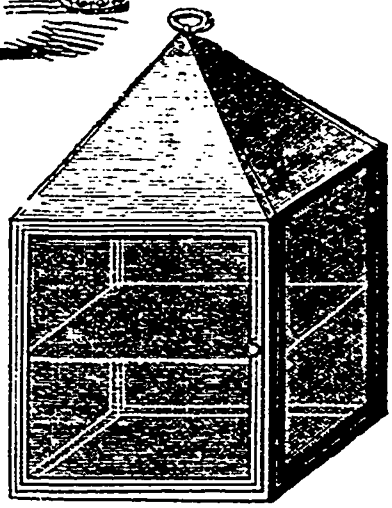


Fig. 5.

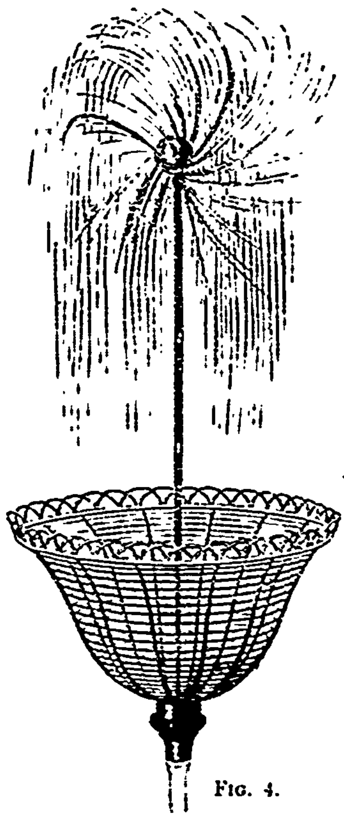


Fig. 4.

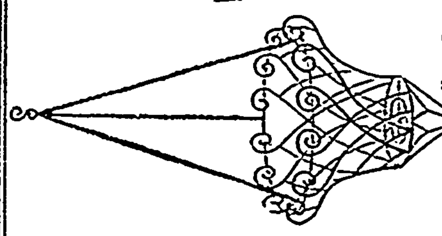


Fig. 7.

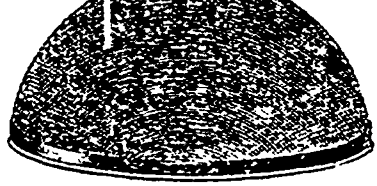


Fig. 6.

by the indentations, each wire holding the one which crosses it in its place. The absence of the tying wires much improves the appearance, and entirely prevents the roughness that was so objectionable under the old method." It is made in large rolls, then cut up, and worked into flower-stands, arches and ornamental work.

Rat-proof fencing is made in a peculiar manner. The wires are rounded into a scroll at the top, so that the rat cannot run up them, which he would be able to do if they were straight all the way, and they were in the old method of working. By this arrangement our aviaries and other wire houses, made for the service of our pets and favourites, are rendered secure from the depradations of this terrible animal. All kinds of ornamental wire fences for gardens, parks, for dividing houses from each other instead of using rails, and for similar purposes, are now made by using appropriate tools in place of the old-fashioned nippers and pliers, so that the articles made are precisely alike and can be matched at any time by merely giving toe kind and number.

Chains for land-measuring are also made of wire: the wire is first pegged, cut off into the lengths required and the ends turned on tools. At proper intervals small pieces of brass are attached, having one, two, three, or four inches indicating the length of the measuring chain When linked together the chain can be folded up into a very small compass—the length of each part being about 9 inches. The chains are made in different lengths to suit the various measurements of different countries, for, as if to render all things as difficult as possible, each nation has its own standards, and different chains have to be made for England, Ireland, Scotland, France, Russia, and so on.

Riddle-making is another branch of this trade, and riddles are made for foundry work, for building and gardening. A rim of oak is nailed together over a board of the required size, generally 18 inches in diameter. A wire is bent round the rim, which is pierced with the holes nearer or farther apart, according to the width of the mesh; through these holes the wire is passed across the frame of the riddle, and then another wire across this, an operation which has the name of "crackering." The wire is thus passed from bottom to top, and then *vice versâ*, and when complete the riddle is as tight as a drum. By placing two wires across called "cross bars," the whole is rendered firm and fit for use.

"The foundation of many wire articles is woven wire gauze of different degrees of fineness; and the weaving of this gauze of wire for malt-kiln and other drying floors, and for netting of different meshes, is a very large and important branch of the trade. The loom employed is of the simplest construction, all patterns being given to the articles by other means, and in the case of fine gauze or kiln-floor web, the wires forming the weft are brought together by a sharp blow of the batten of the loom, as close as the thickness of the woof will allow. In wire cloth of a more open mesh, considerable skill is required on the part of the workman to keep the weft at regular distances, the regularity being entirely dependent on the correctness of his estimate of the distances; the woof, of course, being regulated by the machinery of the loom." At Messrs. Baker's more powerful looms, with iron frames instead of wood, are now used for weaving kiln and other kinds of wire gauze. Wire-gauze netting machines are used which are capable of making netting of from ½ inch to 4 inches mesh.

In making sofa and bed springs, coppered and bright wire is employed It is placed on a double conically-formed block of wood, placed in a machine, by turning which it is wound round the block in a snake-like coil. It is then taken off the block, pressed to the height required, the ends turned and tied, and the spring is finished. These springs are made at the rate of about one a minute.

Wire chain making is another branch, and of this article, we are informed, a very large quantity is made, both of iron and brass wire. It was formerly made by hand, but is now done by machinery. The machine used is complicated in construction, but so simple and effective in action that it can be worked by a child. The wire to be made into a chain is wound on a "swift," like cotton on a reel. It is taken into the machine by a feeder, then cut off to the required length, then bent round two "spits," next closed, then placed in position for the next wire to pass through the eye to form the next link, and so on in continued succession, and a perfectly made chain comes regularly out of the machine. By machines, also, are now made all kinds of wire pins for escutcheons, gimp, coachpins, pianoforte pins, staples, cotters, and so on. One movement of the machine cuts off, heads, and points a pin, and so of the various articles made in this department of the trade.

The process of "galvanising" is one worth seeing. For spelter, a huge pot containing 25 tons of metal is employed. The wire articles to be galvanised are first cleaned in acid, and then are immersed in the metal, a coating of which adheres to each article, soldering, as it were, every wire together, and making it as strong as if it were all of one piece. The pot is made clean from all sand and ashes, and the liquid metal covered with salt ammoniac. The article dipped passes through the salt ammoniac into the metal, and comes out of its perilous bath as bright as silver. In articles made of tin a similar bath is employed, but a flux is substituted for the salt ammoniac.

We may mention here that the making of Venetian shades and wire blinds is an important branch of the varied industries here carried on, and that in wire-drawing, needle wire, also copper and brass, of a very fine quality, is made.

The various articles when made have to be jappanned and painted. Mr. Baker has "introduced a process of 'enamelling,' a sort of japan, which being perfected by the action of a stove, is much more firm and durable" In painting, all goods have three coats of paint, and the ornamentation, whether consisting of birds, flowers, scrolls, or whatever pattern, are all done by hand — no transfers being used in the establishment. Some of this work is of a very artistic character, and is admirably executed by the skilled workmen employed.

The specimens illustrated are from the works of Messrs. Baker & Co., Chester street, Birmingham.

INDESTRUCTIBLE WOOD.

A very important invention has lately been patented in England. It is a process for rendering timber uninflammable, preventing dry rot and decay, and for rendering the softer kinds of timber as hard and durable as oak and teak. This process, which is at once cheap and effectual, consists in impregnating the timber with a hot solution of tungstate of soda, at a cost of about five cents per cubic foot. The success of the operation has been amply demonstrated by public experiments which have been so entirely satisfactory to as to lead the English Government to enter on an agreement with the patentee. At a recent trial of the prepared wood at Chicago two wooden houses were set on fire, one being of prepared wood and the other of wood unprepared, except the framing. The result of the experiment was that the latter was entirely consumed except the prepared framing which was left intact, while the former was entirely uninjured.

To Drill into Hard Steel.—Make your drill oval in form, instead of the usual pointed shape, and temper as hard as it will bear without breaking; then roughen the surface where you desire to drill with a little diluted muriatic acid, and, instead of oil, use turpentine or kerosene, in which a little gum camphor has been dissolved, with your drill. In operating, keep the pressure on your drill firm and steady; and if the bottom of the hole should chance to become burnished, so that the drill will not act, as sometimes happens, again roughen with diluted acid as before; then clean out the hole carefully, and proceed again.

To re-cut Old Files.—Remove the grease and dirt from your files by washing them in warm potash water, then wash them in warm water, and dry with artificial heat; next, place 1 pt. warm water in a wooden vessel, and put in your files, add 2 oz. of blue vitriol, finely pulverized, 2 oz. of borax, well mixed, taking care to turn the files over, so that each one may come in contact with the mixture. Now add 7 oz sulphuric acid and ½ oz. cider vinegar to the above mixture. Remove the files after a short time, dry, sponge them with olive oil, wrap them up in porous paper, and put aside for use. Coarse files require to be immersed longer than fine.

STEAM BOILERS.

There are not many articles that have been produced in such a variety of forms, and been the subject of so many patents, as steam boilers, each new form professing a vast superiority over its predecessor. The waggon boiler of Watt has nearly disappeared, since, although not a wasteful one, it is quite unsuited from its form for the production of high-pressure steam. The economy attending the use of high-pressure steam employed expansively is so generally acknowledged that the high-pressure boiler has become nearly universal.

THE TREVITHICK BOILER.

This boiler, named after Richard Trevithick, the celebrated Cornish engineer, consists of an outside cylindrical case or shell, within which is a ⊃-shaped fire tube, commencing at the front and continued at the back, turning round and returning to the front, where it is connected to the chimney. The tube is tapered along its length, being largest at the furnace end gradually diminishing till it delivers into the chimney. This is a boiler which does not require setting in brick-work, will work with economy, and last a great number of years. Although nearly the first high pressure boiler made, this form is at the present time extensively patronised, thus showing the possibility of a number of alterations without improvement, as well as the sound judgment of Trevithick.

THE PLAIN CYLINDER BOILER.

This boiler is generally made with spherical or dome-shaped ends if small, sometimes it is made with dished or nearly flat ends. It is the least costly of all forms, and also the strongest; it is the most convenient form to keep clean, but should never be made more than four or at the most four and a half diameters in length, as after that limit is passed, an injurious expansion takes place. The under surface over the fire will get hot before the steam is up, and the upper part being comparatively cool, a great strain is thus brought upon the side joints. For high-pressure steam, say 60lb. or 70lb., to the inch, they ought not to go over 5ft. 6in., or at most 6ft. in diameter, and be made of half inch plate, or at the very least 7-6 in. It is a mistake to set these boilers with flues round them, they ought to be set so that the whole bottom half is exposed to the direct action of the fire, and the damper regulated to a moderate draught. Side flues are not only troublesome to clean out, but are nearly useless, for in this position the sides of the boiler become covered with a coat of carbon, through which the comparatively low temperature of the flue heat will not pass. These boilers last a long time, and are remarkably handy for chemical or steaming purposes, where close attention cannot be given to them, as they will work for three or four hours without feed, and a large slow economical fire can be put under them. Weak liquors can also be boiled down in them, so long as they are not brought to saturation, and the steam may be applied to the driving of an engine or any other purpose. In this case of course some of the liquor must be blown off at intervals, as at sea, and the boiler replenished with fresh. As there is plenty of room in these boilers they may be worked very clean by the introduction of some light shallow iron pans, made by merely turning up some light sheet iron about 3in. at the ends and sides, make them narrow enough to go through the manhole, and long enough to cover the width of fire-bars or nearly so, and put on legs to keep them 4in. from each side of the boiler to allow the circulation of the water and the passage of the steam. When the boiler is at work the dirt is held in suspension in the water, but that portion over the pans being in a comparatively quiescent state, the dirt is at liberty to sink into them, instead of as usual covering the boiler with scale where it is likely to have an injurious effect. The pans should be set in a row, and extend to a foot or two beyond the bridge of furnace, I used them and found they did me service. The only drawback to this boiler is that it takes 8 or 9 per cent. more fuel than the internal fired boiler, but as the furnace can be made large, and slow combustion practised, I believe this loss could be nearly met.

THE CORNISH BOILER.

This boiler which has been used for a great number of years in Cornwall for the pumping engines, and also at nearly all our water-works, stands A 1., and is the boiler by which others are compared. Nothing has come up to it, taking all its qualities into consideration. It is simple in form, consisting of a cylindrical shell containing a fire-tube; the casing or shell is mounted with a steam chamber. A strain on these boilers when made too long, is caused by the internal flue becoming hot, and expanding before the shell, when getting up the steam. I have the water comparatively cold at the bottom of the boiler, with the steam at full pressure. There being but a small quantity of plate between the tube and shell at the lower part of the diameter, it has not a chance to adjust itself by springing, consequently in a boiler of great length the expansion starts the work at this point. I have seen new boilers start their work in this way, and leak ever after; boilers of this description should never be more than four diameters in length, and always be made with a vertical tube or two placed behind the bridge, as this would give a general circulation of water as soon as the fire was lit: also the tubes would break up or distribute the flame and act as a heat-absorbing surface. The Cornish boiler requires care in setting; if you have only doubt about the foundation, as to its being damp, have at least 14in of concrete under it, and avoid setting on a mid-feather. I mean a line of brickwork directly under the centre of casing, to divide the flues. Let the flue turn down at the back end, and under the centre of the boiler, dividing off in front into each side flue. By setting in this way the boilers will rest upon two side walls. You cannot be too careful with the bottom of these boilers, as any leakage or dampness would find the lowest point, and there getting doses of sulphur from the coals, would act upon the iron rapidly. Should the foundation be slightly damp a mid-feather acts like a sponge holding and collecting the water.

(To be continued.)

MODERN PROCESSES OF STEEL MANUFACTURE.

