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The Canadian Patent Office RECORD AND MECHANICS' MAGAZINE

Vol 3.—No. 9. SEPT., 1875. Price in Canada $2.00 per An.
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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 improvements 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 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 acount 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.

AVIS AUX ARTISANS CANADIENS-FRANÇAIS.

A ceux de nos artisans qui ne possèdent pas assez la langue anglaise pour en comprendre les mots techniques, nous annonçons qu'aussitôt que nous aurons parmi eux un nombre suffisant d'abonnés, nous donnerons dans chaque numéro de cette Revue, à la suite de chaque expression scientifique, le mot équivalent en français. Il est bien à désirer qu'ils tiennent tête aux ouvriers anglais et américains qui se mettent au courant des découvertes et des améliorations dans tous les arts et métiers. Et pour cela, qu'ils ne laissent pas s'échapper l'occasion qui se présente de s'abonner à la REVUE DES ARTISANS CANADIENS,—*Canadian Mechanics' Magazine.*

G. B. BURLAND, Directeur-Gérant.

THE MAMMOTH CITY OF THE WORLD.

We have much pleasure in furnishing our readers with an illustration of a "*Vision of the City of London*" designed by Mr. Godwin, an eminent English architect, from the original plan left by the great architect Sir Christopher Wren, after the destruction of the city by the great fire in 1666, in the reign of King Charles II. The increase of this "Monster City" will be read with astonishment. Speculative minds will vainly conjecture as to its future, should it continue to increase in the same ratio as it has done during the last quarter of a century. It has laughed at the gloomy prophesies of old, and has continued to grow in wealth and grandeur until it has become the Queen of Cities, having the best disciplined, wealthiest and healthiest population of any other city in the world.

We publish the following from the *London Builder*.

LONDON: AS ARRANGED BY SIR CHRISTOPHER WREN.

By desire of King Charles II., Sir Christopher Wren, in the year following the Great Fire, prepared a report with plan on the best mode of rebuilding the City. The plan is well known. Wren sought in his plan to avoid the deformity and inconveniences of the old town, by enlarging the streets and lanes, giving main thoroughfares north and south, and east and west, by placing all the churches in conspicuous positions, and insulating them, by forming the most public places into large piazzas, the centres of eight ways, by uniting the Halls of twelve chief companies into one regular square annexed to Guildhall; and by making a commodious quay on the whole bank of the river, from Blackfriars to the Tower.

In making the plan he arranged that the streets should be of three magnitudes; the principal, leading through the City, and one or two cross streets, to be at least 90 ft. wide, others 60 ft., and the lanes about 30 ft., excluding all narrow dark alleys without thoroughfares, as well as all courts. The Exchange was to stand free in the middle of a piazza, and be, as it were, the centre of the town, whence the 60ft streets, as so many rays, should proceed to all the principal parts of the City, the buildings to be contrived after the form of the Roman Forum, with double porticos. Many streets were to radiate to the bridge. The streets of the first and second magnitude were to be carried on as straight as possible, and to open into piazzas. On the banks of the Thames was to be formed a spacious and convenient quay, with some large docks. He proposed that the churches should be designed according to the best forms, for capacity and hearing, adorned with useful porticos, and with lofty towers and steeples in the greater parishes. All trades that use great fires, or yield noisome smells, were to be moved out of the town.

In placing the plan before the plan before the King, and the House of Commons, Wren himself thus explained it:—

"From that part of Fleet-street which remained unburnt about St. Dunstan's Church, a straight street, 90 ft. wide, crosses the valley, passing by the south side of Ludgate Prison, and thence in a direct line ends gracefully in a piazza at Tower-hill; but before it descends into the valley where now the great sewer (Fleet ditch) runs, about the once middle of Fleet-street, it opens into a round piazza, the centre of eight ways, where at one station are these views — first, straight forward quite through the City; second, obliquely towards the right hand to the beginning of the quay, that runs from Bridewell Dock to the tower; third, obliquely on the left to Smithfield; fourth, straight on the right, to the Thames; fifth, straight on the left, to Hatton street and Clerkenwell; sixth, straight backwards towards Temple-bar, seventh, obliquely on the right to the walls of the Temple, eighth, obliquely on the left to Cursitor's-alley.

"Passing forward, we cross the valley, once sullied with an offensive sewer, now to be beautified with a useful canal, passable by as many bridges as streets that cross it. Leaving Ludgate Prison on the left side of the street (instead of which gate, was designed a triumphal arch to the founder of the new City, King Charles II.), this great street presently divides into another as large, which carries the eye

and passage to the south front of the Exchange (which we leave as yet for a second journey), and before these two streets, spreading at acute angles, can be clear of one another, they form a triangular piazza, the basis of which is filled by the cathedral church of St Paul. But leaving St. Paul's on the left, we proceed, as our first way led us, towards the Tower, the way being all along adorned with parochial churches.

"We return again to Ludgate, and leaving St. Paul's on the right hand, pass the other great branch to the Royal Exchange, seated at the place where it was before, but free from buildings, in the middle of a piazza, included between two great streets; the one from Ludgate leading to the south front, and another from Holborn over the canal to Newgate, and thence straight to the north front of the Exchange."

The practicability of this whole scheme, without loss to any man, or infringement of any property, is said to have been demonstrated, and all material objections answered; the only—and, as it happened, insurmountable—difficulty remaining, was the averseness of great part of the citizens to alter their old properties, and to recede from building their houses on the old ground and foundations; as also the distrust in many, and unwillingness to give up their properties, though for a time only, into the hands of public trustees or commissioners, till they might be dispensed to them again with more advantage to themselves than otherwise was possible. A grand opportunity in consequence was lost of making the new city the most magnificent, as well as commodious for health and trade, of any existing.

More than three years ago,—that is, in March, 1872,—Mr. Edwin Chadwick, C.B., who was proposing to read a paper at the Society of Arts on what engineering art and architectural art, under the guidance of sanitary science, could do for the building of new cities and the rebuilding of old ones; and had arranged to re-introduce Sir Christopher Wren's plan for the rebuilding of the City, to show what his diagonal lines would have done for external ventilation, and what he would have done by excluding blind courts and alleys, and providing a better order of dwellings; suggested to us that a sort of bird's-eye view of the City, produced on Wren's lines, would form, if published in our journal, an interesting accompaniment to his lecture. The drawing was made and engraved very rapidly in order to be ready for the occasion, but circumstances led to the postponement of the lecture, and from that time to this we have retained the engraved block. We follow out the original arrangement to some extent by publishing it in our present issue in connexion with a report on the City thoroughfares, wherewith Mr. Chadwick has been mainly concerned, and portions of which we print on another page.

The author of the well-known "Critical Review of the Buildings of London," writing of this plan, says "Wren has planned a long and broad wharf or quay, where he designed to have ranged all the Halls that belong to the several companies of the City, with proper warehouses for merchants between, to vary the edifices, and make it at once one of the most beautiful and most useful ranges of structures in the world. But the hurry of rebuilding, and the disputes about property, prevented this glorious scheme from taking place." We do not find, in Wren's own report, confirmation of this statement as to the arrangement of the Halls on the quay, nevertheless we have followed it in the view we give. We will only add at present that Wren's plan is full of suggestiveness, both from a sanitary and an æsthetic point of view.

THE VERY "GREAT METROPOLIS."

It is as difficult for the ordinary Londoner to tell where London commences and where it terminates as it is to point out the precise line of demarcation between the divers colours of the rainbow. The suburban townlets and hamlets blend so insensibly into the cities and liberties of the urban boroughs and bailiwicks, that one might as well attempt to define the particular point at which the fresh water gets to be salt at the mouth of some estuary as to say where the capital ends and the environs begin.

Moreover, the generality of Cockneys have hardly any clearer ideas concerning the extent of the huge metropolis in which they live than the Atlantic fishes have of the vastness of the ocean in which they swim. Indeed, even the best disciplined intellects can but form the same hazy concrete notion as to the collection of units which serve to make up large aggregate numbers as they never fail to entertain respecting the multiplicity of square yards or acres which go to compose in ordinate dimensions in space. Does it give a person any real sense of the enormity of this enormous wilderness of brick and mortar which we style the British Capital to be told that its buildings cover an area of nearly 120 square miles?—that the houses huddled together upon it amount in round numbers to half a million—and that the great swarm of working bees frequenting the huge hive is made up of some three millions and a half of busy honey seeking creatures? What mind can comprehend the *forty thousand millions'* of silicious shells of insects which the great microscopist Ehrenberg assures us are contained in every cubic inch of the fossil slate of Bilin? What brain is helped to compass the aqueous immensity of the sea by being informed that the total area of the several oceans amounts to not less than 145,000,000 of square miles of water? or that the capacious saline pond contains, altogether, dissolved in it as many as 6,441 *billions!* of tons of common salt? (*Austed.*)

The first and main difficulty in the way of forming a comprehensive conception of London in its integrity, is that there are as many different Londons as there are divers modes of dividing the current coin of the realm in Germany. And thalers, florins, and gildern—silver-groschens, kreutzers, and stivers, are not more perplexing to the traveller, nor the several thermometric scales of Fahrenheit, Centigrade, and Réaumur, more troublesome to the chemical student, than are the various metropolises which it has pleased the various official Boards to invent and prescribe. Not only has the metropolitan police a special metropolis; but the Registrar-General has another with a more circumscribed area, and widely-dissimilar boundaries. Then, again the Post-office has its particular London, and the City Mission also a London of its own peculiar manufacture, and so on, until there are nearly the same number of diverse British capitals as there are "real original" Eaux de Cologne fabricated in the native town of the veritable Jean Maria Farina—and each, too, compounded in a wholly different manner.

Is there, then, no Metropolis proper?—no definite palatinate which can be mapped out as the special county of Cockaigne?—no precise territory, hemmed in by a topographical ring-fence as it were, to which the name of London, *in propriâ terrâ*, can be strictly applied? Or is the horizon which seems to gird the capital with a silver zone from the top of St. Paul's a mere illusion?—like the visionary atmospheric vault which appears to concentrate within its ever-varying bounds the very boundlessness of the ocean itself.

Let us see. But first let us take a cursory glance at the limits of "Police London," for this will serve to rest the eye for a while, instead of keeping it continually on the statistical strain.

Well, the police metropolis covers a circle whose circumference is very nearly a hundred miles in extent,—the radius from Charing-cross being just upon fifteen miles long. Hence the entire domain watched over by the Metropolitan "Force" comprises, in round numbers, half a million statute acres, or exactly 688½ square miles,—an extent of territory that is about one-tenth the size of the entire Principality of Wales, and very nearly twice the magnitued of the entire island of Madeira.

The extreme boundary of this same police metropolis includes, on the North, the parish of Cheshunt, in Herts, and South Mimms (near Enfield); on the South, Epsom, in Surrey; on the East, Dagenham and Crayford (near Dartford), in Kent; and on the West, Uxbridge and Staines, in Middlesex.

Such constitutes what is termed the "Metropolitan Police District,"—the entire district being divided into an "Inner" and "Outer" one; and the smaller, or inner district, having hardly one seventh the area of the outer, since it comprises somewhat less than 100 square miles. Indeed, the Inner Police District, as it is called, is nearly equal to that included within the tables of the Registrar General,—the former being rather more than 90 square miles, and the latter not quite 120 in extent.