The statement that a Bessemer steel rail can be produced at a cost but slightly, if at all, exceeding that of an iron rail will seem extravagant to those who have been accustomed to think of steel as the product of laborious and expensive processes, and who have not become acquainted with the great development of methods for its cheap manufacture on a large scale. But a little consideration of the subject will suffice to show that the transformation of cast iron into steel need not be more expensive than the transformation of the same material into wrought-iron. In fact the lowest grades of Bessemer steel are little more than wrought-iron melted. The texture supposed to be peculiar to wrought-iron, and known as "fibrous" or "laminated," turns out to be merely the result of the mechanical treatment involved in puddling, hammering, and rolling. In neither of which processes does the decarbonized metal undergo fusion. Hence it retains minute portions of earthy matters which are hammered or rolled out with it, imparting to it a texture which does not belong to it as iron merely. The high temperatures of the Bessemer converter and the Siemens furnace having made it possible to melt wrought-iron on a large scale, its true nature and its relationship to the steels low in carbon is better understood.

The Bessemer process is in one sense a substitute for the puddling furnace. In the latter, cast-iron is deprived of its carbon by fusion upon a hearth lined with iron-ore (oxide of iron) which yields its oxygen to the carbon of the cast-iron, forming carbonic oxide and carbonic acid, which escape as gases. The iron, deprived of its carbon, becomes infusible at the temperature of the furnace, and thickens to a pasty condition in which is it skillfully balled together by the puddler, and removed from the furnace to the "squeezers," hammer, &c. In the Bessemer process, on the other hand, the carbon is removed from the cast-iron by blowing air through a molten mass of the latter. Here it is the oxygen of the air which unites with the carbon of the pig iron. Since steel is an alloy of iron and carbon containing more carbon than wrought-iron, but less than cast-iron, it is natural to suppose that by stopping the Bessemer blast at the proper instant, the desired grade of steel might be at once obtained. This can, indeed, under certain circumstances, be accomplished, but in the vast majority of instances (and universally in English and American works — in fact, everywhere, we believe, outside of Sweden) it is found most convenient first to take out all the carbon, and then to restore the amount required for the grade of steel sought. But it is not easy to take out the carbon completely without encountering a new difficulty. Namely, when the carbon is nearly gone, the oxygen of the blast begins to act upon the iron itself, forming oxide of iron; and this substance existing in the mass of molten iron, even in extremely small quantity, deprives it of homogeneity and renders it liable to brake under the hammer at red heat, or as the iron masters say "makes it red-short." Now to cure this red-shortness, and at the same time to recarbonize the melted wrought-iron, a compound of iron, manganese and carbon, called *Spiegeleisen* or specular iron, from its brilliant luster and large mirror-like crystalline faces, is added to the bath before casting. The manganese is supposed to unite with the oxygen of the iron oxide just referred to, and to pass as oxide of manganese into the slag which floats on the bath, while the carbon unites with the iron in the bath to form steel.

Now the Bessemer operation, thus sketched, is simpler, quicker and applicable to larger quantities at once than puddling. There are in fact but three reasons which occur to us why the product should not be as cheap as that of the puddling furnace. 1. The latter will successfully treat sorts of pig iron which cannot be used in the Bessemer converter; and these sorts are (partly for that reason) cheaper than the "Bessemer pigs." 2 The Bessemer process involves a large loss of iron. 3. It requires very expensive "plant" or machinery, the interest on the cost of which is to be assessed upon the product. Nevertheless, the statement hinted at the commencement of this article is scarcely premature Steel rails, acknowledged to be in all respects superior to iron ones, can be produced at a cost which is rapidly approximating that of iron. The "rail of the future" will be steel!

Yet it is not likely that any more Bessemer works will be erected in this country. For a rival process — the only one, so far, which is worthy of that name—is coming into favor, and already in England, and on the Continent, puts its product into the market on equal terms. We refer to the Martin process of manufacturing steel on the open hearth of a Siemens reverberatory furnace. Here the decarbonization of the pig-iron is effected by the reactions, upon the molten bath, of wrought-iron or ore and of the furnace-flame. The operation is slower and more completely under control than that of the Bessemer method; and the ease and regularity with which any desired grade of steel can be produced has led to the employment of this method for some purposes to which the Bessemer is less adapted—for instance, the manufacture of boiler-plate, machine and tool steel, &c. But the gradual perfection of the arrangements and manipulations of the Martin system, in such works as those of Siemens in Great Britain, Martin in France, and also the establishment at Terre Noire in the South of France, has brought about a competition between Bessemer and Martin steel on the chosen ground of the former, namely, the manufacture of rails.

One of the advantages of the Martin process in this competition seems to be its capacity of employing old iron rails (usually containing phosphorus) in making new steel rails. It does not appear that the treatment eliminates the phosporous but, on the contrary, that a steel is produced containing more phosphorous than was hitherto supposed consistent with tenacity. The secret is asserted to lie in the reduction of the quantity of carbon in proportion as that of phosphorus is increased, or, as it has been expressed, in the substitution of phosphorus for carbon as a "steelifying agent." Phosphorus has been universally regarded as the great foe of the steel manufacturer; and if by this means it can be utilized as an ally, a very large amount of material will be rendered available for making steel; and the transformation of thousands of miles of iron tracks on the railroads of the world into tracks of steel will be greatly facilitated. It must be added that engineers and metallurgists are still doubtful about "phosphorus-steel rail though the reports concerning their use in France for a year or two past have been generally favorable.

The decisive effect produced by minute proportions of a substance like phosphorus in combination with iron may be seen in the fact that one-tenth of one per cent. of it is considered all that ordinary "carbon steels" will bear, while even the "phosphorous-steel," of which so much is said, never contains so much as half of one per cent., and usually, we are informed, the proportion of phosphorus in it is about 0.35 per cent.—that of carbon being perhaps 0.12 per cent.

THE EIGHTY-ONE TON GUN.

(*See illustration on page 304.*)

The sketch we give of "Boring the Trunnion Coil" is the last operation connected with the manufacture of the monster 81-ton gun We do not cast them, as Krupp does his famous steel weapons at Essen, but we build them up piece by piece In the first place, a long pillar of solid steel is obtained which, in the case of the 81-ton gun, alone cost £1600. This pillar is bored out to the proper diameter of the cannon, and the tube thus secured forms the centre of the gun. The next thing is to provide several wrought-iron cylinders to clasp this tube and strengthen it, and it is in the manufacture of these cylinders wherein lies the strength of our 'Woolwich infants" A long bar of stout iron, sometimes 200 ft. in length, is put into a furnace of the same dimensions, and heated to redness; one end is then attached to a revolving iron pillar at the mouth of the furnace, and the pillar is set in motion, so that the heated iron bar gets wound round it in the form of a spiral Subsequently this spiral is slipped off the pillar, and is carried to a reverberatory furnace to be heated once more, but this time to a white heat In this condition the mass is brought under a huge steam-hammer and welded into a cylinder, in which form, after having been properly turned and bored, it is ready to slip on to the steel tube we first alluded to.

Two or three iron cylinders, or jackets, are usually placed around the steel tube in our big guns at the breech, where, of course, most strength is necessary, while one suffices for the muzzle, and this is the reason why our modern cannon have that humped-back appearance behind. The biggest cylinder is termed the "trunnion coil," for it carries with it the trunnions on which the gun rests when in its carriage. In the case of the 81-ton gun, the trunnion coil is of immense proportions, 6 ft. in height and 18 ft. in girth, and the finished gun will be 27 ft. long. Our illustration shows the last operation of all being performed—that of boring this cylinder inside to render it smooth, so that it may be easily slipped over the steel tube, or, rather, over the first iron jacket with which the steel tube is already surrounded The cylinder is made so that it is a trifle too small and will not slip over the tube; but it is heated to make it expand and in this condition it is easily fitted in its place, where it shrinks very tightly on cooling. In this very neat and simple manner are the guns at Woolwich now built up, and from the circumstance that the bore of the gun is made of hard steel, while the cylinders around are constructed of tough wrought iron, they may be relied upon for great strength and endurance.

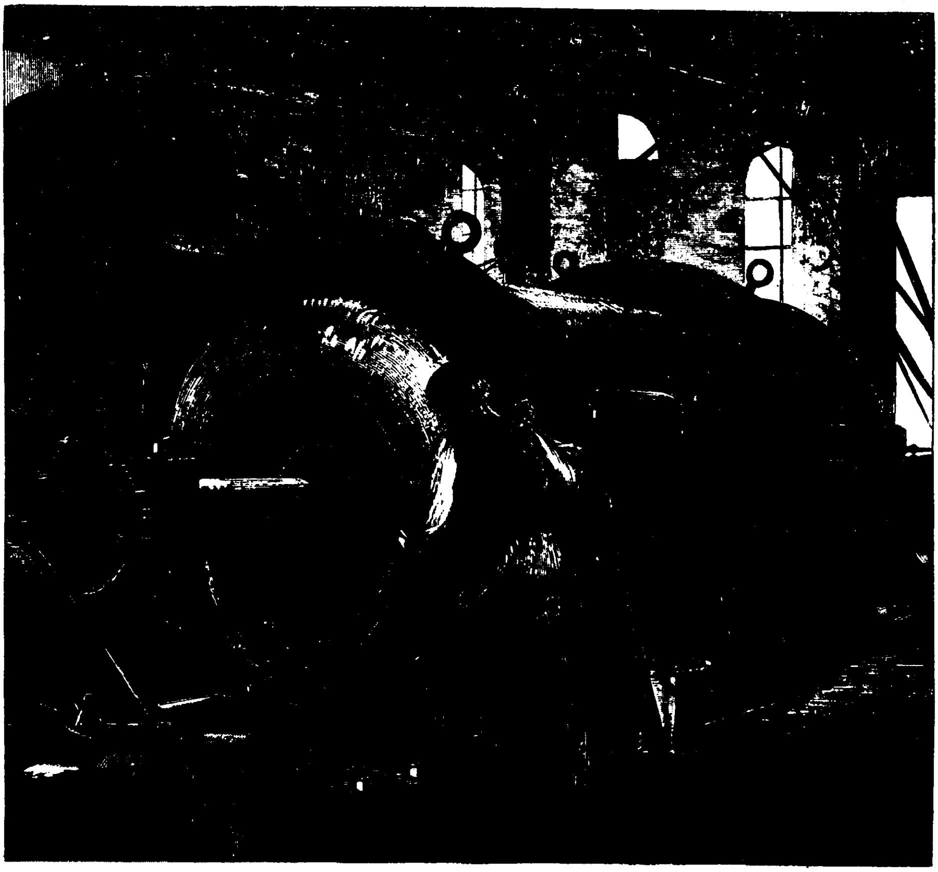
It is anticipated that the 81-ton gun will be able to send a projectile through twenty inches of solid iron, or, in other words, through the sides of the strongest ironclad now built or building. For this purpose 300 lb. of gunpowder will be required, and a shot weighing half a ton.—*London Illustrated News.*

APPARATUS FOR PRODUCING GAS INSTANTANEOUSLY.

This apparatus consists of three vessels,—an air pump, a receiver, and a carborator. In the latter is enclosed the essence of the mineral which forms carborated air—that is to say, the air becomes instantaneously changed into lighting gas by escaping from the receiver and coming in contact with the mineral in the carborator. A few strokes of the pump is sufficient to send into the receiver enough air to make gas for an evening. On opening a tap the gas is conveyed to the different burners. Instantaneous gas thus made has an advantage over ordinary coal gas, of not only being nearly 100 per cent more economical, but its brilliancy is greater, and it burns with a steadier light, It is odourless, and does not injure gilding or picture frames, and is unattended with any danger

The price of an apparatus large enough to supply 10 burners is about $320 It is manufactured by Mr. Martin, 63, Rue de Molté (Château d'Eau), Paris.

COUGH.—Valerian root 5d.; snake root, 1d., Peruvian bark, 1d.; Spanish juice, 1d; peppermint, 2d. Boil the roots and juice in about a pint and a half of water down to a pint. When cold, bottle, and add the peppermint. Dose: A wineglassful when the cough is troubles ... .

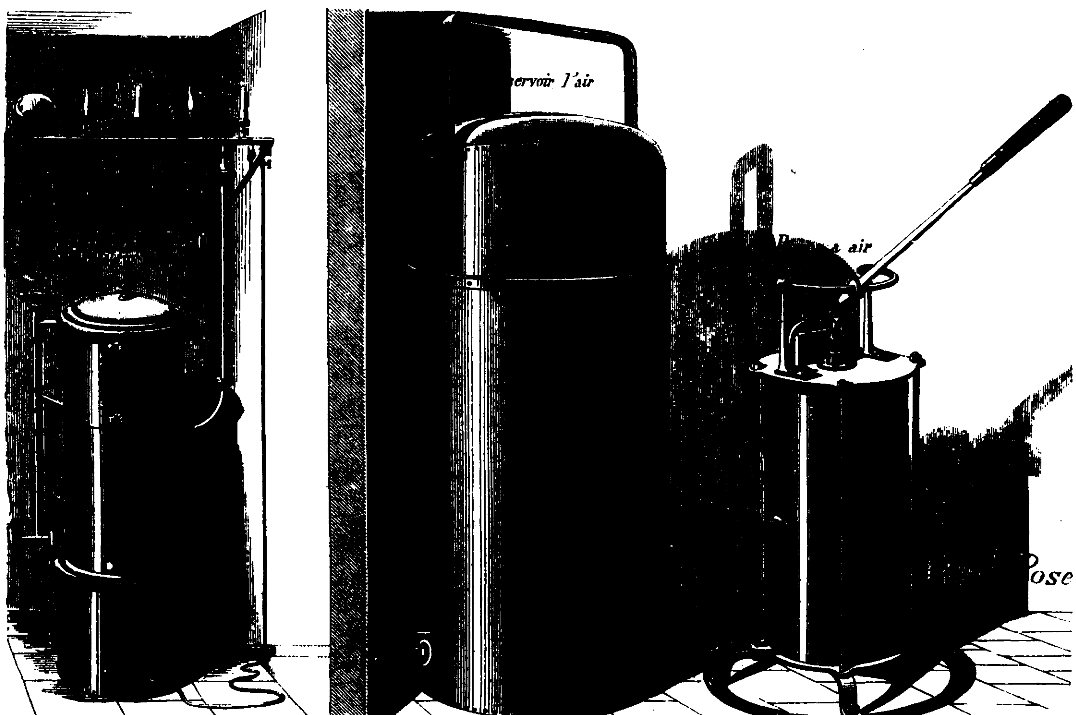


BORING THE TRUNNION COIL.