Now this same "Registrar District" must be regarded as constituting the metropolis proper, or *London as regulated by law*. For, in the year 1852, it was found necessary to pass a special Act (to wit, the Burial Act, 15 & 16 Vict., cap. 85), in order to let Londoners know how far London extends into the country,—as well as to define the exact limits of the "Great Metropolis," according to Act of Parliament. This,

A VISION OF THE CITY OF LONDON, CONSTRUCTED ON THE PLAN LEFT BY SIR CHRISTOPHER WREN

Drawn and Engraved by MR. WORTHINGTON G. SMITH, *under the Direction of* MR. GODWIN.

Streets.

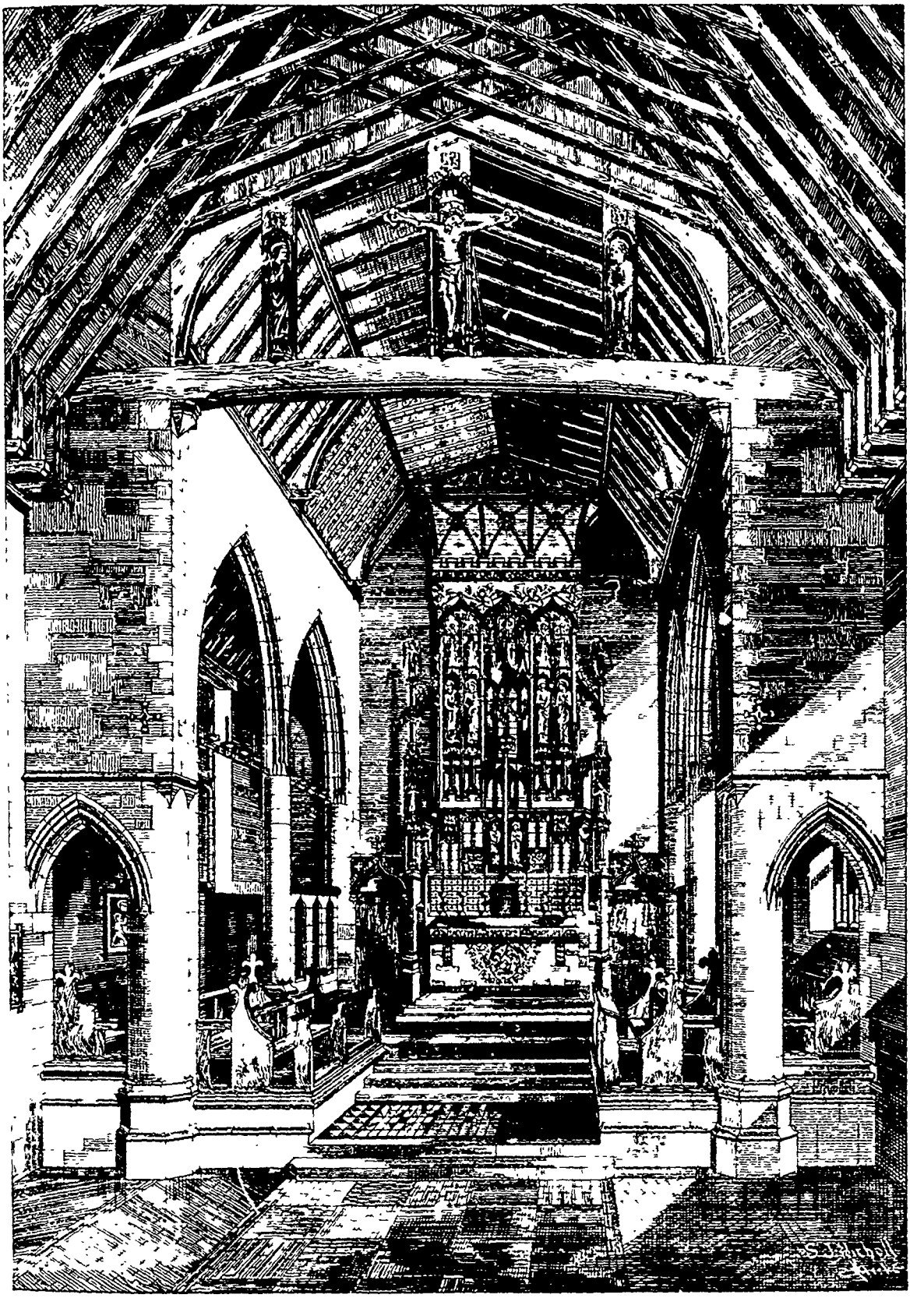
A A A, Old London Wall. B. Cheapside. C. Cannon-street. D. Farringdon-street. E. Barbican. F. Bishopsgate-street. G. Cripplegate. H. Moorgate-street. I. Holborn. J. London Wall-street. K. Tower hill. L. London-bridge. M. Ludgate-hill. N. Fleet street. O. Newgate-st. P. Aldgate.

Public Buildings, &c.

Q. Tower. R. Trinity House. S. Custom House. T. Billingsgate. U. Bank. V. Mint. W. Post Office. X. Goldsmiths' Hall. Y. Post Office. Z. Excise. 1. Insurance. 2. Royal Exchange. 3. Monument. 4. Guildhall. 5. Market. 6. Weed-market. 7. Public Halls. 8. Newgate Prison. 9. Bridewell Dock. 10. Queenhithe.

Churches.

11. St. Paul's Cathedral. 12. St. Bride's. 13. St. Margaret's, Fenchurch-st. 14. St. Margaret's. 15. St. Michael's, Cornhill. 16. St. Mary Woolch. 17. St. Bride's. 18. St. Stephen's, Walbrook. 19. St. Michael-le-Que. 20. St. Margaret's. 21. St. Stephen's, Coleman-st. 22. St. Alban's, Wood. 23. St. Lawrence, Jewry. 24. St. Mary-le-bow. 25. St. Martin's, Ludgate.



THE CHAPEL OF S. FRANCIS HOME FOR ORPHANS AND DESTITUTE BOYS.—(See page 263.)

however, was a feat of legislation very much of a piece with that performed by the renowned progress hating King Canute, at the beginning of the year 1000; since it is quite as absurd for would-be rulers to say, "Thus far shalt thou go, and no farther," to the metropolitan bricks and mortar, as to the waves of the ocean. Indeed, the celebrated bean-stalk planted by the aspiring Jack in the nursery story was hardly more rapid in its growth than has been that of this giant mushroom of a British capital of ours. At the commencement of the year 1600 the legal limits of London, "within and without the wall, were but little better than two square miles in extent, or hardly bigger than the tiny island of Gibraltar; whereas, in the next century, the metropolis, according to law, had swollen to rather more than thirty square miles. Then, at the beginning of the present century, the area was further enlarged to just upon fifty square miles; after which, in 1837, in was again increased to sixty odd square miles; and latterly, in 1852, as we have said, it was still further extended by special Act of Parliament to nearly double the size it was fifteen years previously; so that it now has a superficies of exactly 117½ square miles. And who can say but that at its recent rate of expansion, the huge brick-and-mortar fungus may not by the end of the present century spread into a civic toadstool, of even double its present dimensions?

Nevertheless, in the Burial Act it is expressly laid down that the term "metropolis" is to be understood to mean and include "the cities and liberties of London and Westminster, the borough of Southwark, and the parishes, precincts, townships, and places," thereinafter duly specified and recorded. And, accordingly, we find that London by law is made to extend into Middlesex as far as north as Hampstead, and into Surrey as far as south as Tooting; whilst it stretches into Kent as far east as Plumstead, and thence back again into Middlesex and Surrey as far west as Hammersmith on one side of the Thames, and Barnes on the other.

These, then, are the extreme legal limits of the metropolis proper. From east to west it ranges on the Middlesex side of the river almost from Blackwall to Brentford, and on the Kent and Surrey side from Woolwich to Wimbledon; whilst north and south it runs very nearly from Crouch End to Clapham. Moreover, so directly connected are these diametrically-opposite point of the compass of the capital that there is one continuous street of houses joining the several metropolitan polar regions, and measuring about fourteen miles in length from Chiswick to Stratford, and about thirteen miles from Highgate to Dulwich. So that this same inner circle of urban London (as contradistinguished from the larger outer disc of the suburban metropolis, guarded by the police of the capital) is found to have a radius of just about 8§ miles, whilst its circumference is within a fraction fifty-five miles in extent; and thus the one gigantic town is made to cover a territory which is very nearly as large as that of the *entire county of Rutland*!

Now this immense monster of a city, which is as big as a county, country-people delight to call ironically the "little village." But though we may gain some notion of its size from learning that the ground on which London stands is just about as extensive as the whole are of the Isle of Wight,—still what can impress us with a sense of the seemingly-countless crowd of houses which are packed within its boundaries almost as close as figs in a "drum"? A coral reef hardly consists of a more solid mass of habitable walls; nor do the ant-hills of India teem with a denser or busier swarm of living creatures. Were it possible to count the grains of sand in the Sahara, the infinite host of numerals representing the sum of the collective particles would no more give one an idea of the Great Desert, than the fact that the enormous habitable honeycomb of this huge of a town is made up of some half a million of distinct domiciliary cells all walled together in the close contiguity of geometrical compactness.

Such numerical statements, however, are the mere sawdust of statistics,—the pedantic foppery of figures. How can the mind possibly comprehend half a million in one simple thought? It is as difficult to grasp large numbers as it is to clutch water.

How, then, can we conjure up an adequate conception of the mighty multitude of buildings with which this bricken county of a capital is covered? Well, if we have but a misty idea of mass in its integrity, at least we can arrive at a clearer sense of length in its continuity. Spin an ounce of platinum which would hardly fill a nutshell in the lump, into a thousand miles of wire as fine as a silkworm's thread, and the wondrous extent of the fibre will give one a more or less vivid notion of the original bulk of the metal. Now, half a million houses having an average frontage of five yards each would form an unbroken line of buildings which would be just upon 1,200 miles long; and 1,200 miles of dwellings would be nearly sufficient to form one continuous row right round the entire island of Great Britain, from John O'Groats to the Land's End, and from the Land's End to the North Foreland, and from the North Foreland back again to John O'Groats. Or, what is more striking still, such a line of buildings would be more than enough to make one long street stretching right across Scotland, England, France and Switzerland from Dunnet Head in Caithness, to the banks of the Mediterranean.

If, then, such be the mere length of the aggregate houses in London, it may be readily conceived that the streets of the monster metropolis which, on looking at the map, seem to be a perfect maze of highways and byways, — a closely knitted network of thoroughfares,—should be some thousands in number; and accordingly we find that there are upwards of 10,500 different streets, roads, lanes, gardens, and parks, squares, ovals, polygons, crescents, circuses, and terraces, villas, buildings, rows, and places; particularised in that voluminous civic cyclopædia, the "London Post-Office Directory." Many of these thoroughfares, too, are of non inconsiderable dimensions. The New-road, for instance (exclusive of its City appendage) is very nearly three miles long; Oxford street, more than a mile and a quarter; and Regent-street from Langham Church to Carlton-terrace within a few yards of a mile in length; whilst the two great lines of thoroughfare running parallel to the river,—the one extending from Bayswater along Oxford-street, Holborn, Cheapside, Cornhill, and Whitechapel, to Mile-end, and which is really but one continuous street with different names; and the other stretching from Kensington, along Knightsbridge, Piccadily, the Haymarket, Pall-mall East, the Strand, Fleet-street, Cannon-street, Tower-street, and so on by Ratcliffe-highway to the West-India Docks, are each, from one end to the other, just upon ten miles in length.

Indeed, the gross extent of the London streets, small as well as great, is almost incredible; for by a return made by the police as far back as the year 1850, the aggregate length of the metropolitan thoroughfares, in the "inner" police district alone, amounted to not less than 1,850 miles, while those within the boundaries of the "Registration District," or metropolis proper, made up as many as 1,820 miles. In 1861, however, they had increased to 2,100 miles; whilst in 1871, these same collective thoroughfares of London as regulated by law had become extended to 2,500 miles. So that not only are they now a third of the earth's diameter; but would, if stretched into one long line, just about *span the Atlantic*, and reach from Liverpool to New York!

But prodigious as this vast amount of roadway may seem, it dwindles down into the mere dimensions of a rope-walk in comparison with the total length of streets patrolled by the Metropolitan Police; for by a recent return which has been specially prepared for us by the kindness of Colonel Henderson, we find that the aggregate extent of the thoroughfares included within the *entière* Police District amounts to not less than 6,612 miles, or more than one-fourth of the earth's circumference! Hence, it would appear that the roadways of this same Police District, which were hardly more than 3,500 long in the year 1850, have been nearly doubled in length the last quarter of a century.

And who can wonder? seeing that the same return informs us that between January 1st, 1864, and December 31st, 1873, there were as many as 133,808 houses built within the Metropolitan Police District, comprising 28 new squares, and 2,952 new streets! so that, as this is just about one-third of the gross number of the houses there were in London at the time of taking the last census, it follows that at such a rate of expansion the Monster Metropolis,—monstruous as its present dimension may appear,—will assuredly be twice the size it now is by the end of the present century.

To be continued.)

The surveyors are said to be at work on the Dresden and Oil Springs Rail road. Mr. Sisk proposes to have the road running this fall, and an extension to Sarnia next spring.

S. FRANCIS HOME FOR BOYS, SHEFFORD, BEDFORDSHIRE—THE CHURCH.

At the time when hostility to Roman Catholics was very strong, Shefford appears to have been a sheltered retreat where Catholics lived unmolested. During this period a small chapel was built in the garden behind the priest's house, hidden out of sight of persons passing along the street. This is now the chapel of a home for orphan and destitute boys, and being much too small for this purpose, a new church is to be erected, of which we give an interior view, taken from the drawing exhibited at the Royal Academy. In accordance with the character of the institution, the church will be of the plainest description, the whole of the ornament being concentrated upon the altar and its reredos. The arches shown on the right hand of the view open into a small chapel, with space for the choir organ, and on the left there is a narrow aisle leading to the old chapel, which will serve as sacristy for the new church. To harmonise with buildings in the locality, a late style of architecture has been chosen. The architect is Mr. S. J. Nicholl.—*Building News.*

MOWING MACHINES.

CONSTRUCTED BY MESSRS. MARSHALL, SONS AND COMPANY ENGINEERS, GAINSBOROUGH.

We take from the *Engineering* journal illustrations and description of Thrashing and Mowing Machines at the Exhibition of Agricultural Machines recently held at Taunton, England.

To facilitate the descriptions of the machines in these classes we have selected two different types, American and English, for illustration, and by inspection of them our notice of the other implements will be more clearly understood.

The American mower we have chosen is the two-horse implement manufactured by the William Anson Wood Company, whose London offices are at 5, Upper Thames-street

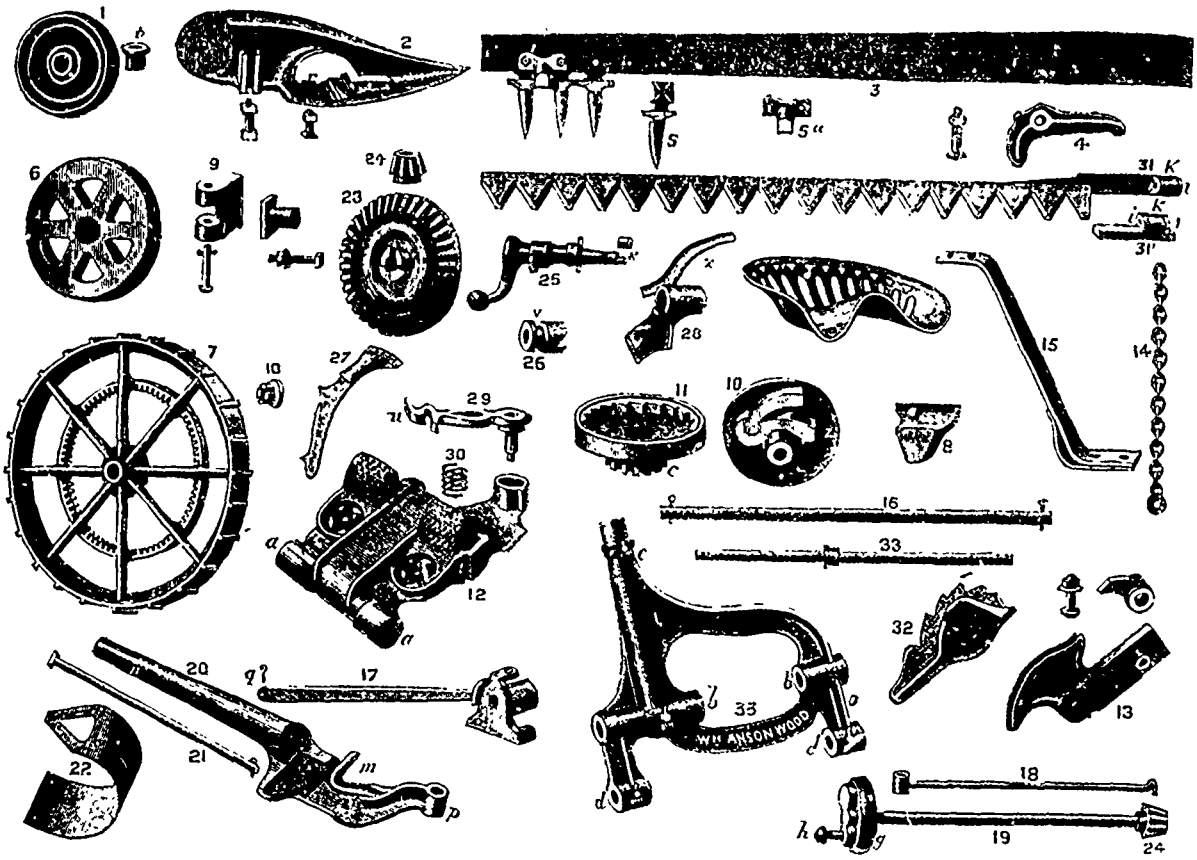
The engravings on page 264, show a general view of the machine, while the whole of the different parts are represented in the details marked 1 to 33 The only parts made of wood are the pole A, the hand-lever B, and the track board C. The width of the machine between wheels is 37 in., and to overcome the side strain produced by the action of the finger-bar and knife when in action, and which would otherwise be thrown against one of the horses, the pole, together with the driver's seat, is set somewhat out of centre. The pole is bolted to the draught plate 12, the axle of the wheels passing through the holes *a a*. On the same axle a floating frame 33, is carried by the brackets *b b*, the width between which is exactly equal to the width of the draught frame *a a*, so that the latter fit between the brackets of the former. The driving wheels 7 are placed on each end of the axle, as shown in the general sketch, and on each of them is cast a wheel with internal teeth, into which gears the pinion *c*, of detail 11. There are two of these pinions, each gearing into the internal toothed spur wheels, and mounted on the cross-shaft running in the bearings *d d*, of the floating frame 33. Upon the cross shaft is placed the bevel spur wheel 23, which drives the pinion 24. on the end of the spindle 19, which passes through the arm *e*, of the floating frame 33, this arm containing two bearings 6 in. long, one at each end, in the positions shown by the lutricators *f f*¹. At the end of the spindle 19 opposite the bevel pinion 24, is the disc *g*, on the face of which is cast a projection which serves as a counterbalance. Opposite to this is the crank pin *h*, set a little more than 1½ in from the centre, so that the throw is rather over 3 in, which is the pitch of the fingers. On the crank pin is placed the "pitman" or connecting rod 18, one end of which is formed with an eye brass bushed, and the other with a hook that takes into the end or the knife bar 31. This knife bar, of course, works to and fro upon the finger bar 5 being held in place by three small guides 5*a*, bolted down to the finger bar, a fourth one being formed of one end of the piece 4, the use of which will be explained shortly. A very noticeable detail in this machine is the manner in which the connecting rod is attached to the knife bar shown at 31 and 31*a*. To the end of the knife is welded a small block, out of which are cut two projections *i i* Between these a block *k*, is placed and held by pins, as shown, while in the block is formed a hole in which the hook at the end of the connecting rod is placed This arrangement permits the free working of the machine even if the connecting rod is bent by a blow in the field. The knife bar is held in place by an extremely simple contrivance. On the top is placed the casting 4, which is bolted down through the finger bar to the sole plate *l*, formed in the bar 20, while in front, and pressing against the front edge of the knife bar is the piece *m*, (see 20), which is also fastened to the end of the arm 20, and is kept up in its normal position by a spring. When it is desired to take out the knife or to remove the connecting rod, all that is necessary is to depress the piece *m*, till it clears the hook and attachment to the knife bar, and to unhook the former. The arm 20 to which we have just referred is a very important part of the implement. It forms a part of the floating frame 33, one end *n*, resting in the bracket 8, which is bolted underneath the bracket *o*, on the frame 33 On the lower end of the arm 20, and beyond the sole plate *l* in the bracket *p*, which carries the castor wheel 6, to which a free motion is imparted by means of the coupling 9, that attaches it to the bracket *p*. Through the hollow arm 20, passes the rod 21, one end of which is bolted fast to the bracket 8, and the other projects sufficiently to have attached to it the end of the chain 14. The end *g*, of the bar 17, is also passed over the end of the rod 21, the other end being attached to a collar placed around the end *f*, of the arm *e*, of the floating frame 33. We should here mention that the hole in the back of the bracket 8, through which the end of the rod 21 passes, is not round but oval, in order that the arm 20 may be free to rise or fall, and still remain tight.

Having now described the leading parts of this mower, we may recapitulate a little in order that our description may be clearly understood. The implement then runs upon two wheels 31 in. in diameter and placed 37 in. apart, each with an internal geared wheel upon it, which together drive pinions mounted on a spindle parallel to the axle of the carrying wheels. This spindle has upon it a bevel wheel driving a bevel pinion which passes down one arm of the floating frame placed on the axle, and driving, through a crank pin and connecting rod, the knife working in guides on the finger bar. The latter is bolted to a shoe on the end of an arm threaded on a bolt fastened at one end to a bracket on the floating frame, and at the other having a tie-rod connecting this arm and the fixed arm through which the spindle driven by the bevel wheel on the cross shaft passes. By this arrangement the movable arm 20 can be raised or lowered, or it can be turned around the bolt on which it is threaded.