THE 81-TON GUN.

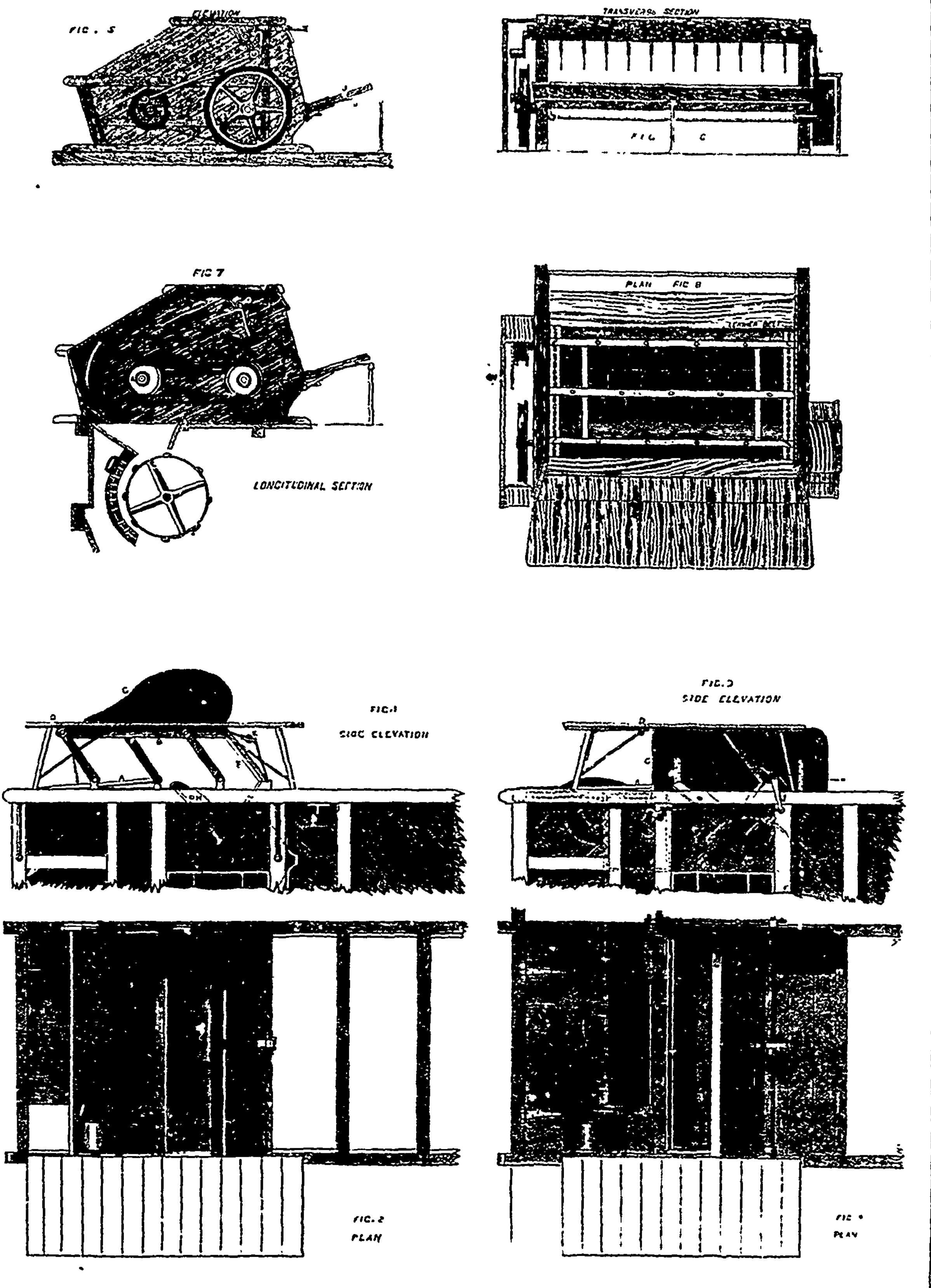
The 81-ton gun when completed, will consist of an inner tube of firths steel weighing 16½ tons as a forging, and measuring 24 feet, 7 inches in length, and 5 inches in thickness, except at the breech end, where it is greater, and the muzzle where it is less. It will have a bore 24 feet in length, and a primary calibre of 14 inches. This calibre will ultimately be increased to 16 inches, but the gun will first undergo a series of trials with the 14-inch bore. It will then be bored out to 15 inches: will be again experimented with and subsequently bored out to the final calibre of 16 inches, thus giving the steel tube a mean thickness of 4 in. It will be rifled with 12 grooves, 2 inches deep and 1.5 inches wide with an increasing twist. The gun is composed of seven pieces, namely: five wrought-iron coils, the steel tube, and the cascabel.

See page 303 for further description.



APPARATUS FOR PRODUCING GAS INSTANTANEOUSLY.

THRASHING MACHINE DRUM GUARDS AND FEEDERS—TAUNTON SHOW, ENGLAND.



TAUNTON SHOW.—DRUM GUARDS AND PROTECTORS.

We conclude our illustrations of Thrashing Machine Drum Guards exhibited at the Taunton Show, England. Figs 1 and 2 show Messrs. Marshall's drum protector. It consists of a platform D D, fixed at a convenient elevation over the drum, and within reach of the feeder, to which is connected, by a spring or catch action E, a protecting board F, a handrail B C, surrounding the feeder; the former is hinged to one edge of the drum mouth, and also connected to the handrail; in ordinary working the drum mouth has a clear opening for the grain, which falls down the incline M, but should any of the attendants fall against the platform, or the handrail, or the feeder wish to leave the feeding box, the spring or catch action is released by his pressing his hands on the handrails B, when the protecting board falls over the drum mouth, effectually blocking the entrance thereto. In addition to the above, a lower platform or cover of boards round the feed box marked A is also attached to the hand-rail, so that the feeder, in stepping out of the box, places his feet on the platform or cover which presses it down, pulling with it the handrail—the cover being connected thereto—and thus closes the drum mouth. D is arranged to be fixed on either side or end of handrail. G is a light guard which can be moved on either side to protect the drum mouth on the opposite side to which the grain is being passed to the feeder. N, is the thrashing drum O, the concave.

Figs 3 and 4 show a second drum protector, No. 2, exhibited by the same firm.

This is similar to the first in its action as regards closing the drum mouth, but instead of the handrail, it is provided with a pair of bellcranks I, working on fixed studs, one on each side of a main frame, connected by a rod or wire, to a lever J on each side of a spindle K, which turns in the brackets X; on the centre of this spindle is secured a double-ended lever I, on the one end is a catch which lays hold of another catch on the protecting board F, the other and takes a spring; when in action the spring causes the lever L to sustain the protecting board F in the position shown in full lines, and also the platform A which surrounds the feeder, by means of the rods and bellcranks; but should anyone fall on the platform D, or the protecting board F, or the feeder press down the platform A by stepping out of the feeding box, the catch lever L releases the protecting board F, instantly closing the drum mouth, as shown in dotted lines. G is a light guard board placed at opposite side from the platform D.

The apparatus consists of a boarded platform T, on the upper surface of which a number of wood cross bars B travel towards the drum, motion is imparted to these through an endless belt working over suitable pulleys A; at a convenient distance over the cross bars a series of prongs H are introduced, to these an oscillating motion is imparted through the shaft F, crank C, and pulley E; an arrangement is also applied for raising and lowering the shaft F, by means of a lever and apparatus marked V and U, for regulating the feed. Fast and loose driving pulleys are used marked C, which receive motion from the shaker shaft. L is a hand lever for throwing the apparatus out of gear. J is a hinged receiving board, which is supported on a spring J1, and arranged to give way and throw the apparatus out of gear in case anyone falls upon it.

Figs. 5, 6, 7, and 8 illustrate the self-feeder which received the prize.—(*See page* 305.)

PRIMING OF CANVAS FOR OIL PAINTING. — Stretch good durable canvas on a frame or stretcher to keep it without creases. Then take the best white lead (without dryers) and mix to a proper consistency with raw linseed oil, and give the canvas a coat and allow it to dry hard before giving it another, which will take two or three days. Let the second coat be more round to fill up pores. Give three coats, rub well down with sand paper between each coat. Size or glue is objectionable, as either causes the paint to peel off and crack Dryers strike through and cause the ground and other colours to change. Tint the ground to your own taste.

PERPETUAL INK FOR TOMBSTONES, ETC. — Pitch, 11 lbs.; lamp-black, 1 lb.; turpentine sufficient; mix with heat.

THE HISTORY OF PAPER-HANGINGS.

Block Paper-Hangings.—In the manufacture of block printed paper-hangings, the first process is that of preparing the grounds to the required tint. This was formerly done upon a table, 12 yds. long, by means of two circular brushes filled with colour, to which a revolving motion was given by the workman, so that an even coating of colour was laid over the paper. A machine is now generally used for the purpose, and the work is executed with much greater rapidity. Satin papers are grounded in a similar manner, but with a preparation of lime potash, alum, called *potash-alum*, and when dry, polished by means of revolving brushes, and powdered French chalk, —steatite. The artistical talent that at the end of the last century was expended on finishing and filling up the details of a pattern by hand, is now devoted to the production of an elaborate drawing of the design, the various parts of which have to be cut on wooden blocks for printing These are usually carved in pear-tree wood, and each shade or colour is represented by a single block. The design is first traced on the surface, and then the block-cutter cuts out the intervening spaces, and where very few lines are required, pieces of brass are inserted. The back of the block is crossed with woodwork in contrary directions, so as to prevent warping, and the breadth is always 21 in., while the length is a little more or less, according to that of the design. In printing, each block as required in succession to form the complete design, is supplied with colour by dipping it into a shallow trough, across the bottom of which is stretched a cloth, floating upon water or some viscid fluid, the upper surface being continually coated with colour by a boy. The workman then places the block gently on the paper in the requisite position, exactness being ensured by brass pins in the corners, and pressure being applied by means of an upright lever above the printing-table, acting on the block through the intervention of a bridge-shaped piece of wood, after which the paper is drawn off by the attendant. When the required number of colours have been applied the design is complete, the paper is dried and rolled up. Flock and gold paper-hangings are made by printing certain portions, as the whole of the design, with gold-size. The flock is simply thrown over the moist gold-size and adheres to the part that has been printed; and the gold or bronze powder is dusted over the paper, and in like manner becomes fixed on the sized parts. Sometimes powdered leaf is used; and when it is, it presents a dull appearance until drawn through a calendering machine, which burnishes it. Many gold and other paper-hangings are embossed by being drawn between a brass cylinder, with a minute design engraved upon it, and a paper roller, by means of which various waved lines in imitation of leather and silk are produced. A variety known as stamped gold paper-hangings is the result of a more tedious process with leaf gold, — Dutch metal. The paper is prepared with dry gum-size, and gilt-leaves laid over the parts of the design that are to be gilded. The paper is then stamped under a number of heated metal dies in a machine for the purpose, and a very brilliant effect is produced. All the paper-hangings previously described were made by means of blocks with hand labour, and to the year 1850, they were the only kind that were used, excepting for the most common purposes.