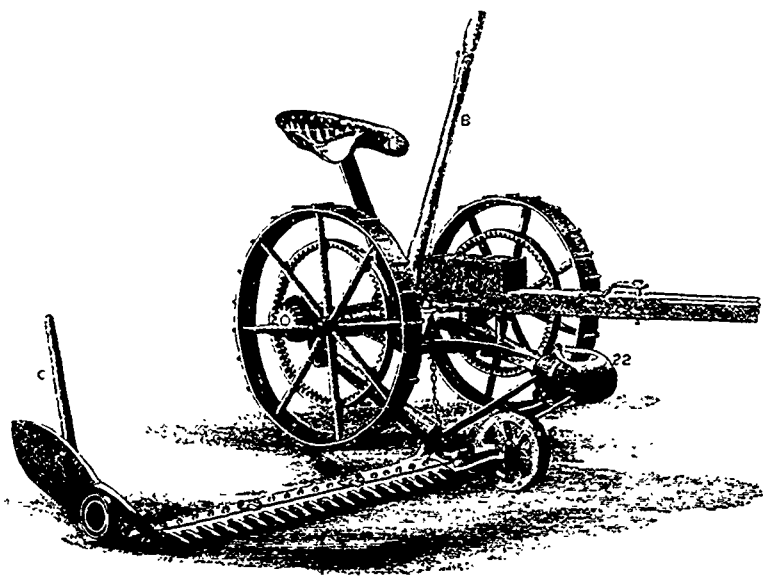
To return to further details. On the end of arm *e*, 33, and protecting the disc *g*, 19 from obstruction, as it passes through the crop, is the shield 22. This is a very essential provision to prevent the grass from winding round the disc and damaging the machine. The form of the dividing shoe is shown at 2. In the forward part of the shoe is an opening in which is the sole plate *r*, to which the finger bar is bolted. To the rear at *s* a projection is cast on the shoe, having a groove in it as shown, to which is attached the small wheel which supports the end of the dividing shoe. This wheel is shown at 1, and it runs on a small sleeve *t*, through which a square headed bolt passes, the head is placed in the groove in the shoe, and the nut is tightened up against the sleeve so as to hold the wheel in place. By this arrangement it is obvious that the position of this wheel may be shifted at will so as to raise or lower the finger bar. This latter is shown at 3, and consists of a taper bar of wrought iron rolled cold, ½ in. thick, 4½ in. wide at one end, and 2½ in. at the other. To it the fingers 5 of steel are bolted, as well as the three guide brackets 5, as before spoken of. It is necessary to fulfil the conditions of working that the finger bar and knife should be under the control of driver, so that it can be lifted instantaneously to pass over any obstacle, and dropped again as suddenly to resume its normal work. Again it is often desirable to raise the inner end of the bar, or to lift the latter, so that the dividing shoe is higher than the attachment between the knife and the connecting rod. The arrangement of the machine enables all these conditions to be fulfilled. The lifting of the finger bar is effected by means of the lever B, which has a spring detent operated from the handle, and engaging in the teeth of the curved rack 32 attached to the frame. The lower end of the lever B, is turned round, and at the end is fastened the chain 14 which passes around the quadrant 13 also on the frame. When the driver raises the detent and throws over the lever the chain is lifted, and as it will be remembered that

TWO-HORSE MOWING MACHINE, AT THE TAUNTON SHOW.

CONSTRUCTED BY THE WILLIAM ANSON WOOD COMPANY —(See page 263.



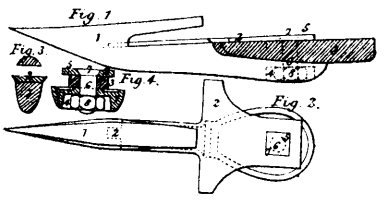
MECHANICAL DRAWING.—(See page 285.)



RESTORING BURNT STEEL.—It is not generally known that burnt steel may be almost instantaneously restored by plunging it while hot in cold water, and hammering it with light strokes on the anvil, turning it so as to hammer all over it, again dipping in cold water, and repeating the hammering process as before. Try it, if you don't succeed the first time, you will soon do so. We saw this done by Mr. T. S. Smith, while in Cincinnati, Ohio, and can vouch for the truth of this statement. Mr. Smith stated that it was an accidental discovery of his own.

IMPROVED DRAWING-INK.—The addition of one part of carbolic adid to 80 parts of the fluid India-ink, while it does not impair its fluidity, causes it to dry rapidly even in heavy lines so that they can be varnished over. the proper amount of carbolic acid to be added in any case may be ascertained by adding drop by drop the ordinary apothecary's solution of it in alcohol until varnishing does not affect the definition of a test line by causing it to run. The addition of too much carbolic acid is indicated by the transparency of the line and the inability to draw fine lines, a condition easily remedied by the addition of more of the fluid ink.

MOWING MACHINE, CONSTRUCTED BY MESSRS. H. & J. KEARSLEY, RIPON.—(See page 266.



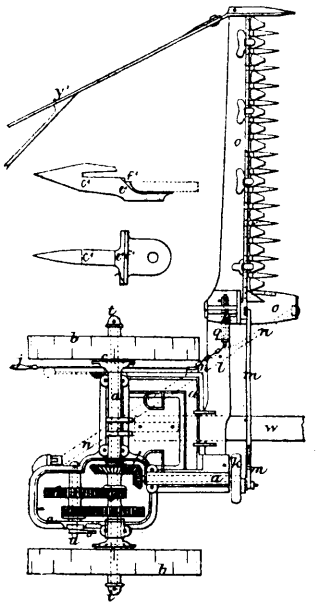


FIG 5.

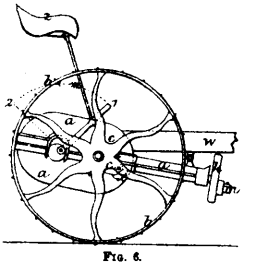


FIG. 6.

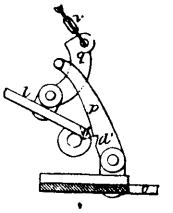
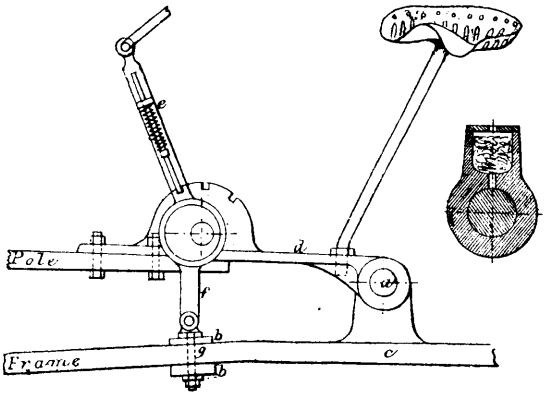
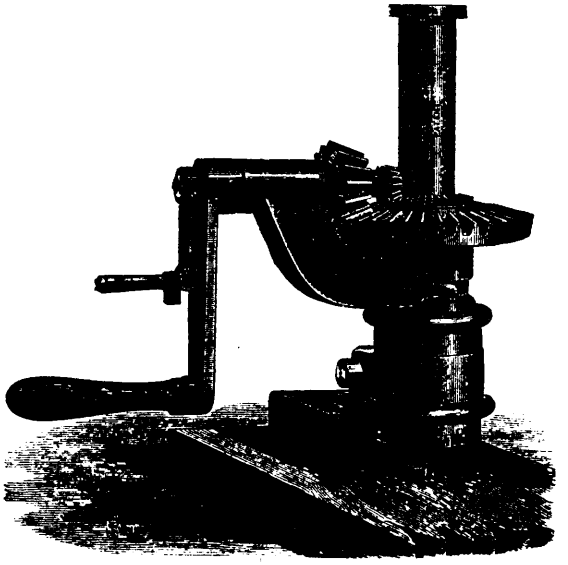


FIG. 7.

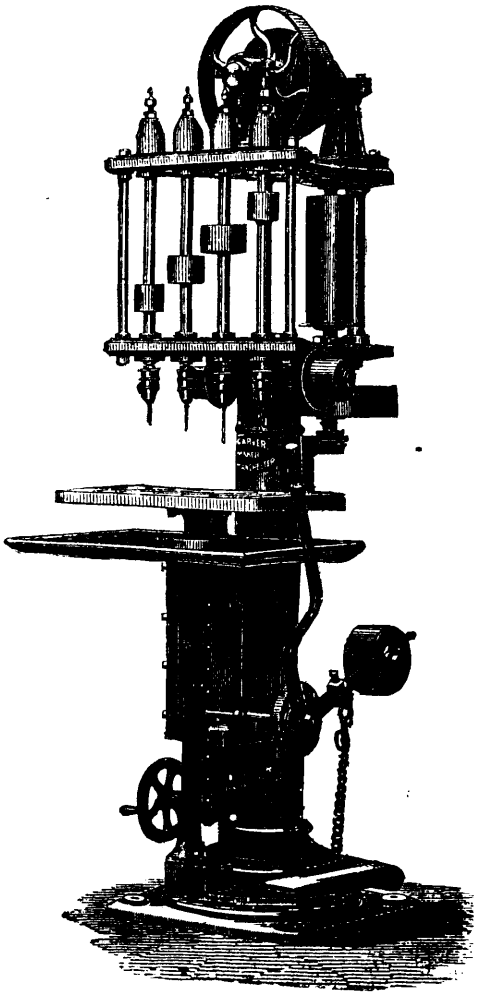
MOWING MACHINE BY MR. W. BRENTON, POLBATHIC, CORNWALL; DETAILS OF LIFTING GEAR.—(See page 266.



Description in next number.



NELSON'S PORTABLE DRILL.—(See page 267.



CARVER'S MULTIPLE DRILL.—(See page 270.

the lower end of the latter is attached to the end of the rod 21, passing through the hollow arm 20, to which the finger bar is bolted, this latter is lifted to any desired height. In this operation it will be observed that the arm 20 is also raised turning upon its support it the bracket 8, bolted to the floating frame as already described, while the arm c, of this frame remains unaffected. But if be desired, the draught frame can be locked with the floating frame by means of the lever 27, which is pinned to the latter, and has projections on it as shown, which engage in the former. This lever can be thrown in and out with the foot at the will of the driver, who can also, without leaving his seat, raise the finger bar, &c., and turn it up over the machine, when going to or from work. This is effected by means of the hollow arm 20, with which the finger bar is connected, and with which it turns as the bar is being raised. When at its highest position it comes into contact with the catch 29, which rests in a socket in the draught frame is shown, and in which there is also a spiral spring tending always to keep the catch in its normal position. As soon, however, as the edge of the finger bar strikes against the curved face n, of the catch, the latter is pressed back until the bar enters the recess shown in the catch, and is held there securely.

The detail for throwing the machine in and out of gear is very simple, and is shown in the details 25, 26, 28. It consists of a clutch, one part of which is cast on the bevel wheel 23, running on the cross shaft, the other portion of the clutch 26 on the same shaft being formed with a groove around it, as shown at t. In this groove fits a small roller W, shown on detail 25. This roller is placed eccentrically on the pin in the end of 25, which is a casting with a small handle at the other end, and fitting into the socket 28, which is bolted upon the floating frame at the point marked t', detail 33 This brings it into such a position that when the roller w, is in the groove round the clutch 26, by turning the handle of the spindle 25, which can be done with the foot by the driver, the clutch can be thrown in or out of gear, and the machine stopped or set in motion. It will be noticed that there is a small curved projection s on the piece 28. This, when the latter is bolted in place, partially covers the bevel wheel 23, and serves as a protection against fouling of the reins, &c. Finally, we may mention, that the knife in this, as in most machines, works only when the implement is being driven forward. If it is backed all motion of the knife ceases. This is effected as follows: It will be noticed that on the pinion c, in detail 21, there is cast a circular box y, around which on the inside a ratchet gearing is formed. Within this box is placed the disc 10, keyed on the ends of the cross shaft carrying the bevel wheel 23. On the face of the disc is the pawl 2, which engages in the teeth round the box y. The whole motion is thus transmitted through the pawls and ratchets at each end of the cross shaft, and when the implement is moved backwards, the pinion c revolves alone. The weight of this machine is about 600 lb.

We may dismiss in a very few words our notice of the W. Anson Wood's single horse mower, the construction of which is practically the same as that already described. It is, however, of course a smaller and lighter machine, the weight being 425 lb., and the width of cut 3 ft. 6 in.

Two small differences in detail alone call for comment. One is that a hinged joint is introduced into the connecting rod close to the point where it is placed on the crank pin. This done to allow the rod to yield in case of its striking any obstacle in the field. The other difference is found in the arrangement of the catch for holding up the finger bar when travelling.

MOWING MACHINE CONSTRUCTED BY MESSRS. H. & G. KEARSLEY, OF RIPON.

The English mowing machine we have selected for an example is one of several varieties manufactured by Messrs. H. & G. Kearsley, of Ripon. The illustrations on page 265, explain the arrangement of the implement, which it will be seen differs essentially in all respects from the American machine we have just described.

The form of the frame, which is of iron, is shown in the plan Fig 5, from which also the arrangement of the motion will be understood. Upon the axle of the travelling wheels of the implement is keyed a spur wheel gearing into a pinion cast in one piece on a spur wheel which tuns on a movable stud, and allows the motion to be thrown in and out of gear by an eccentric lever. The spur wheel last alluded to gears into a pinion on the main axle, and cast in the same piece with it is a bevel wheel, which drives the bevel pinion keyed on the crank shaft of the implement. This gearing is enclosed in a casing, which protects it from dirt, and also serves as a guard to prevent the entanglement of the reins The lifting apparatus consists of an ordinary lever and chain attached to a quadrant that is fastened to the joint bar by a double stud and bolt. A short slotted lever is fastened to the joint bar by a bolt and stud, and in this lever is a notch, there being a corresponding notch in the end of the joint bar, which forms a fulcrum for the lever to work upon. The quadrant passes through a slotted lever, and thus, if the outer end of the guide bar is in a hole, the driver can raise it to a lever position, as soon as the inner end begins to move, and by the same means the finger bar can be raised high enough to clear obstructions in the field. The guide in which the knife works is formed with a step next to the finger bar in order to increase the slanting edge under the guide, and prevent the accumulation of dirt under the knife. Thus referring to Figs. 6 and 6, the spur wheel *d* is keyed to the main axle *t*, and gears into the pinion *e*, cast in the wheel *f*, and running on the stud *u*. The wheel gears into the pinion *g*, on which is cast the bevel wheel *h*. The pinion *i* is driven by the wheel *h*, and on the other end of the shaft is the crank disc *k*, to which is attached the end of the connecting rod *m*. In this rod is a tube containing oil, and at every revolution of the disc *k*, a quantity sufficient for lubrication is liberated. The other end of the connecting rod is attached to the knife bar. The dotted lines *n n* show a stay or support secured to the frame *a* at the back of the implement and to the finger bar *o*, and joint bar *l*, to keep the frame in position. The lever *j* is pinned at *n* on the frame *a*, which carries the crank lever, and to which is attached the chain *r*, and the quadrant *q*, which passes through the slotted lever *p*, (see Fig. 7), attached to the finger bar, the quadrant being connected to the joint bar. This is the lifting arrangement. For stopping or starting the implement, the lever *s* is employed, having at its lower extremity an eccentric working on a stud *v*, on which the wheel *e* and *f* revolve. This is effected by moving the lever from 1 to 2, as shown in dotted lines. The guide in which the knife works is shown at c_1, and the notch already mentioned is at t^1. This forms part of the guide for the knife to work in. The slanting edge c^1 prevents the accumulation of dirt upon the guide. Figs. 1 to 4 also show the manner in which Messrs. Kearsley form the fingers of their implements. The fingers 1 are made in the ordinary way, but in the bottom is formed a recess 4, and on the top is placed a steel lining 2, secured to the finger bar 3, by the bolt 6, the squared head 7, of which lies flush in the recess 5, the same bolt on the other side being secured by the nut 8 in the recess 4. The front end of the steel lining is made with a tongue that fits into the recess shown on the top of the finger bar The advantages claimed by this arrangement are, that there are no projecting nuts to offer any resistance or obstruction, or around which the cut grass can gather.

PHOTOGRAPHERS will find the following a useful glass-cleaning preparation; water 1 pint, sulphuric acid ½ oz., bi-chromate of potash ½ oz. The glass plates, varnished or otherwise, are left for 10 or 12 hours, or as much longer as desired in this solution, then rinsed in clean water and wiped dry with soft white paper. The liquid quickly removes silver stains from the skin without any of the attendant danger of cyanide of potassium.

ADESIVE fly paper is made by boiling linseed oil to which a little resin has been added, until a viscid mass is formed. The latter is then spread evenly upon the paper.

HOP YEAST.—Boil 5 gals. water and 10 ozs. hops together from 10 to 15 minutes; put 6 lbs. flour in a tub, to which add as much of the boiling liquor as will be necessary to make a thick paste. When the remainder of the liquor is perfectly cool, add it, together with 1 gallon of stock yeast, to the paste, when the whole will be ready for use.

ORIGINAL DESIGN FOR A SIDE-BOARD

The side board is designed so that it may be executed with equal good effect in the plain Oak or Walnut or in ebonized Mahogany, partly gilt, and the small centre panels of back and doors painted with fruit or flower designs. If oak or walnut is employed, or a combination of the two,—which would have an excellent effect,—the small panels, instead of having painted decoration, should be carved as shown in the drawing. The hinges and drawer handles should be of white metal or polished brass, to suit the material used for the side-board. The style, a free rendering of English late 17th century work, is one which from its simplicity of construction admitting at the same time of rich detail, renders it the most suitable for modern requirements.

The side-board is from the design prepared expressly for the *Furniture Gazette* by Mr. W. C Brangwyn, a gentleman of great artistic ability, with whose name most of our readers will be familiar. We shall be happy to give insertions to meritorial designs by Canadian mechanics of an original character.

REFERENCES TO PLATE.—A, is detail of cup-board door, drawing half full size, or 1½ inch scale. B, Mouldings of top. C, Cupboard doors. D, Shelf. E, Back panels F, Half drawer front G, Section of drawer-front

ORIGINAL DESIGN FOR FURNITURE.

CORNER BRACKET.

We give in this issue the front view of a bracket in the Moorish style, which differs from the one we give in having arches in front of its shelves thus giving it a somewhat architectural appearance. It is also capable of more decoration than the other, for it would be perfectly consistent in style if made of cheaper wood than the oak recommended for our previous design, and afterwards elaborately painted and gilt. Indeed it is hardly possible in Moorish decoration to lay on too much gold and colour. As, however, it is impossible in so small a drawing to give details of ornamental work, we have shown it as it would appear made in one of the ordinary woods used in the furniture trade. It is intended as a receptacle for an Algerine coffee service, bubble-bubble and other pipes, tobacco-box, pastile burners, scent-vases, &c., and would be an appropriate piece of ornamental furniture in the houses of gentlemen of eastern tastes and habits.

The plan of the bracket is so simple that we feel that we should be writing unnecessarily were we to trouble our experienced readers with a step-by step description for its manufacture.—*Furniture Gazette*.

DESIGN FOR A BRACKET VALANCE.

The design for the Valance requires no particular description, both material and colour should match with the furniture of a room. Red, black and gold, or blue scarlet and gold afford a rich and pleasing contrast.

RUSTIC BASKETS, VASES, &c.

In connexion with our remarks on rural ornamentation, we furnish in this number some excellent designs of Hanging Flower Baskets, &c Now is the time to make a collection of knotty roots and crooked branches for the purpose. Wild Vine, Briar and Cedar, furnish excellent roots and branches for the purpose, but in clearing land a great variety of roots from different kinds of trees, can be easily obtained suitable for Rustic Work. The more grotesque the shape, the more suitable for the purpose.

The roots should be well washed and the tough bark scraped off and then kept in a damp cellar until required for use. The branches and roots should be entwined around a wooden bowl and firmly attached to it with malleable iron tacks or nails. After the rustic work has been put together, it should be stained with a coat of thin asphaltum, and afterwards varnished with shellac, or common furniture varnish: some use varnish tinted with yellow ochre Boys could employ their spare time in winter making up for sale these pretty Rustic Baskets and Vases. They are worth, if nicely made, from $1 to $3 each, according to size, &c.

We shall continue to furnish designs of Rustic Work for various domestic purposes.

NELSON'S PORTABLE DRILL.

The most striking feature of the machinery exhibits at the Manchester Show, Cheetham Hill, was certainly the numerous and valuable specimens of engineers' tools. And this was very suitably the case, since the exhibition was professedly for labour-economising machinery. Of course the prime and most important economy of labour has been attained by the introduction of motors operated by heat or other natural motive power in place of human or animal labour. The wonderful economy effected in this way must strike any observer when looking at any steam-engine, and ascertaining its actual horse-power, to figure to the mind's eye the immense number of horses and eight times that number of men which would be needed to effect the same work as is produced by the small compact machine before him.

This special field of prime motors forms, perhaps, the most important field for the economy of labour, but there is also another large field of operation in which nearly as much may be effected. It is that of machine tools.

After the more laborious part of actual motion had been attained, there still remained for a long time in the history of engineering progress, a necessity for the handicraft skill of the artisan in the production of the finished work. The next step in progress was the substitution of the constant repetition of handicraft skill by the unerring accuracy of self-acting tools, so that the skilled work having been once done on the machine was recopied faithfully on to the work. We have thus now in our large workshops got into a class of machinery in which the work is simply passed through a series of machines, and is thus turned out finished from the rough entirely by machine-work.

It is not our intention, however, to follow here the development of this class of machinery, but to draw the attention of our readers to an intermediate class of tool, which in the powerful strides of improvement, as above indicated, has been rather overlooked and passed by. This intermediate class of semi hand-machinery is nowadays obtaining a little more of the attention it deserves, and we thus illustrate Nelson's Portable Drill, which forms a very worthy and useful representative of this class.

It is all very well when manufacturing new work, much repeated, on a large scale to make the tools subservient to the work, or "special," so that the work may be brought to and passed through the tools, but there are many descriptions of work, both repairing and large accidental work, which cannot be managed and undertaken in the usual fixed shop tools.