Machine Paper-Hangings.—the importance of some method of producing paper-hangings by machinery seems to have occupied the thoughts of several persons over a period of one hundred years. In 1764, Thomas Fryer and others obtained a patent for "A machine of a new construction, and in mixing and adapting colours to the use of the said machine for printing, staining, and colouring of silks, stuffs, linens, cottons, leather and paper." The patentee used engraved copper cylinders and colour rollers. This appears to be the earliest attempt at calico printing by machinery. The next patent was granted to Jacob Bunnett in 1786, for "A machine for the printing of Paper-Hangings, calicoes, cottons, and linen in general, whereby any number of colours may be printed thereon at one and the same time; and whereby ten times as many pieces may be printed in as short a space of time as one piece is now printed by the common method." The printing cylinders were to be of wood, metal or other material, and the paper introduced into the machine in a roll. Whether paper-hangings were printed by this machine is very doubtful; it was evidently the intention of the patentee, but it is more likely to have been used for calico printing. In 1816, Edward Cooper, obtained a patent for "A method of printing paper-hangings and other purposes." This was by means of a kind of printing press which produced pictures at regular distances from each other, but nothing like a continuous pattern. In 1823, he took out another patent for a machine which seems more especially intended for printing calico. In the same year William Palmer obtained a patent for printing paper-hangings by a machine, which elevated and depressed a stationary block, and supplied it with colour on the under-surface. The machine was worked by means of a handle, which regulated a lever, but as nothing further is known of this invention it may be safely pronounced to have been a failure. There were improvements in machinery for printing calico, paper-hangings, &c., patented by James Hudson in 1834, and John Buchanan in 1835; but it does not appear that up to this date any successful attempts has been made to print paper-hangings. There were, however, at this period machines of a very simple construction used by paper-stainers, though they were by no means generally known. They printed only one colour, which was supplied by a colour-roller in the usual manner, and the machine was turned by a handle In 1839, Archer and Taverner had a patent machine, which supplied colour and painted by means of an ordinary block with great exactness. It was worked by means of a handle turned by a boy, but it was found too cumbersome to move. Hand-machines with a roller-block, and supplied with colour by a roller for the purpose were in use in York and Dublin so late as 1850, but they have now all been long discarded, though they form interesting links between hand labour and the successful application of mechanical skill aided by steam power. There were besides these machines for printing a pattern upon the paper, others which produced particular kinds of paper-hangings such as oak. A machine for making plain striped patterns was brought into use about 1820, and one for producing pin-marked grounds, by means of a cylinder with holes perforated through it which formed the required design, was first used about 1835. About the same time rainbow grounds were introduced, and though in fashion for a period are now almost forgotten. The firm of Evans & Fisher of Tamworth, seems to have been the first to produce any paper-hangings of marketable value. These manufacturers were not originally paper-stainers, but paper-makers, and their motive seems to have been to increase the sale of their paper by converting it into paper-hangings, and so far their efforts must have succeeded. They commenced to print in 1837, and continued to do so for about twenty years when the printing was continued, and the manufacture limited to plain paper. Very little improvement was effected by this firm during the interval, but it is easily accounted for, as Mr. Fisher, who had become the only representative of the concern, stated that he had relinquished the business entirely in consequence of the restrictions placed upon him by the Excise. Mr. Fisher's designs were formed almost entirely of lines, without any width of colour, and resembled the mere outlines of patterns, somewhat like wire-work, without any recommendation except cheapness. This peculiarity was the result of printing in the mill, where the paper itself was manufactured; for duty had to be paid on the colour that was used, as well as upon the paper, and consequently only such patterns could be produced as required very little. The paper was taxed by weight as it left the mill, and the only alternative was either to build paper staining works, at least a mile from the place where the paper was made, or to give up the business, — the latter course was decided on. It is well known that William Troutbeck, of Liverpool, claimed to be the first to print paper-hangings by a calico-printing machine. He certainly did so in 1838,—perhaps before,—and printed a considerable quantity of paper with a machine which had two rollers and a cylinder, which latter he did not use. Shortly after he had a machine for printing four colours. Immediately after, or perhaps simultaneously with the manufacture at Tamworth, C. H. & E Potter, of Darwen, in 1837, directed their attention to the practicability of printing or staining paper-hangings by machinery They were calico-printers and not paper-stainers, and had everything to learn. Although they had the calico-printing machine, which seems to have been patented for paper as well as for calico, there were many difficulties encountered, and it was not until much time and trouble had been expended, that some measure of success rewarded their efforts. The process of calico-printing, whether by hand blocks or by the machine, is very similar to the printing of paper-hangings, and the machine used is the same with some minor adaptations In calico printing by machinery engraved metal cylinders, as well as wooden surface rollers are used, though the work is for the most part performed by the former. It was found that the use of the surface rollers, with the pattern raised upon them in copper, alone promised a successful result. Many alterations and improvements were made during several following years, though machine paper-hangings were very indifferent productions. and could only be used for most ordinary purposes. The difficulty seems to have been to lay on a sufficient body of colour, to produce a solid and uniform effect over the pattern. In 1846 a patent was obtained by Harold Potter, and was intended to insure a more regular supply of colour. He was one of the originators of the firm that has greatly improved, and done much to bring the manufacture of machine paper-hangings to its present advanced condition. Since Messrs. Potter many others have entered the field in various parts of the country, and the trade has become a very important branch of industry.

Manufacture of Machine Paper-Hangings.— The first process in machine-printing is preparing the ground of the pattern to the colour or shade required. This is done by passing the paper through a machine which spreads over it an equal coating of colour, by means of a series of brushes moving transversely. As the paper comes off the machine it is quickly dried, by being drawn through a hot-air chamber. All the paper is treated in this manner, except the very lowest qualities, in which case it receives the required tint during the process of manufacture. The paper for satin grounds is prepared in a similar manner to that used for block papers, and polished afterwards by means of revolving brushes with French chalk The printing-machine contains a varying number of rollers or blocks, constructed of wood with a metal axle, and they print the pattern upon the paper. Great care and exactness are required in the preparation of these rollers, and a separate one is required for each colour. The design having been traced upon them, it is raised on the surface by driving slips of copper into the wood, and filling up with *felt* the portions which are to make the impression In some patterns as many as twenty colours are used, requiring as many separate rollers. To print a flower, for example, several blocks are required, and in a design embracing various light shades and deep colors, each shade and colour requires a corresponding roller. By changing the colours very different effects may be produced and various qualities of the same pattern are produced with the same set of rollers. Of course, every new pattern requires a fresh set of rollers, and a large sum is frequently expended in producing a novel design The rollers or blocks are arranged in a circular form around the machine, which is about 10 ft. in height. Each roller having been supplied with its proper colour from a corresponding trough, the paper is taken up by the machine in a continuous web, or at least in pieces from 5,800 to 6,000 yards in length The rollers press the paper against a large central cylinder, and as it moves along it receives the various colours in succession, and comes out with the design fully developed Many of the colours are printed one on the other, but blending is prevented by the use of several varieties of size. There are machines for printing different numbers of colours; one with two rollers prints about 500 pieces in an hour according to the pattern; one with twelve rollers about 200 pieces; and one with twenty rollers about 100 pieces in an hour. A machine with two rollers produces the printed paper at the rate of four miles an hour; and one with twelve rollers at about half the speed. Plain paper is produced from pulp at the rate of one mile an hour The printed paper is marked off in 12 yard lengths during the process of printing, and on leaving the machine it is dried by means of hot air. The rolling-up of the paper is also effected by machinery

Although machine paper-hangings have been wonderfully improved during the last twenty years, there is still a wide difference between them and those printed by hand-blocks They are printed upon thinner paper, with less colour on the prepared ground and in the formation of the design. Machine paper-hangings are, upon the average, about a third, and those in general use about half the price of those printed by hand-labour. About 25-15ths of the paper-hangings sold are produced by machinery They have provided the cheapest possible means of giving a clean and cheerful aspect to all kinds of rooms, and are used by all classes of the community.

Fig. 4.—The Dive.

Fig. 5.—The Header.

Fig. 7.—Treading the Water.

Fig. 6 — Floating.

SWIMMING.

HOLIDAY PASTIMES.

Swimming.

(Concluded.)

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 first 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 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 shown 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 afterwards 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.)

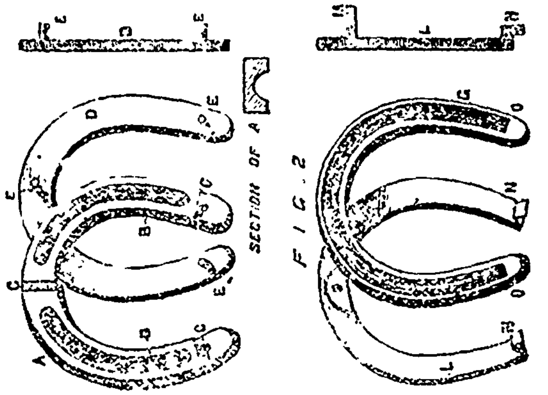
Much the same position as this is maintained when *standing* in the water—or, as it is termed by some, *perpendicular-floating*—only that the head is thrown back, with the nostrils elevated in the air, while the arms are either folded across the chest, which is arched well forward, or kept down close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

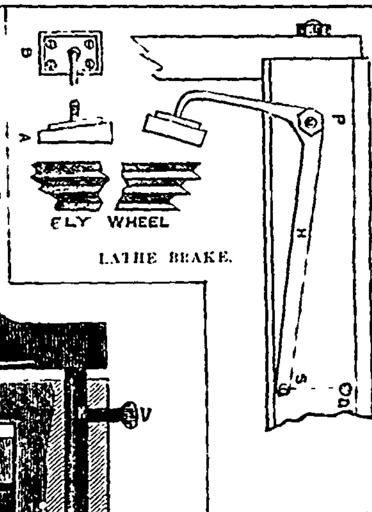
We must say a few words respecting *cramp*, and on this point we cannot do better than repeat Walker's instructions on the subject:—"Those chiefly are liable to it who plunge into the water when they are heated, who remain in it till they are benumbed with cold, or who exhaust themselves with violent exercise. Persons subject to this affection must be careful 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 the front, but take 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 help 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.

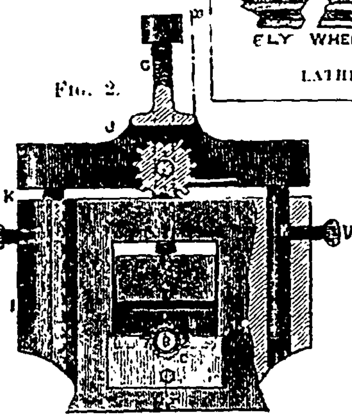
Shifting Barrels.—Presuming the entrance to the cellar for heavy goods will be from the outside, a simple plan will effect the purpose desired, though perhaps somewhat expensive in the outlay. It may certainly be reduced if the situation of fixtures on the premises will allow. For instance, the winding-up apparatus may be placed between two posts driven securely into the ground, and a stay across the top. The cradle should be made of oak or ash, and its bottom plated with iron, and several iron angle-plates along at *a*. A roller of wood should be placed under cradle at *d*, to give an easy start, *c*, steps to the cellar. I have not added front view of cradle, deeming it unnecessary. The thing (I hope) explains itself, merely adding, by way of caution, to lash the barrel to the cradle, and to tip it on its end at bottom of cellar to unload it.—*See page* 312.



IMPROVED HORSE SHOES.



LATHE BRAKE.



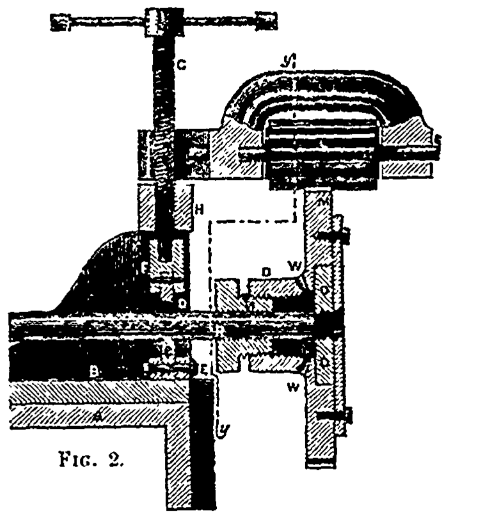


Fig. 2.

APPARATUS FOR CUTTING SCREW THREADS.

AN IMPROVED HORSESHOE.

The annexed engraving illustrate two forms of Winder's Patent Elastic Horseshoe. Fig. 1 represents the shoe for heavy horses, A being the underside of the part of the shoe that is nailed to the hoof. B is a hollow channel in the shoe as a seating for the indiarubber, C are flat faces with holes drilled in the centre, which have also dovetailed key ways, into which keys are driven to retain the wearing-plate in position. D is the flat steel plate which bears on the ground and forms the wearing surface, and is held in place as mentioned by means of the pins E and the dovetailed keys. It will be seen that the horse by means of these shoes is mounted on an elastic base, and although the elasticity of the rubber is but slight, it is found to be sufficient to prevent any of those injurious effects which result from the continual stamping of the rigidly-fixed shoe on a hard roadway. Fig. 2 shows the construction of shoe best adapted for lighter horses—*i.e.*, for horses which have to travel at a more or less rapid rate, and which naturally require a more elastic shoe than heavy horses, which rarely travel faster than a walk Here G represents the under side of that part of the shoe which is nailed to the hoof, one-half of the channel being filled with the india-rubber. L is the upper side of the wearing plate, provided with a lug, M (lettered in the section), on the inside of the front part of the plate L, which, aided by the lugs N, secure the wearing-plate to the stock of the shoe affixed to the hoof. The lug M has an oval hole to allow a little play on the pin fixed in G. The solid ends O are undercut to enable the lugs N to work freely. Besides the principal advantage claimed for these shoes—viz., the elasticity—the facility with which the wearing plates can be replaced is considered to be of no little importance, as new plates can be fitted on by the groom or coachman in a few minutes, and the horse need only visit the farrier when the shoe-stock, in consequence of the growth of the hoof, requires re-setting. Many shoes for horses are in, the market at the present time; but the above seems to possess the greatest number of advantages, combining the elasticity of rubber with the durability of steel.

APPARATUS FOR CUTTING SCREW THREADS.

An improved apparatus for cutting screw threads on gas-pipes and tubes of all kinds, as well as on rods, bolts, and similar articles, has been recently patented in this country on behalf of the inventor, Mr. N. W. Frost, of Cohoes, Albany Co., New York Fig. 1 represents a vertical section of the apparatus taken on the line *x x* of Fig. 2, and the latter figure is a representation of a section of Fig. 1 taken on the line *y y*. Corresponding parts are represented by the same letters.

A is the bed-plate by which the machine is fastened to a bench or other fixture; B is the vice-plate which is made adjustable on the bed A; C and D are jaws of the vice. The lower jaw is stationary, and is made in two parts connected together by the bolt E (see Fig. 1). The upper jaw D is fastened to the sliding block F, which is attached to the vice-screw G; this jaw D works down between the two parts of the jaw C. Each of the jaws has a **V**-shaped opening, the sides of the **V** being serrated, so as to effectually hold the tube within the angular opening and keep it from turning. The vice-screw G works through the crop bar H of the vice-plate. On each side of the vice-plate is a socket I; J is an arm or brace which is provided with two pins or bars K These bars enter the sockets I and support the arm in a horizontal position, as soon in Fig. 1; L is a pinion; M is the die-wheel; N is the feed-screw; O are the dies which are made fast in the face of the wheel M. The hub P of the die-wheel works on the stationary fed-screw N as the die-wheel is turned, and draws the die O on to the tube and cuts the thread, R is the tube. The die-wheel is a cog-wheel with which the pinion L engages; S is the pinion shaft to which is attached the crank by means of which the pinion is revolved.

Instead of a crank, fast and loose pulleys may be placed on the pinion shaft for the employment of other motive power, as steam or water. The pinion is made long to allow the die-wheel to move as the die works on the tube The tube is held stationary in the jaws of the vice and the feed-block, and screw N is held stationary on the tube by a set screw. The arm or brace J which carries the pinion L is raised and lowered as may be desired, and is held in position by the set screws V V. This adjustment adapts the machine for cutting screw threads on different sized tubes; W represents holes in the hub of the die-wheel for the discharge of the chips made by the dies. A cutter for cutting off the tubes may be attached to the machine in any suitable manner.