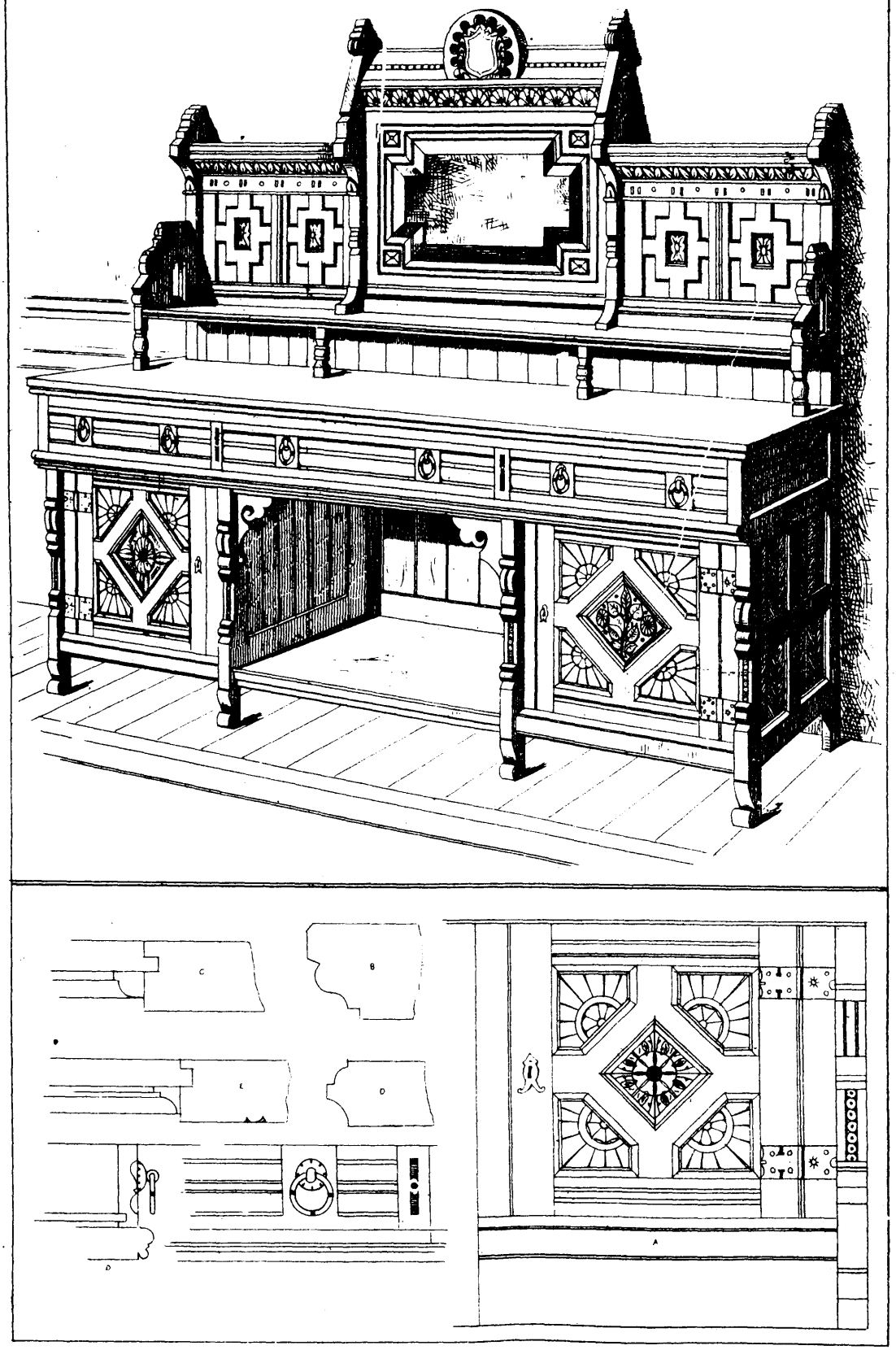
This is so far the case that we would engage that in any workshop a very considerable number of men will be found employed upon erected work, which could not be brought to machines, either in altering or adding last touches, in improving, or repairing It is a matter to be noted and regretted that this very necessary branch of manual labour has not hitherto met the attention it deserved, to supply such labour with the most convenient and effective tools.

Take the operation of drilling. How many holes cannot be drilled until the work is put together, and thus the position determined? How many holes are forgotten to be drilled until the work is too far advanced to go under the machine? These holes must now be all drilled by hand, and the old ratchet-brace by which such work is usually effected is essentially deficient, in not being a self-contained tool. The ratchet-brace cannot be used without an elaborate extraneous bar and gear against which to take the thrust.

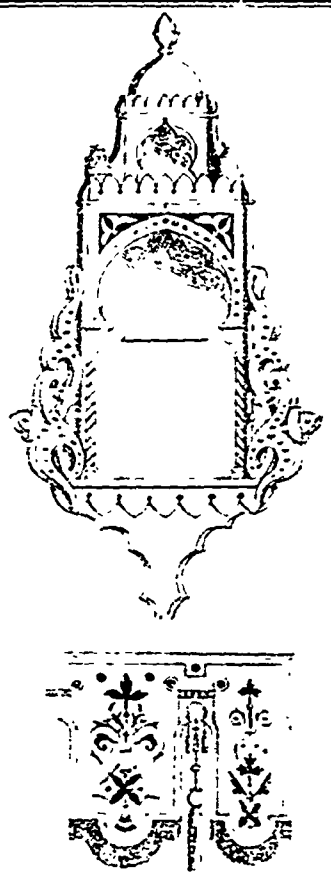
Referring to our illustration, we see that the essentially noteworthy and important improvement in this tool is in its being a self-contained and portable drill. It is ready to be fixed by a holding-down bolt to any work, metal or wood, that it might be required to pierce. It is thus ready for fixing and work without any vexatious forging or altering of bars and rests, as is too often the case in ratchet-brace drilling.

The motion by the handle and bevel gear is also a quick one, which gives it a further advantage over the ratchet, and is always in the direction of the cut and doing work; whilst in the case of the ratchet every stroke has its back stroke, and every revolution of the drill a large number of effective and non-effective strokes.

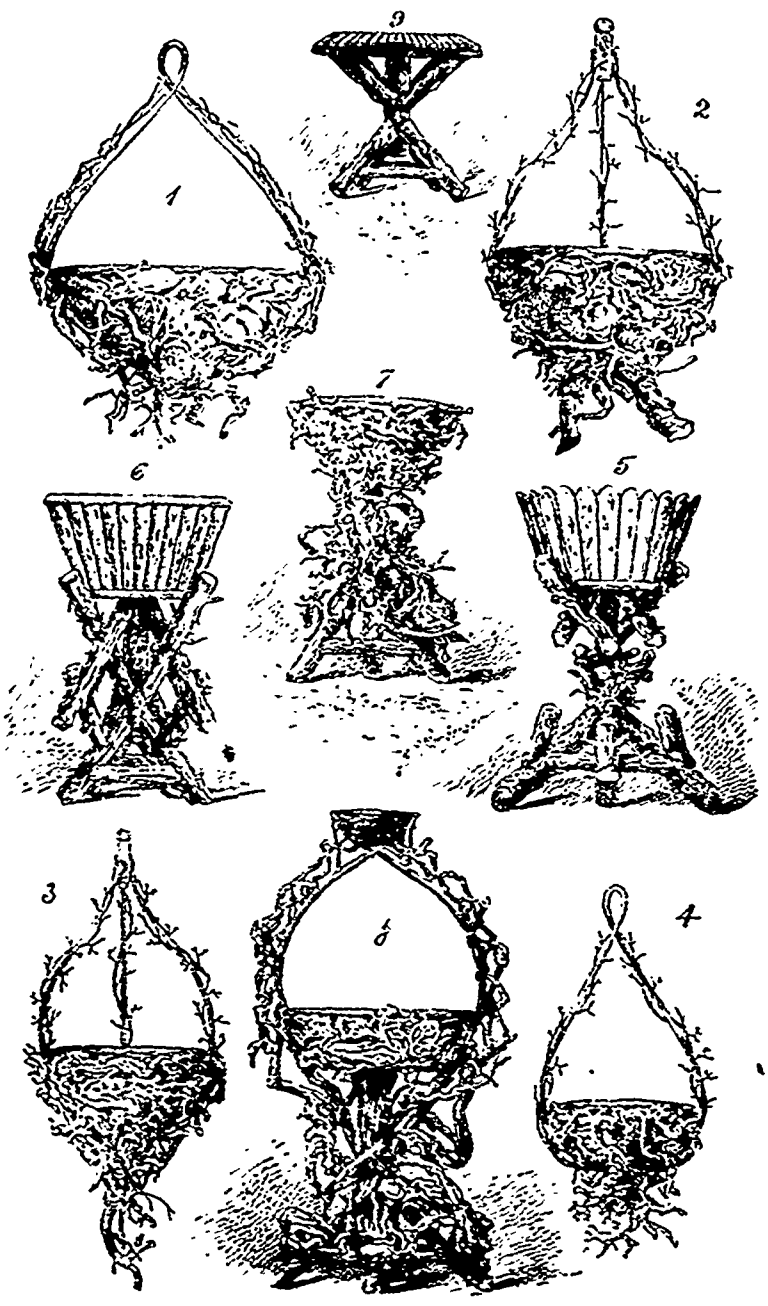
The down pressure of the drill is obtained in a very simple and effective manner by a small auxilliary handle and bevel gear, with the ordinary screw thread on the verticle spindle. This will give a very steady pressure and may be regulated to



ORIGINAL DESIGN FOR A SIDEBOARD.—(See page 267.)



DESIGN FOR A BRACKET AND VALENCE.



RUSTIC BASKETS, VASES, &c.—(See page 267.)

NEW FIRE-PROOF CONSTRUCTION.

A new and cheap plan for rendering buildings free from danger of conflagration has been produced in many prominent buildings of Chicago, by Mr. James John, of 457 Wabash avenue, in that city. The mode of application of the invention consists of first nailing rough boards to the under side of the furring, between the wooden joists, and then to fill in even with the furring with coarse hair mortar, gauged with sufficient plaster or cement to make it set. On the mortar, is cemented a row of square boxes, cast also of mortar above which a second row is laid so as to break joints. The boxes are slightly smaller than the spaces in which they are laid, so that the intermediate crevices can be filled up with a liquid concrete. Finally a coarser composition, like the concrete of lime, cement, plaster, etc., with screened ashes of cinders, is packed on top of the boxes to a thickness of one inch. This leaves about half an inch to the top of the strips on the joists to which the floor is nailed. The ceiling of the room beneath the joists is formed by securing sheet-iron strips to the latter, close to the wall, and extending, across and between them, iron wires some two or three inches apart, after which more sheet-iron strips are nailed on to secure the wires to the furring. Over the latter the plastering is laid. The weight of filling and concrete is 20 lbs. to the foot when dry, and it costs about $2.25 per yard. The inventor claims that the joists thus protected can not burn.

MR. FORTIS HERMANN, says *Les Mondes*, is testing a machine which is moved by articulated feet which are successively planted upon the ground. Two feet act from the front body and two from the rear, being pressed downward by steam, which besides, in an horizontal engine, oscillates rods which, acting upon the feet, cause the apparatus to drag itself along. From experiments cited, it appears that the feet, when shod with rubber and charged with a weight of 2·2 lb per 0·4 m., indicated an adhesion equal to 0·75 of the weight of the motive machine. The apparatus travels at a rate of from 4 to 4·8 miles per hour; and by a new arrangement in which one pair of feet trot while the other pair amble, it is expected to run at the rate of 12 miles. It will ascend grades of 1 in 10 with quite heavy loads.

any requirement, but in ordinary work the small handle may be made to catch in a lot of the main handle, and thus the drill becomes self-feeding. What an improvement this forms over the very clumsy and uncertain manner of setting up the ratchet-brace with a spanner. Any operator or employer of such work will remember how often the necessary spanner is not to be found when wanted, and how apt the workman is to put too much feed on suddenly and jam or break his drill.