The machine is portable, and may be used to great advantage by gasfitters and plumbers in fitting gas and waterpipes to dwellings and buildings when the pipes have to be cut to suit the various apartments. It may also be used for cutting bolts or long screw rods of various sizes with equal facility. With the addition of the proper feed-screw on the feed-block (which is put on and taken off at pleasure) left-hand screws may be cut thereon the same as right-hand screws.

PRACTICAL MECHANISM.

HAND TURNING—BRASS WORK.

For roughing out brass work, the best and most universally applicable tool is that shown in Fig. 99, which is to brass work what the graver is to wrought iron or steel. The cutting point A, is round nosed. The hand rest should be set a little above the horizontal centre of the work, and need not be close up to the work, because comparatively little power is required to cut brass and other soft metals, and therefore complete control can be had over the tool, even though its point of contact with the rest be some little distance from its cutting point. The best method of holding and guiding is to place the forefingers of the left hand under the jaw of the hand rest, and to press the tool firmly to the face of the rest by the thumb, regulating the height so that the cutting is performed at or a little below the horizontal centre of the work. The tool point may thus be guided with comparative ease to turn parallel, taper or round or hollow curves, or any other desirable shape, except it be a square corner. Nor will it require much moving upon the face of the lathe rest, because its point of contact, being somewhat removed from the rest, gives to the tool point a comparatively wide range of movement. The exact requisite distance for the rest to be from the work must, in each case, be determined by the depth of the cut and the degree of hardness of the metal; but as a general rule, it should be as distant as is compatible with a thorough control of the tool. The cutting end of this tool should be tempered to a light straw colour.

SCRAPERS.

To finish brass work, various shaped tools termed scrapers are employed. The term scraper, however, applied as much to the manner in which the tool is applied to the work as to its shape, since the same tool may, without alteration, be employed either as a scraping or cutting tool, according to the angle of the top face (that is, the face which meets the shavings or cuttings) to a line drawn from the point of contact of the tool with the work to the centre line of the work, and altogether irrespective of the angles of the two faces of the tool whose junction forms the cutting edge. To give, then, the degree of angle necessary to a cutting tool, irrespective of the position in which it is held, is altogether valueless, as will be perceived by considering the following illustrations (Fig. 100) A, being in each case a piece of work, and B, a tool. The tool edge, as applied in No. 1, will act as a scraper, whereas in No. 2 it will act as a cutting tool.

Now let us take a tool applied to flat surfaces, as in Fig 101, A, representing a piece of flat metal. The tool, if applied as shown in B, would present a cutting edge, and as shown at C, a scraping edge to the work, the tool being the same in both cases. The result of attempting to present the cutting edge, as at B, is that it would jar in consequence of the spring of the tool.

The angle of the back or side face of any tool (that is, the face A, in Fig. 102), either to the top face B, or to the work, does not in any case determine its tendency to cut or scrape but merely affects its capability of withstanding the strain and wear due to severing the metal which its cuts. Nor is there any definite angle at which the top face B, to the work converts the edge from a cutting to a scraping one. A general idea may, however, be obtained by reference to Fig 103, the line A, being in each case one drawn from the centre of the work to the point of contact between the tool edge and the work C, being the work, and B, the tool. It will be observed that the angle of the top face of the tool varies in each case with the line A. In position 1, the tool is a cutting one; in 2, it is a scraper, in 3, it is a tool which is a cutter and scraper combined, since it will actually perform both functions at one and the same time; and in 4, it is a good cutting tool, the shapes and angles of the tools being the same in each case Fig. 104 represents a flat scraper for finishing brass A, being in each case the cutting edge. Since the tool may be turned upside down, the end of this tool may be, and frequently is, ground at an angle, especially in those cases where, for some required purpose, the tool is made of a particular shape—such for instance, as in the case of the tool shown in Fig. 105, the angle being shown at A. On all brass work, it is, however, better to dispense with any angle. Fig. 106, represents a scraper (A, being the cutting edge) designed for operating close down to the lathe centre or in a square corner such as is formed at the junction of a head or collar upon a shaft or bolt. This tool may also be turned upside down, so as to form a right or left hand tool.

Scrapers will cut more freely if applied to the work with the edges as left by the grindstone; but if they are smoothed, after grinding, by the application of an oilstone, they will give to the work a much smoother and higher degree of finish. They should be hardened right out for use on cast iron, and tempered to a straw colour for brass work. If the scraper jars or chatters, as it will sometimes, by reason of its having an excess of angle, as shown in Fig 105, or from the cutting end being ground too thin, a piece of leather, placed between the tool and the face of the rest, will obviate the difficulty.

Round or hollow curves may be finished truly and smoothly by simply scraping, but parts that are parallel or straight upon their outer surfaces should subsequent to the scraping, be lightly filed with a smooth file, the lathe running at a very high speed to prevent the file from cutting the work out of true. The file should, however, be kept clean of the cuttings by either using a file card or cleaner, or by brushing the hand back and forth on the file, and the striking the latter lightly upon a block of wood or a piece of lead, the latter operation being much more rapid, and sufficiently effective for all save the very finest of work. If the filings are not cleaned from the file, they are apt to get locked in the file teeth and to cut scratches in the work. To prevent this, the file may be rubbed with chalk after every eight or ten strokes, and then cleaned as described. After filing the work, it may be polished with emery paper or emery cloth. The finer the paper and the more worn it is, the better and finer will be the finish it will give to the work; for all metals polish best by being rubbed at a high speed with a thin 'm composed of fine particles of their own nature, as ivory is best polished by ivory powder, and wood by shavings cut from itself. To facilitate the obtaining the film of metal upon the emery paper, the latter may be oiled, to a very slight extent, by rubbing a greasy rag over it, which will cause the particles it at first cuts to adhere to its surface. Emery cloth is the best for highly finishing purposes, because it will wear longer without becoming torn. It should be pressed hard against the work, and reversed in all directions upon it, so as to wear all parts of its surface equally, and to distribute the metal film all over; and the work should be revolved at as high a speed as possible, while the emery cloth is, during the first part of the polishing, kept in rapid motion upon the work backward and forward, so that the marks made upon the work by the emery cloth will cross and recross each other When fine finishing is to be performed, the emery cloth (or, what is better, crocus cloth) should be pressed very lightly against the work and moved laterally very slowly.

Round or hollow corners, or side faces of flanges, of either wrought or cast iron or brass may be polished with grain emery and oil, applied to the work on the end of a piece of soft wood, the operation being as follows: The end of the wood to which the oil and emery is to be applied should be disintegrated by being bruised with a hammer; this will permit the oil and emery to enter into and be detained in the wood instead of passing away at the sides, as it otherwise would do, thus saving a large proportionate amount of material. The wood, being bruised, will also conform itself much more readily to the shape of curves, grooves, or corners. The hand rest is then placed a short distance from the work, and the piece of wood rests upon it, using it as a fulcrum. The end of the wood should bear upon the work below the horizontal level of the centre of the latter, so that depressing the end of the wood held in the hand employs it as a lever, placing considerable pressure against the work, and the distance of the rest from the work allows the end of the piece of wood to have a reasonable range of lateral movement, without being moved upon the face of the lathe rest. The method of using the wood is the same as that employed in using emery cloth, except that it must, during the earlier stage of its application, be kept in very continuous lateral movement, or the grain emery will lodge in any small hollow specks which may exist in the metal, and hence cut small grooves in the work. Another exception is that the finishing must be performed with only such emery as may be embedded in the wood, and without the application of any oil: especially are these directions necessary for cast iron or brass work The work may then be wiped dry, and an extra polish imparted to it by the application of fine or worn and glazed emery cloth, moved slowly over its surfaces.—*English Mechanic.*

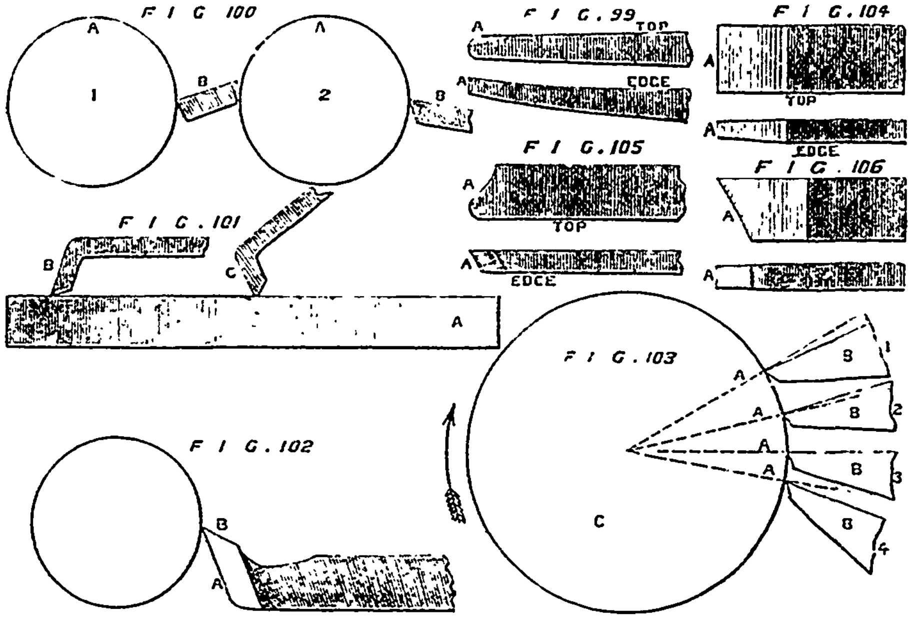
LATHE BRAKE.

Perhaps the accompanying sketch of a brake for the fly-wheel of the lathe may prove useful to some, in connection with cutting screws by cords and pulleys or other makeshift means. It was arranged to meet the double purpose of avoiding the difficulty of checking the fly-wheel by hand when cutting a screw at the end of a long piece of work, and also to lock the train of pulleys when disconnecting the slide rest in order to move the tool forward for its fresh cut. Nothing can answer these purposes more conveniently or effectually, and it is also a great luxury in ordinary practice, as a substitute for the knee or foot in brakeing the fly-wheel while chucking or gauging the work. The addition is amply worth the small cost and trouble of its construction, if only for this purpose.

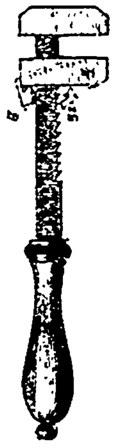
The drawing shows the brace pivoted to the lathe bearer at P. The handle H, is purposely shortened in the sketch to save waste of space in these columns. It should be made long enough to be within convenient reach of the left hand when the turner is working at the extreme right. A stout washer, about ½ in. thick, should be first slipped on to the pivot in order to set out the handle so far from the lathe-bearer that it may be caught comfortably by the fingers wherever the turner is standing. But the end of the handle must be bent in to touch the bearer with sufficient spring to force the short steel pin, inserted at S, into the hole drilled at D, when the handle is raised. B, is the back view of the plate carrying the wooden clog, A is a plan view of the same part, showing that the plate is not to be quite parallel with the fly-wheel, but slightly skewed, so that the clog may be wedge-shaped, which facilitates first fitting and future adjustment. The brake may be made of oval-shaped iron It should be puched (not drilled) for the pivot, so as not to weaken the elbow, and the short arm carrying the plate should be drawn down sufficiently to give a little spring.

Vice for Holding Spokes when Shaping them. — B. (Fig. 1) is a block of wood about 4 in. square and 1 ft. long; A, an iron bolt with a clump at the end, in one of the jaw of which is tapped a screw with a foot working on the end of corresponding size to the other jaw, and the spoke D, may be inserted between as shown. F, (Fig. 2) shows the end of bolt squared to take collar so as to prevent the nut from shifting when the jaws are turning. Fix the block in an ordinary vice.

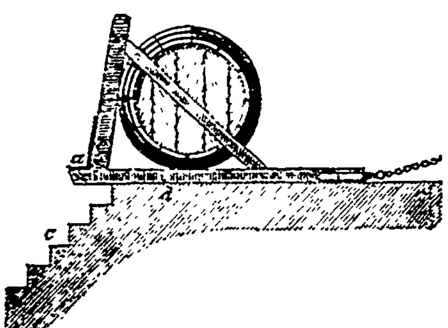
Self-Adjusting Wrench — We supply a sketch of a self-adjusting wrench just patented by Mr. M Macleod, Manchester. The moveable jaw Z being so formed, that a spring at Z1 forces the ratchet piece Z2, into the teeth of the stock, but when it is desired to move jaw it is raised as indicated by dotted lines, so as to compress the spring and allow the ratchet piece, Z2, to pass freely over the teeth. When the jaw is liberated the spring, Z1, again sets the ratchet piece into the teeth. This has proved to be a very handy tool.



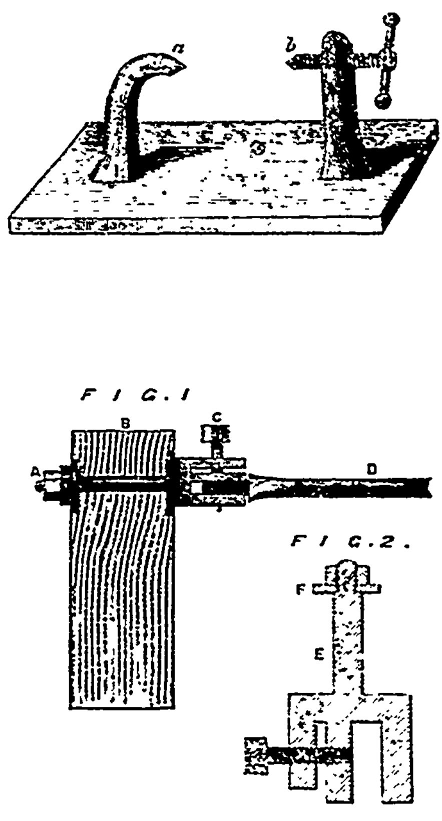
HARD TURNING TOOLS.—BRASS WORK.
(See page 310.)



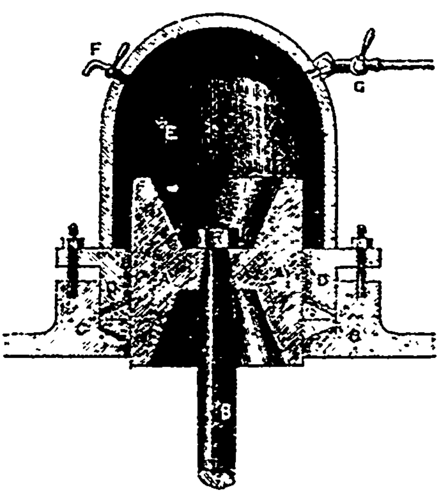
SELF ADJUSTING WRENCH.— (See page 311.)



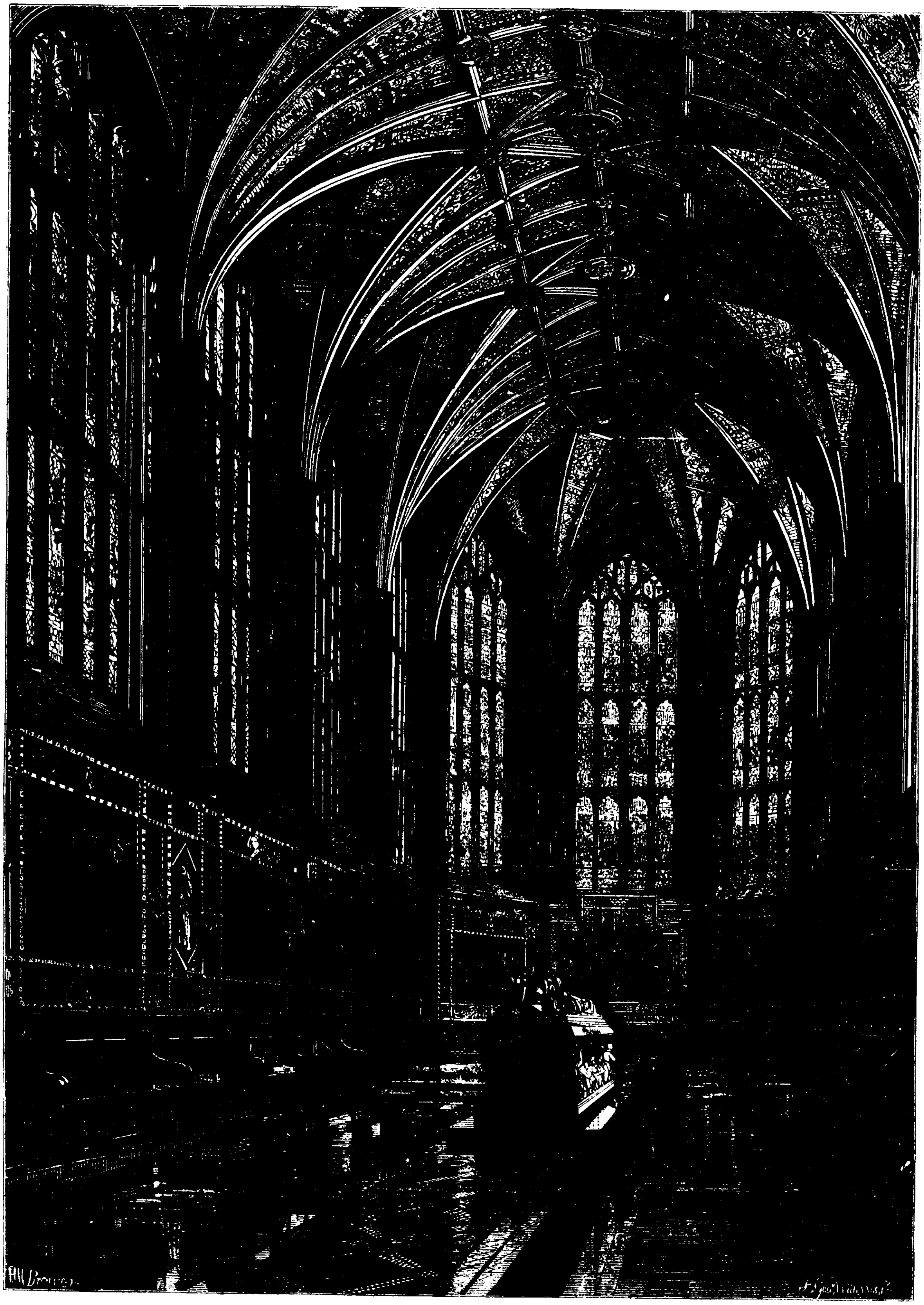
SHIFTING BARRELS.— (See page 309.)



VICES FOR HOLDING SPOKES.— (See page 311.)



SLIDE VALVES. (See page 315.)



THE ALBERT MEMORIAL CHAPEL, WINDSOR CASTLE.

LECTURE TO LITTLE FOLK.

MY DEAR BOYS,—

Things which we see every day, and wonders which are close to us we are too apt to overlook, but if you will give me your attention for a short space of time you will begin to find out many extraordinary powers in objects with which you have seemed already familiar.

Let us take for example Air, probably many of you up to the present moment have never given so apparently a common thing as the air we breathe a thought, and yet without it for a few minutes and we cease to live. When people are drowned what causes then death? because the water prevented the air being breathed, that is to say the air could not get into the lungs, which is our breathing apparatus within the chest, and they suffocated. The same thing happens when persons are smothered But although we die under water-fishes live; and yet air is as necessary to fishes as to us. If any one was to put water from which the air had been expelled by heat into a glass globe where small gold fishes swim so happily, and then cover over the top so as to perfectly exclude the air, the poor fishes would soon become distressed and then die, but I hope none of you will ever be so cruel as to test this experiment. Everything made by God is fitted for its own element, and though our lungs cannot breathe in water, fishes are provided with gills which enable them to do so. I suppose you think the air which you draw into your chest goes out in the same state, but that is not the case. When you breathe it out again it has become poisonous to you and to all animals. A very cruel ruler in India, whose feelings had made him brutal, once proved this in a dreadful way, by shutting up a crowd of English prisoners in a kind of cellar or dungeon, to which there was but a small opening to admit fresh air. It was called the Black Hole, of Calcutta. During the night almost all of these poor prisoners were poisoned by their own breath and died a most frightful death. This was a very horrible thing and will perhaps appear strange to you till you understand it, but give me your attention a little longer and I will explain.

The air, through which I wave my hand and which agitates the particles of dust you see floating in the sun-beam which enters your window and makes the leaves upon the trees in summer dance as it rushes by—the air which drives the ship, which flies your kite—this air without which the birds could not sing or the organ & bells peel forth on sunday, the air without which you could hear no sound, this transparent air which makes the sky or blue, the leaves so green, which holds up the clouds, and allows the feathery snow to fall so gently, this air is a mixture of two airs, or gases of very different characters. This I now intend to tell you how to find out, and how to prove that the air you take into your chest goes out in a poisonous state. I shall leave you to make these experiments because they will be more instructive than if I make them for you and will be retained longer in your memory. To show that the air will not support life after being breathed repeatedly, it is not necessary for us to put an animal cruelly to death; we can prove it without making any poor creature suffer. The same process which goes on in a lamp or fire goes on in your body, and keeps you warm. In breathing a very small portion of your body is consumed, as the candle is, and that heat is produced which keeps you warm.

When you run and jump a great deal you breathe faster, and there is more heat produced in your lungs, and this heat which is increased by exertion, is diffused all over your body, by the blood, which courses, like hot-water through all the pipes provided for it. Remember then that what you see going on so fiercely in a lamp or fire, is also going on, but very slowly, in your lungs. In place of a breathing animal, we can therefore use a lamp because they are much alike in this respect If we find that a lamp burns dimly or goes out in air which has been repeatedly breathed, than that air is not fit to support animal life, hence it is a very unhealthy custom to burn lamp in a sick chamber, a gas-burner consumes as much air as eleven men would do, that is, one gas burner in three quarters of an hour consumes as much air as would answer a man for a whole night.

Now for an experiment. Take a piece of sperm candle (tallow will also answer) about one inch long and place it upright in the middle of a saucer, and after lighting it, cover it over with a clean glass tumbler (which should be first warmed to prevent it from cracking from too sudden heat) and then wait the result. You will see the candle in a minute or two, burn very dull, flicker and then go out. The reason why it will not burn is because it has converted the good air into a kind of gas, which will not support life or fire. That part of the air which was necessary to the burning of the taper has been exhausted, and another kind of gas, called *carbonic acid* has been formed. To prove this I will describe another experiment with the tumbler and saucer.

Having lifted the saucer from the table with the left hand, steady the tumbler by placing your right hand upon it, and then turn the whole apparatus upside down, so that the saucer may bear the top of the tumbler glass. The glass must then be placed upon the table. Take another bit of candle, and having fastened it upon the end of a piece of crooked wire, let it be lighted, and at the same time let the saucer be slowly slided off side-ways from the top of the tumbler, it will immediately extinguish the flame. The experiment may be repeated several times. This proves that the air is poisonous, because that which extinguishes flame, if taken into the organs of breathing, the lungs, is fatal to animal life. The same process which produced heat in the candle, produces heat in your body, and that which prevents the process going on in the one, also prevents it taking place in the other Remember this then, that both you and the candle produce poisonous gas, and if you are denied fresh air, the candle will go out, and you will die. Now, my dear boys, the knowledge which I desire to instil into your young minds from this little experiment, is much greater that you will at first see, and will be useful to you in many different ways. It shows you why it is a bad practice for little boys to sleep with their heads under the bed clothes in cold winter nights, when they do this, they breathe bad air which has already been thrown off from their bodies, and which should be permitted to move way. Many children become ill from this practice, and their skin assumes a sallow cast, their spirits low, and if persisted in will eventually shorten their lives.

The poisonous air or gas which is left in the tumbler, does not fly out at the top when the saucer is removed, it remains settled in the glass. *it is therefore heavier than common air.* That is the reason why it is apt to accumulate at the bottoms of deep cellars and wells, or other places which are not disturbed by draughts or fresh air. In these places *carbonic acid gas* settles down, just as it settles down in the tumbler and if ignorant men go down throughtlessly into such places, they are very likely to be suffocated or poisoned by it. Now you see the advantage of knowledge, knowing this, and I am sure you will not soon forget it, it may be the means of saving the life of one or more of those who read this lecture. Men who are accustomed to examine such places, perform experiments with a lighted candle before they risk their lives. Before going down into a well or old close cellar, they let down a lighted candle to the bottom, and if the candle goes out they know that this deadly gas is there and that any person who went into it would be suffocated. The well is only a large tumbler, and the experiment is only upon a large scale.

You will remember that good air after being breathed, became, in part, changed into *carbonic acid gas*, which is heavier than air, and which equally extinguishes flame and destroys life There are many changes which your sight will not detect, but we will endeavor to find them out by other means, you will now be able to understand how this air we breathe is composed of two different gases, of which I purpose to speak hereafter I have shown you that there is something in the air which is necessary to support life or fire. This is one of the two gases or elements of which I spoke just now. It is called *oxygen*, and has a great many very wonderful properties, which will delight you very much when you are able the make the experiment by which those properties are shown.

Hard steel wire will actually burn brighter than a gas light and almost as quick as a piece of string. If the candle that you dipped in the tumbler that contained *carbonic acid gas*, after being extinguished there, were to be dipped into a jar of this *oxygen* in its pure state, it would burst into flame again, and burn with a rapidity and brightness unknown to it in common air. Of these things I must talk to you another time. I hope you will not think my lecture too long and feel that you have added something to your little store of knowledge that will prove useful to you in days to come.

NEPHEW.

GRASSHOPPERS FOR DINNER.

We see by the American papers that Professor Riley and a few gentlemen have succeeded in "turning the tables" on the grasshoppers and locusts in a manner that those pirates will scarcely appreciate It is certainly a species of retributive justice that if the locusts will eat the crops, they must expect to be eaten themselves. At any rate at a dinner given by Professor Riley to a party of scientific gentlemen at St Louis, Missouri the "lively locust" formed the sole animal food. It is said to be a feast that the "veriest epicure might envy." Caloptenus soup was the first course, then hopper fritters—"vastly better than oyster fritters," and so on, through roast, boiled, fried, &c., till the final dish—"locusts served with honey." When the matter is considered without prejudice, there is no reason why the locust should be regarded as more repulsive than a shrimp, or even an oyster: it feeds on the best of vegetable food, and, according to Professor Riley and his friends, is itself really acceptable to the human palate. If the facts are as stated it is to be regretted that a ridiculous prejudice permits people to half-starve when food in abundance is within reach—in the very animals which have rendered the "short rations" an unpleasant necessity.

Improved Balance for Screw Marine Engines Slide Valves. —We give a sketch of an arrangement of balance for slide valves. The following will explain it:—A is the balance ram, B the slide-valve spindle, C the steam-chest cover, D the gland by which the balance is kept tight, E the dome, F a test-cock by which it may be ascertained if any steam is escaping from the steam-chest to the condenser, G the vacuum pipe. (Page 312.)