The above detailed advantages over present methods in use, will at once give the drill we illustrate its true value and appreciation as a most useful and labour-saving tool.—*Iron.*

CARVER'S MULTIPLE DRILL.

The science of tool-making is now becoming one of the leading features of English engineering. We say English, for that includes the great r portion of the tool-manufacturing trade, with, perhaps, the exception of America.

It is interesting to note the turns and developments of engineering ingenuity as it is to be seen in the history of the past half century. At first, all our skill and attention was required for the one great problem of the substitution of manual labour to produce motion, by the expansion of steam under the influence of heat. This was a stupendous innovation, and the engines of Newcomen and Watt deservedly attracted all attention and praise.

For some time, and even up till now, the improved forms of, and alterations in, steam motors have claimed a large share of attention and ingenious contrivances But, latterly, it has been seen that one of the most successful and remunerative adaptations of mechanical contrivance consists in the guidance of motion to destined ends rather than in the simple production of that motion. This was a very large and new field of production, but it was rapidly occupied and energetically followed up. Sir Joseph Whitworth has made himself a never-dying reputation by the mark he has left in the science of tool-making. His first efforts were directed to systematising all oft-repeated and universally-used articles—such as bolts and nuts.

When once those things had been systematised and reduced to some standard, it was an easier matter to set about their manufacture on a large scale. The idea was then developed, which rules at present in all machinery, viz., the copying principle, by virtue of which a tool carries in itself a copy of the work required to be produced, and can thus reproduce or copy it most accurately and faithfully, as often as may be desired, without special handcraft skill on the part of the worker. This is the *raison d'être* of the self-acting screw-cutting lathes, planing and shaping machines, &c.

Our present times have marked a further era in tool manufacture, and that is the construction of tools which shall produce the maximum amount of work in the minimum time. These are the class of machines which are the mainstay and backbone of our large manufacturers. In these days of keen competition the man who can manufacture details a few pence cheaper than his neighbour cuts him out of the market. We have then, now arrived in our tool designing very much to the consideration of how can time be best saved and employed with the tool.

The answer to this is to be found in the fact that in self-acting tools—as most are, nowadays—the attendant has very often little else to do than to sit still and watch his machine do the work. He might be much more profitably employed in setting other tools to fresh work But as he should not move far from his work in any case, it follows as a necessity that the duplicate tools must be contained in the one machine. This has given rise to the designing and construction of a large class of machines with multiple tools and tool-rests.

The multiple drill of William Carver, which we this week illustrate, is a good instance of such a tool containing, as it does, four drills which might each and all, if occasion should arise, be set to work under the superintendence of a single attendant. Another most useful, and, perhaps, most practical adaptation of this drilling machine would be the saving in time required to change drills so frequently, if even only one drill was used at a time.

In many cases a hole is required to have two different diameters in its length, and may also require to be countersunk. Here the value of such a drill would be appreciated, as each different tool might be used in succession indefinitely without change of drill. And, again, it is frequently the case when a long series of holes, or holes of a considerable depth forming a long job, have to be drilled that some other pressing job steps in, and must of necessity be done at once. In this machine such a case need nor be inconvenient in the slightest degree, since the required work of emergency could be at once effected without disturbing the arrangements or even progress of the principal work in hand.

Referring to the illustration, it will be seen that the construction of the frame is strong and compact, the drill being only intended for comparatively light work. The main portion is a stout pillar to the side of which is attached a travelling table operated by the usual vertical screw and bevel gear. Upon this pillar stands a table frame bolted together with stretchers at the four corners. This table frame carries the row of drills in the front and a long band pulley at the back.

On the top is fixed the cone pulley from whence the primary motion is derived. This motion is conveyed by means of a suitable strap round the two auxiliary guide pulleys to the bottom of the vertical drum-spindle, which carries the long drum at the back of the top framing. Upon this runs the different bands driving each separate drill and from which the driving speed may vary in the case of each drill by having different sized pulleys on each drill-spindle. The feed-motion is put on by the vertical movement of the table, which is produced by the lever handle at the side of the table. The lever is counterbalanced by a weight to support the weight of the table. A foot-treadle is also added by which the pressure of the feed can be increased when needed for large holes. There is also a wheel-handle with bevel gear at the bottom by which the table can be rapidly run up or down when necessary.

The whole arrangement of the tool is novel, and shows considerable ingenuity and neatness in design. We are pleased to see that particular attention has been paid to the bearing parts, which are case-hardened and finished with care. As a machine is essentially a copyist, it is of the utmost importance that a machine should have no defects to copy; and it is undoubtedly well worth any manufacturer's while to lay out a little more in getting a first-rate tool than to buy one which can only do defective work by reason of its inherent deficiencies. There is nothing that pays a manufacturer better than to use the best class of tools, and thus to produce the best description of work. A slackness in the spindle-bearing of a drill or lathe, produced by bad fitting or abnormal wear, will always tell on the quality of the work, preventing accurate fit and steady progress of manufacture.

We must congratulate Mr. Carver on having produced something novel and advantageous in the form of an improved tool, and also for having had sufficient discrimination to ensure the efficient performance of the same, by sound and excellent workmanship—*Iron.*

A PREVENTIVE FOR SHAFTING ACCIDENTS.

There are no accidents more common in large manufactories, and few more fatal, than those caused by the engagement of some portion of a workman's garments with a swiftly rotating shaft. The loose dresses of female operatives are especially liable to become entangled in countershafts placed near the floor, or in the revolving shafting of the machines which they may be attending. There is a very simple way of rendering these casualties impossible and this without necessitating the usual plan of constructing a railing or fender about the moving piece. It is simply to cover the shaft with a loose sleeve along its whole length The sleeve may be of tin or zinc and made so as to be removable if desired. The friction between it and the shaft would be sufficient to cause its rotation with the latter but of course, in event of a fabric becoming wrapped around it, it would quickly stop, and allow of the easy extrication of the same. The sleeve should be lined with leather both within and at the ends in order to prevent noise

The same idea in the shape of loose covers might readily be applied to cog wheels or pulleys, and thus prove a valuable safe-guard against loss of life or limb.

TRAVELLING STONE BREAKER FOR PREPARING BALLAST.

CONSTRUCTED BY MR. H. R MARSDEN, ENGINEER, LEEDS.

We annex illustrations of a neat arrangement of combined stone breaker and engine mounted on a travelling carriage, which has been constructed by Mr. H. R. Marsden, of Leeds, for the London and North-Western Railway Company, by whom it is employed for breaking ballast, preparing materials for concrete, &c. The two upper figures of our engravings show the whole arrangement complete, while the third figure gives a perspective view of the machine and engine apart from the carriage.

The conditions to be fulfilled in designing this machine were: first, that it should be capable of crushing large masses of furnace slag, limestone, granite, or other available materials for ballasting, or for making concrete; second, that it should be transportable from one part of the line to the other; third, that it should be self-contained and mounted on one frame, so as to require no fixing beyond the application of the brake to the wheels; and, fourth, that it should elevate the broken material, so as to deliver it into a truck standing on an adjoining siding. These conditions have been well fulfilled, as our readers will see from our description.

The stone-breaking machine proper is one of the most powerful yet constructed, and it is capable of dealing with a piece of the hardest granite weighing 15 cwt. The dimensions at the mouth, or opening at which the stone is introduced, are at the top 24 in. by 12 in., and at the bottom 24 in by 1 in., adjustments being provided so that the machine can either break fine gravel or turn out the stone in the form of 3-in. cubes for the foundations of the road. The weight of the whole machine is 26 tons, and it is capable of breaking about 150 tons of stone per day. We may mention that a less powerful machine constructed by Mr. Marsden (and which had been guaranteed to deliver per day of 10 hours 100 tons of 1½ in. cubes for concrete, and also a large percentage of small and gravel) was recently tested, and found to turn out the broken stone at the rate of 120 tons in 10 hours. Of course, however, to obtain the full duty from such a machine care has to be taken to make proper arrangements for feeding and taking away the material.

To return, however, to the subject of our engravings. The machine illustrated is of the improved double-acting type, in which one revolution of the crank gives two vibrations of the jaw, and it is similar in principle to the smaller-sized machines made by Mr. Marsden, and which have worked so well in practice. It is driven by a single cylinder 14 in. in diameter with 14 in. stroke, the steel piston rod 2¾ in. in diameter being keyed into a strong crosshead carrying a couple of slipper blocks which work in V guides bolted one to each side of the machine. These guides are fitted with slips to take up wear. To prevent dust and grit from getting into the cylinder, a second stuffing-box is placed on the piston rod outside the ordinary one, this auxiliary stuffing-box being charged with cotton waste, which can be easily renewed. This arrangement is found to be effective.

By means of a strong link the piston rod is coupled direct to the vibrating lever, which rocks to and fro with the forward and return strokes of the piston. On each side of the rocking lever are toggle plates, one of these plates extending from the lever to a fixed abutment on the frame, while the other is interposed between the lever and the vibrating jaw, which forms the leading feature in this as in all Blake's machines. The toggle plates rest in notches formed on each side of the head of the rocking lever, this lever rocking on a fulcrum, which is prevented from moving vertically by its being carried by dies, which have a horizontal movement in ways to which they are fitted. Thus, as the rocking lever vibrates moving the toggle plates into and out of the straight line, the lower end of the rocking lever itself moves horizontally to the extent of half the movement given to the vibrating jaw. As the toggle plates are placed twice in a straight line for each revolution of the crankshaft, it follows that the jaw vibrates once for each single stroke of the steam piston; and it is only by such an arrangement of parts that an ordinary steam engine can effectively be coupled direct to the machine.

To control the length of the stroke a couple of connecting rods pass back from the crosshead one on each side of the cylinder, these connecting rods taking hold of crank pins fixed on the heavy flywheels as shown. These flywheels, which are 4 ft. 5 in. in diameter, weigh one ton each, and they are mounted on a shaft which passes across the rear end of the cylinder. This shaft has bearings 4½ in. in diameter and 8 in. long, and it is mounted in bearings divided into three parts and having wedge adjustment. In regular work the crankshaft makes 150 revolutions per minute, and the flywheels serve a good purpose in accumulating power to overcome any exceptional momentary resistance which might otherwise overpower the engine. The valve chest is placed at the top of the cylinder, the valve—which is accessible without breaking steam or exhaust pipe joints—being driven through a bell-crank lever, one arm of which is coupled to the valve spindle while the other is attached to a short eccentric rod which is led up to it from the crank shaft. The governor is simply arranged and has an efficient control over the engine.

The elevators are set at right angles to the main frame and radiate round the shaft at the bottom, so that they may be folded close to the frame for travelling or be inclined outwards so as to deliver the broken material into a truck standing on an adjoining line. The elevators consist of a four-ply india-rubber band 13 in. wide, having open buckets rivetted to it close together as shown. A hood at the top of the elevator shelters the buckets from the wind at the moment when they are delivering, and thus prevents the dust from being blown about.

The boiler is of the vertical type, and was made by Mr. F. W. Webb, at Crewe. It is fed by an injector. The whole machine with its boiler is, as will be seen, carried on a strong framing made of wrought iron backed with wood and mounted on six wheels. The machine can thus be readily transported to its destination, which is generally some road-side quarry or stray heap whence the broken material can be taken away in trucks.

Since the construction of the first machine Mr Marsden has had to supply the London and North-Western Company with a second, and this is perhaps the best testimonial to the efficiency of the arrangements.