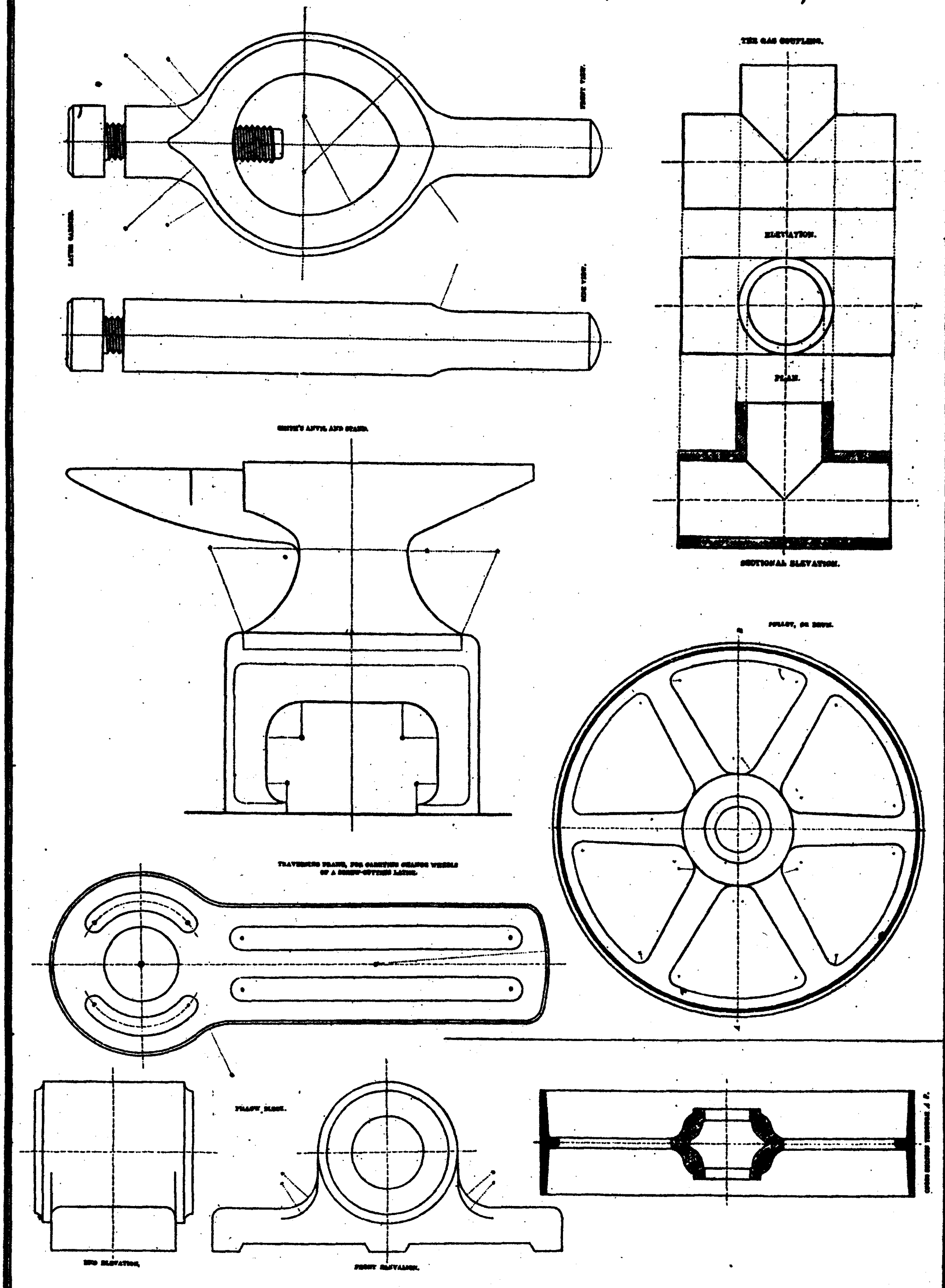
Effect of Electricity on Plants.—The effects of electricity on plants have not been closely studied. It is known to produce contractions in the Mimosa and other sensitive plants, and to retard the motion of sap. M. Becquerel has studied its influence on germination and development. It decomposes the salts contained in the seed, the acid elements being carried to the positive pole, and the alkaline portions to the negative. Now, the former are hurtful to vegetation, while the latter favour it M Becquerel further examined the influence of electricity on the colour of plants The discharge from a powerful machine produce remarkable changes of colour on the pedals, due, he thinks, to the rupture of cells containing colouring matter. Deprived of this cellular envelope by washing, the floor becomes white.

The Reflection of Light.—An almost exhaustive historical essay, by Lundquist, on the investigation of earlier physicists into the peculiarities of the light reflected from the surfaces of solid bodies, is supplemented by observations made by himself on the reflection from fuchsin, and some other substances. The methods followed by him were similar to those adopted of late years by Jamin, Wiedemann, Van der Willigen, and others. A narrow pencil of sunlight, reflected in a fixed horizontal direction from a heliostat, passes successively through an achromatic lens, a flint glass prism, and a polarising Nicol's prism, and falls upon the reflecting surface of fuchsin; the reflected light is then analysed by a compensator, and second Nicol's prism. Rays of light from seven different portiods of the spectrum were examined, and in general Lundquist concludes that in respect to the principal angle of incidence fuchsin comports itself as does indigo; and the observations are represented by the theoretical formulæ for metallic reflection so long as the angle of incidence is greater than 59°. The author's investigation into the intensity of the reflected light shows that in one hand the intensity is always slightly less than that computed, and that on the other hand the quantities reflected vary sensibly with the colour of the incident light—so that when light falls upon the fuchsin the color of the reflected varies with the angle of incidence; and the power of the substance to absorb different coloured rays offers a remarkable anomaly—as, while the yellow light is reflected in greater proportion than the blue, it is absorbed in less proportion.

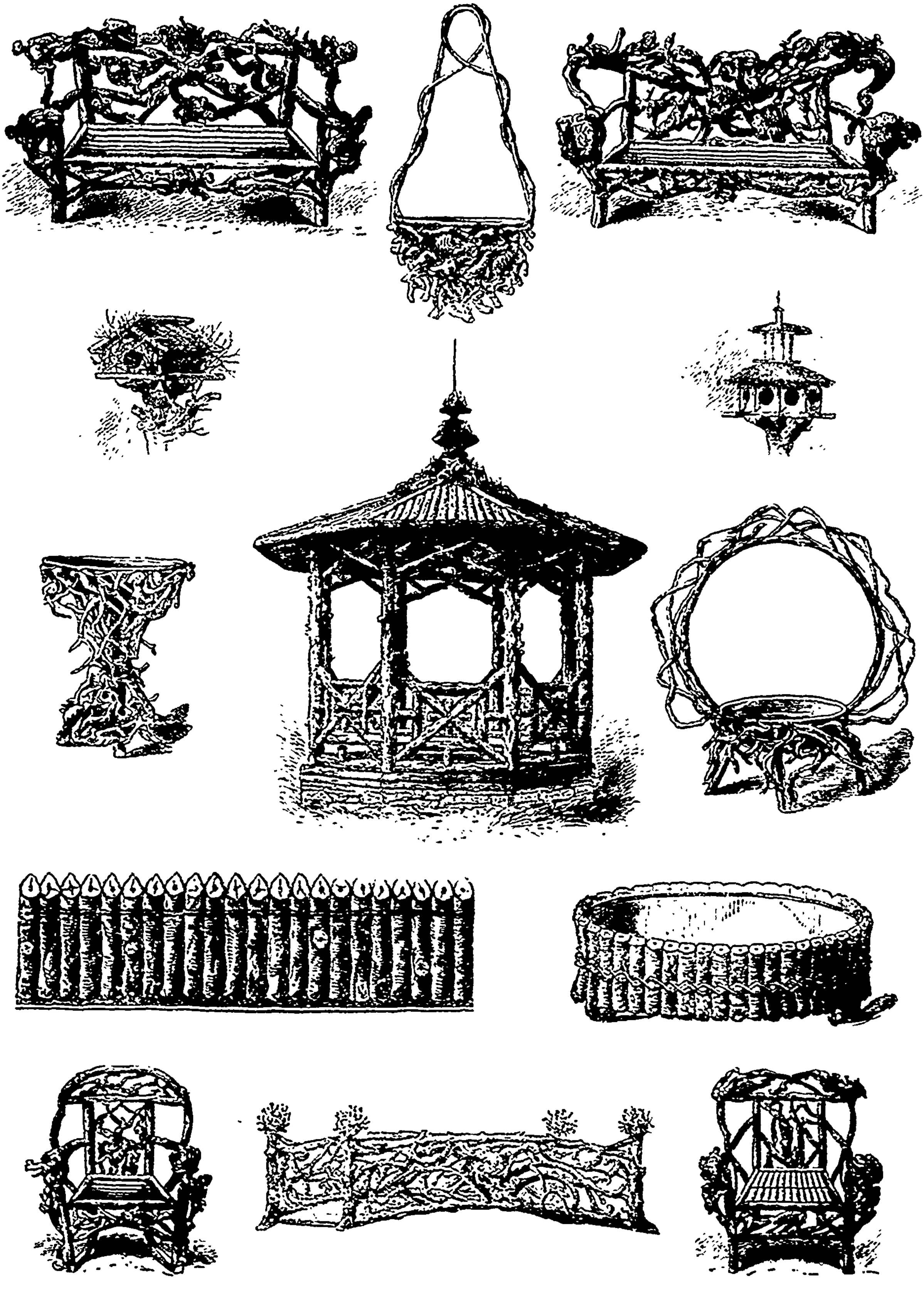
A Public Reader Says:—It is some years since I began reading in public, and one of the first lessons my experience taught me was that I could not secure the attention of my audience, neither could I make the points of my story tell, while my attention was taken up by the fear of bad elocution. There are several things which I found essential to success. To put them briefly: 1. The selection of a reading containing merit and interest of its own apart from the reader. 2. A thorough knowledge of the piece I am going to read. I never read a piece in public until I have thought over its purpose, and got off its strong points in private. 3. The power to lose my own identity in what I read, expressing the meaning not only with the voice but with the eye also. This requires a little study, but the power it gives to a reader is invaluable. I have heard (or seen?) some of the finest works in the English language fail in producing the least effect simply because the reader's eyes were buried in his book. 4. As to the voice, I always commence a reading in a low but clear tone, every word being distinctly uttered in slow time. This gains the ear of your audience. You can then increase both the pitch of your voice and the time also, but never hurry. If the reading be lengthy, an occasional return to your key note will afford an agreeable rest to the listeners.

A New Cement—A French chemist is said to have succeeded in preparing a mineral compound, which is said to be superior to hydraulic lime for uniting stone and resisting the action of water. It becomes as hard as stone, is unchangeable by the air, and is proof against the action of acids. It is made by mixing together 19lb. of sulphur and 42lb. of pulverised stoneware and glass. This mixture is exposed to a gentle heat, which melts the sulphur, and then the mass is stirred until it becomes thoroughly homogeneous, when it is run into moulds and allowed to cool. It melts at about 248° Fahr., and may be re-employed without loss of any of its qualities, whenever it is desirable to change the form of an apparatus, by melting at a gentle heat, and operating as with asphalte. At 230° Fahr. it becomes as hard as stone, and preserves its solidity in boiling water.

MECHANICAL DRAWING—(CONTINUED.)



RUSTIC WORK. (Continued.)



DOMESTIC.

VENTILATION WITHOUT DRAFT.—Fit the center frame of the top sash of a window with double panes of glass, one attached to the outer margin of the frame, and the other to the inner, leaving an interval of about an inch between. The outer pane is deficient for the last inch at the bottom, and the inner pane for an inch at the top, thus allowing a current of air to enter the bottom of the outside pane, pass upward between the two, and enter the room in a vertical direction, causing no draft but maintaining an almost constant supply of fresh air, which can be increased or diminished to any extent in proportion to the number of panes thus treated.—*Herald of Health.*

SUNSTROKE.

Sunstroke is frequently brought on by persistent fretting.

The exhaustion of the nerves is one of the precedent conditions of the disease, and there is nothing which exhausts the nerves so surely as fretting.

An unexceptionally able physician has said that mental labor never alone produces disease of the brain, but that "worry" is the chief source of softening of the brain, and that paralysis which is distinct from apoplexy.

Now if you believe that sunstroke is caused in a similar way, you will comprehend why we have sometimes a hundred cases in a day in our country, but in Italy, where the heat lasts steadily for four months in the year, the disease is nearly unknown.

The reason is that most Americans, when the hot weather begins, go into training for sunstroke, and ignorantly do everything which can produce it.

What we ought to do in hot weather is evident. First, we must keep our minds easy and contented. Secondly, we should drink nothing but moderately cool water, and very little of that. Ice-water is the bane of America, and probably kills nearly as many people as alcohol.

Thirdly, we should avoid so far as is possible all work which overheats and exhausts us.

A SUBSTITUTE FOR SOAP.

A lady writes to one of our agricultural papers, and communicates the following with regard to the use of soap. We suppose she knows of what she speaks, but many housekeepers will be likely to regard her statements as bordering on moonshine. But listen:

"Without giving any recipes for making soap, I wish to tell all the hard-worked farmers' wives how much labor they may save by not using such vast quantities of this article. For nearly five years I have used soap only for washing clothes. In all that time I have not used one pound of soap for washing dishes and other kitchen purposes. My family has ranged from three to twenty-five. I have used cistern water, limestone water, as hard as possible, and hard water composed of other ingredients besides lime, and I find with all these my plan works equally well. It is this: Have your water quite hot, and add a very little milk to it. This softens the water, gives the dishes a fine gloss, and preserves the hands; it removes the grease, even that from beef, and yet no grease is ever found floating on the water, as when soap is used. The stone vessels I always set on the stove with a little water in them when the victuals are taken from then; thus they are hot when I am ready to wash them, and the grease is easily removed.

"Just try my plan, you who toil day after day every spring to make that barrel of soap, and let us hear how it succeeds with you. I like the great barrel of soap on washing-day, but am glad to dispense with its aid on all other occasions. I find that my tinware keeps bright longer when cleansed in this way than by using soap or by scouring. The habit so many of us have acquired of scouring tins is a wasteful policy; the present style of tinware will not bear it. The tin is soon scrubbed away, and a vessel that is fit for nothing left on our hands; but if washed in the way I have described, the tin is preserved and is always bright and clean."

MISCELLANEOUS RECEIPTS.

CORN-MEAL BREAD No. 1.— Take 2 qts. of corn-meal, with about a pint of (thin) bread sponge, and water enough to wet it; mix in about half a pint of wheat flour, and a tablespoonful of salt; let it rise, and then knead well the second time; bake 1½ hours.

CORN-MEAL BREAD No. 2.—Mix 2 qts of new corn meal with three pints of warm water; add 1 tablespoonful of salt, 2 tablespoonfuls of sugar, and 1 large tablespoonful of hop yeast; let it stand in a warm place five hours to rise; then add 1½ teacupful of wheat flour, and half a pint of warm water. Let it rise again 1½ hours, then pour it into a pan well greased with sweet lard, and let it rise a few minutes. Then bake, in a moderately hot oven, 1 hour and 30 minutes.

CORN-MEAL BREAD No. 3. — Take 2 qts. of white corn-meal, 1 tablespoonful of lard, 1 pint of hot water; mix the lard in water, stir it well that it may get heated thoroughly, and add one-half pint of cold water. When the mixture is cool enough add two well-beaten eggs, and two tablespoonfuls of home-made yeast. Bake 1 hour in a moderately heated oven. If for breakfast, make over night.

DYPEPSIA BREAD.—The following receipt for making bread has proved highly salutary to persons afflicted with dyspepsia, viz.:—3 quarts unbolted wheat meal; 1 quart soft water, warm but not hot; 1 gill of fresh yeast; 1 gill molasses, or not, as may suit the taste; 1 teaspoonful of saleratus.

BUCKWHEAT SHORT CAKE.— Take 3 or 4 cups nice sour milk, 1 steaspoonful of soda saleratus dissolved in the milk; if the milk is very sour, you must use saleratus in preportion with a little salt; mix up a dough with buckwheat flour thicker than you would mix the same for griddle cakes, say quite stiff; put into a buttered tin, and put directly into the stove oven, and bake about 30 minutes, or as you would a short-cake from common flour.

CRUMB PIE.—Mince any cold meat very finely, season it to taste, and put it into a pie-dish; have some finely-grated bread crumbs, with a little salt, pepper, and nutmeg, and pour into the dish any nice gravy that may be at hand; then cover it over with a thick layer of the bread crumbs, and put small pieces of butter over the top. Place it in the oven till quite hot.

ECONOMICAL SOUP.—Put into a saucepan one-pound pieces of stale bread, three large onions sliced, a small cabbage cut fine, a carrot and turnip, and a small head of celery (or the remains of any cold vegetables), a tablespoonful of salt, a tablespoonful of pepper, a bunch of parsley, a sprig of marjoram and thyme. Put these into two quarts of any weak stock, (the liquor in which mutton has been boiled will do,) and let them boil for two hours; rub through a fine hair-sieve, add a pint of new milk, boil up, and serve at once.

HOW TO SAVE YOUR ICE BILL.—Get a quantity of empty barrels or boxes during the coldest time in the winter, and put a few inches of water in each; the evening when the cold is most intense is the best time to do this. After the water is frozen solid, fill up again, repeat the process until the barrels are full of solid ice, then roll them into your cellar, cover them up with plenty of sawdust or straw, and your ice crop is safely harvested.

BRINE THAT WILL PRESERVE BUTTER A YEAR.—Among the many devices for keeping butter in a manner that will preserve the fresh rosy flavor of new, with all its sweetness, is the following from the Duchess *Farmer:* To three gallons of brine strong enough to bear an egg, add a quarter of a pound of nice white sugar and a tablespoonful of saltpetre. Boil the brine, and when it is cold, strain carefully. Make your butter into rolls, and wrap each separately in a clean, white muslin cloth, tying up with a string. Pack a large jar full, weight the butter down, and pour over the brine until all is submerged. This will keep really good butter perfectly sweet and fresh for a whole year. Be careful to not put upon ice, butter that you wish to keep for any length of time. In summer, when the heat will not admit of butter being made into rolls, pack closely in small jars, and, using the same brine, allow it to cover the butter to the depth of at least four inches. This excludes the air and answers very nearly as well as the first method suggested.

BICARBONATE OF SODA IN TOOTHACHE.—Dr. Dyce Duckworth contributes a short memorandum on this subject to the *Practitioner* for April. He was called on to treat a case of very severe tooth-ache, and tried various ordinary remedies, including chloroform and carbolic acid, without any benefit to patient. He then remembered having read that the pain might be relieved by holding in the mouth a solution of bicarbonate of soda. He at once gave the patient half a drachm in an ounce of water, and, to his astonishment, the pain ceased immediately, and complete relief was secured. He thinks that, as the remedy is so simple and the disease so distressing and often intractable, this treatment may be worthy of notice and imitation.

HEADACHE — Having been a great sufferer from headache and neuralgia, the latter very severely in the back part of my head, and after trying various remedies, which only gave temporary relief, I at length hit upon a plan which proved effectual One night, being racked with pain, and all the rest of the family retired to rest, I took out the oven shelf and put a pillow on the bottom of the oven; I then placed three chairs opposite, and lay with my back on the chairs, and my head on the pillow in the oven, for about the space of three hours and, I am happy to say, with the very best results.

POWDERED CHARCOAL AS MEDICINE.—The above can be prepared as follows: Buy some stick charcoal at a chemist's, cost 2d. per pound; break it up with a hammer and grind it through a coffee mill, and then sift through a fine muslin sieve; mix, and drink. This is quite passable, though not quite so smooth as that ground in the large iron cylinders. Charcoal is a capital disinfectant.

COLD IN THE HEAD.—Dr. Pollion, of France, says that cold in the head can be cured by inhaling hartshorn. The inhalation by the nose should be seven or eight times in five minutes.

WATERPROOF PAPER—To make waterproof packing paper, dissolve 1¾lb. white soap in 1 quart water. In another quart of water dissolve 1½ oz. of gum arabic and 5oz. glue Mix the two solutions, warm them, and soak the paper in the liquid, and pass it between rollers, or simply hang up to dry.

PROLIFIC ROSE TREE.—On the walls of a house at Gladswood, near Melrose, the residence of Mrs. Meiklam, there is a very fine *Gloire de Dijon* rose tree, which has this season a crop of 850 blooms on it. The height of the wall on which it grows is 15ft. 6in., and the width 24ft., so that Mrs. Meiklam has much reason (says the *Gardeners' Chronicle*) to be proud of her plant.

EXCELLENT TOOTH POWDER —Suds of Castile soap and spirits of camphor, of each an equal quantity; thicken with equal quantities of pulverized chalk and charcoal to a thick paste. Apply with the finger or brush.

DYERS AND BLEACHERS' RECEIPTS.

STEEL MIXED—DARK.—Black wool, it may be natural or colored, 10 lbs.; white wool, 1½ lbs. Mix evenly together, and it will be beautiful.

SNUFF BROWN. — DARK, FOR CLOTH OR WOOL. — For 5 lbs. goods, camwood, 1 lb.; boil it 15 minutes, then dip the goods for ¾ of an hour; take out the goods, and add to the dye, fustic, 2½ lbs., boil 10 minutes, and dip the goods ¾ hour; then add blue vitriol, 1 oz., copperas, 4 oz.; dip again ½ hour: if not dark enough, add more copperas. It is dark and permanent.

WINE COLOR —For 5 lbs. goods, camwood, 2 lbs, boil 15 minutes; then dip the goods for ½ hour; boil again, and dip ½ hour; then darken with blue vitriol, 1½ oz., if not dark enough, add coperas, ½ oz.

MADDER RED—To each lb. of goods, alum, 5 oz; red, or cream of tartar, 1 oz.; put in the goods, and bring your kettle to a boil for ½ an hour; then air them, boil ½ hour longer; then empty your kettle, and fill with clean water; put in bran, 1 pk; make it milk warm, and let it stand until the bran rises, then skim off the bran, and put in madder, ½ lb; put in your goods, and heat slowly until it boils and is done Wash in strong suds.

GREEN.—WITH FUSTIC.—For each lb. of goods, fustic, 1 lb.; with alum, 3½ oz Steep until the strength is out, and soak the goods therein until a good yellow is obtained; then remove the chips, and add extract of indigo or chemic, 1 tablespoon at a time, until the color suits.

BREAD.

By DR. T. L. NICHOLS.

(From the *Herald of Health.*)

Bread is the staff of life. Good bread contains the best food for man, in the proportions required for the healthy nourishment of the system We tire of many kinds of food; but we eat bread every day (so it be good bread) with the same relish. A certain variety is desirable: but if we could have but one kind of food, we should choose bread. In a certain sense we must consider all kinds of farinaceous food as bread. Wheat is the king of grains—the most perfect food of man—but we have bread also of rye, oatmeal, barley, maize, rice, &c. Even a baked potato is closely allied to bread, and the bread-fruit of the tropics is a nourishing substitute.

Few people practise the economy of making domestic bread. Servants either do not know, or will not take the trouble. It is so much easier to get it of the baker. There is the bother of getting flour and yeast, of raising the bread, and then of baking it At the best, white bread made of the innermost portion of the wheat is often a cause of disease. Unless one eats considerable proportions of fruit or vegetables with it, it produces constipation.

The sweetest, and most nutritious, the healthiest bread in the world is that made from unbolted wheat flour —*brown bread;* not the dry and tasteless stuff sometimes made by bakers by mixing bran with their ordinary dough but bread made of the "whole meal" of good sound wheat, and containing all its nutritive elements Chemists have found by analysis that the nitrogenous or flesh-forming portion of wheat resides chiefly in its outer layer—the very portion thrown away, or given to cattle; and physiologists have also discovered that it is this portion which keeps up a healthy action of the bowels. No person who lives chiefly or largely on genuine brown bread, or its equivalent, in perhaps a better form — porridge made of coarse wheat meal—ever suffers from constipation, and long-standing cases are speedily cured by a diet of pure wheat and fruit. I have never known a case, even of years' standing, and constant use of aperients, that did not soon yield to such a diet.

From the earliest known ages brown wheat bread has been famed as a most healthy invigorating food Hippocrates, the father of medicine, prescribed it; the hardy Spartans lived on it; the Romans of the heroic ages lived on it, and their armies conquered the world on a diet of brown bread. The most healthy peasantly of central Europe eat it as their common food. Baron Steuben said the peculiar healthfulness of the Prussian soldiery a century ago was owing to their living almost entirely on unbolted wheat bread. During the naval glory of Holland her sailors ate the same kind. During the wars of Napoleon, when wheat was dear in England, the army, from motives of economy, was supplied with brown bread. The soldiers at first refused to eat it—threw it away—all but mutinied; but in a few days they liked it better than the white, and their health so much improved that in a few months disease was almost banished. Many of the nobility adopted it, and physicians began to prescribe it. An orphan asylum in New York was cured of epidemic ophthalmia by the use of brown bread in place of white.

And this brown bread with its equivalent preparations is the purest, the healthiest, the best form of human food. The model food for childhood and youth; the food of growth, purity, beauty, intellect—in one word, of Health, is brown bread, milk and fruit. There is absolutely no need of any other. A pound of wheat has more nutritious value then three pound of beef or mutton. Lean beef or mutton is 75 per ct. of water to begin with The remaining elements—fibrine, gelatine, albumen—are identically the same as in wheat, but mingled with animal impurities, and the wheat is superior in heat-forming elements. Bread and fruit are the natural food of man; the flesh of animals is an artificial substitute.

DESIGN FOR COTTAGES.

TO OUR READERS.

We sometimes hear the remark from Subscribers that this MAGAZINE does not contain sufficient information respecting the trades they belong to. We respectfully request them to consider that this being a MECHANICS' MAGAZINE, has to represent many trades, and therefore we cannot give a preference to one subject more than another. We shall always do our best to supply as much general information as possible, and if a certain branch of mechanics is not touched upon in one Number, it will probably be so in the one ensuing. What we particularly require at present is correspondents on original subjects of practical utility to our readers, this we are endeavouring to obtain, and trust that the MAGAZINE, if not quite so well supplied with *original* matter as scientific papers of older and more populous countries, will at least be well worthy of the support of every Canadian Mechanic.

The cry of Canadian Mechanics has always been "support and encourage home industries and manufactures"—let them add, also, *home literature*, and to bear in mind that it rests solely with themselves to sustain a scientific publication devoted entirely to the circulation of information appertaining to their own class. Any mechanic who refrains from supporting the MAGAZINE is not loyal to the policy he advocates. Almost every artisan in the United States subscribes to one or more scientific periodicals, and this *certain support* enables the publishers to engage the best talent in the country to supply editorial matter for their columns. All we ask is the same encouragement from the mechanics of the Dominion, to be able to keep up the MAGAZINE to the proper standard of a useful and scientific work. Be it remembered that our English reading population is nearly one twentieth less than the United States or that of Great Britain, and therefore the more reason why we should receive the aid of every mechanic in our own country.

As we are always grateful for information afforded on subjects appropriate for the columns of the Magazine, and in return willing to afford special information to querists, we furnish the following for their guidance under the head of

HINTS TO SUBSCRIBERS AND CORRESPONDENTS.

1. All communications intended for the editorial columns either scientific or on general matters should be addressed to the EDITOR OF THE CANADIAN MECHANICS' MAGAZINE AND PATENT OFFICE RECORD, and all advertisements and letters of a *commercial character*, addressed to G. B. BURLAND, MANAGER, BURLAND-DESBARATS LITHOGRAPHIC CO., *Montreal.*

2. Remittences should be made in registered letters or by Post Office Orders.

3. Write on one side of the paper only, and put drawings for illustration on separate pieces of paper.

4. Put titles to queries, and when answering queries put the numbers as well as the titles of the queries to which they refer.

5. No charge is made for inserting letters, queries or replies.

6. Commercial letters, queries or replies, or illustrations having a commercial tendency to make an advertising medium of the Magazine, will not be inserted.

7. No question for educational or scientific information is answered through the Post.

CHARGES FOR ADVERTISING.

For each monthly insertion · 10 cents per line.

Special rates made for pictorial advertisements.

On standing advertisements the following discounts are allowed:

5 per ct. for 3 months; 10 per ct. for 6 months; 15 per ct. for a year.

Advertisements must reach the office before the 20th of each month, if to be inserted in the next number.