THE IMITATION OF LACE ON SILK BY PHOTOGRAPHY.

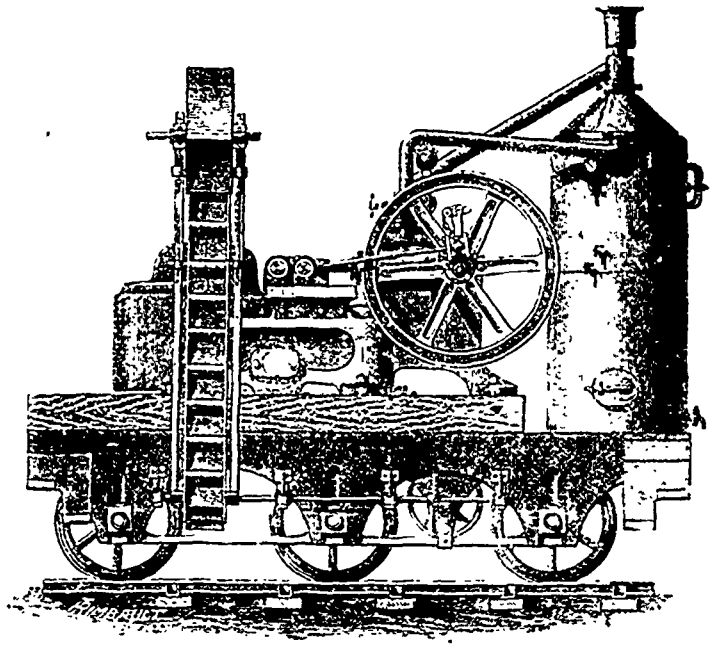
A new and beautiful application of photography has lately appeared in England, by the aid of which any lace design can be transferred to silk, so that the latter material appears to be covered with the delicate and costly fabric. The lace to be copied is secured in a frame in contact with sensitive albumenized paper, and exposed to the light until a very deep impression is obtained. This is then fixed, and the paper, washed and dried, forms a perfect negative. Another piece of paper is then sensitized with bichromate of potash and gelatin, and exposed under the negative. Inking with lithographic transfer ink follows, and the paper is placed in water and lightly rubbed with a sponge. This throws out every detail of the inked spaces, the rest remaining white or free from ink. The impression is lastly transferred to a lithographic stone, and thence printed upon the silk by the usual process.

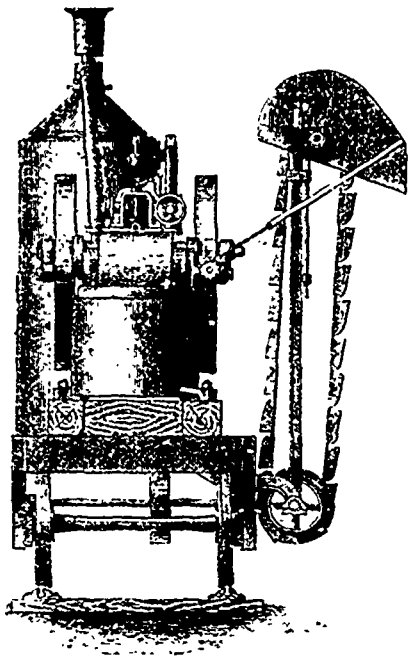
VENTILATION ON BOARD CATTLE SHIPS.

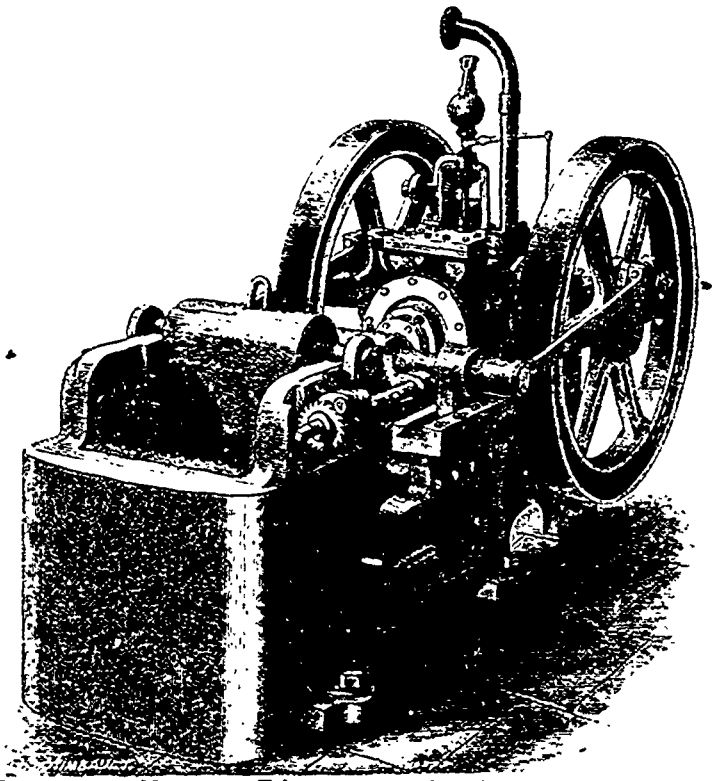
In a very fine iron screw steamship, *Royal Dane*, Capt. Webster, recently built by Messrs. J Wigham Richardson & Co., Neptune Shipyard, Low Walker, on the Tyne, for the Tyne Steam Shipping Company, and intended for the trade between Newcastle and Copenhagen, arrangements are specially made for the cattle trade, the company to whose order she has been built having contracted to carry from Copenhagen to the Tyne no less than 500 head of cattle and sheep every week all the year round. The decks upon which the cattle will be berthed are lofty and spacious, and provision for supplying the animals with fresh air has been made by means of a large number of ventilators, and also by a double hatchway, through which a constant current will be maintained from one end of the ship to the other. When in port, ventilation will be provided by means of a steam-engine. The latter provision is rendered necessary by the deficiency in the accommodation at present provided at Newcastle Quay for the landing of cattle, so that vessels have frequently to be at the quay for twelve hours and upwards after arrival before they can discharge their cargoes.

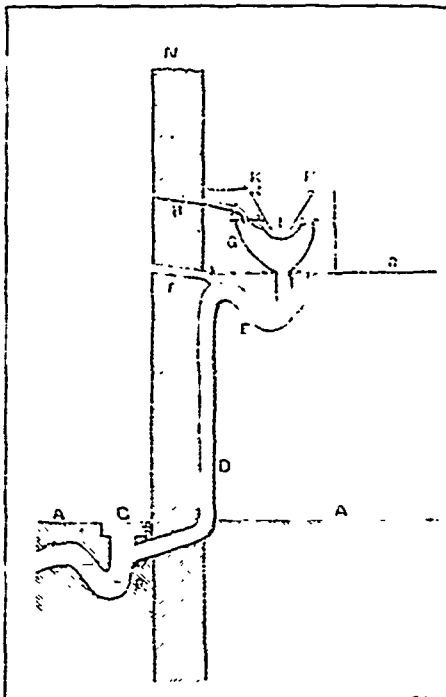
TRAVELLING STONE BREAKER FOR PREPARING BALLAST.

Constructed by Mr. H. R. Marsden, Engineer, Leeds.—See page 271.









Plan for a Water Closet.—See page 274.

To make Apple Molasses.—Take new sweet cider just from the press, made from sweet apples, and boil it down as thick as West-India molasses. It should be boiled in brass, and not burned, as that would injure the flavor. It will keep in the cellar, and is said to be as good, and for many purposes better, than West-India molasses.

We are informed, says the *Electrical News*, that the telegraph lines of Sydney, New South Wales, extend over 7533 miles. The receipts last year were £39,379 19s. 2d. The number of messages transmitted, 569,001. The number of employés, 329.

Coopers' Adze.—The *Cooper's adze*, with its short handle, is a wonderful tool in expert hands. It will split and pare and notch a hoop-pole, alone making a hoop.

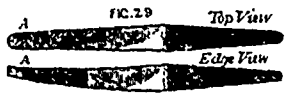
Restigouche Bridge.—The Restigouche bridge on the Intercolonial Railway has been thoroughly tested. The deflection of each span under a weight of 81 tons was only from ¼ in. to ½ in. This bridge connects the provinces of Quebec and New Brunswick. It is 1000 ft. in length, and has five spans of 200 ft. each.

HAND TURNING.

By Joshua Rose, of New York.

BRASS WORK.

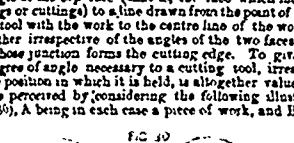
For roughing out brass work, the best and most universally applicable tool is that shown in Fig. 29, which is to brass



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 forefinger 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. Now 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, applies 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 a 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 30), A being in each case a piece of work, and B a tool.

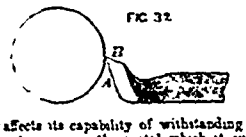


The tool edge, as applied in No. 1, will act as a scraper; whereas in No. 2 it will act as a cutting tool.

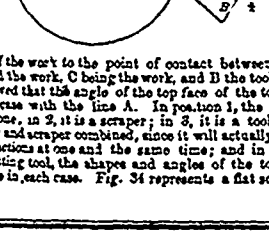
Now let us take a tool applied to flat surfaces, as in Fig. 31,

A representing a piece of flat metal The tool, if applied, as shown at 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 springing of the tool.

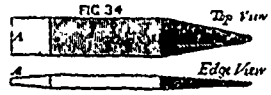
The angle of the back or side face of any tool (that is, the face A in Fig. 32), either to the top face B, or to the work, does not in any case determine its tendency to cut or scrape,



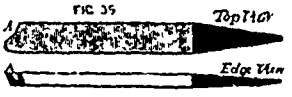
but merely affects its capability of withstanding the strain and wear due to severing the metal which it cuts Nor is there any definite angle at which the top face B to the work converts the edge from a cutting to a scraping one. A general idea may, however, be obtained by reference to Fig. 33, the line A being in each case one drawn from the



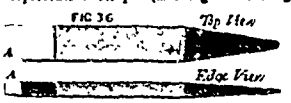
centre of the work to the point of contact between the tool edge and the work, C being the work, and B the tool It will be observed that the angle of the top face of the tool varies in each case with the line A. In position 1, the tool is a cutting one, in 2, it is a scraper; in 3, it is a tool which 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. 34 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. 35, the angle being shown at A. On all



brass work, it is, however, better to dispense with an angle. Fig 36 represents a scraper (A being the cutting edge)



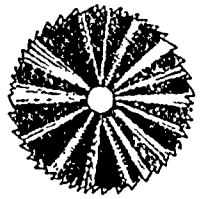
designed for operating close down to the lathe centre or in a square corner such as is formed at the junction of a head or collar upon a shaft or bolt This tool may also be turned upside down so as to form a right or left-hand tool

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. 35, 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 then striking the latter lightly upon a block of wood or a piece of lead, the latter operation being much the 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 film 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 slightly 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 surface of 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.



IMPROVEMENT IN CIRCULAR SAWS.

E. Andrews, Williamsport, Pa., is the author of this improvement, which consists in arranging the teeth in groups, in which the first tooth shall be the longest, and the succeeding teeth shall gradually diminish in space to the last one in the group; but all the teeth, whether longer or shorter, have the same depth radially. The object is to make the saw cut with less applied power, or do more work with a given power. The saw is alleged to revolve with a series of reliefs from the usual constant resistance of the wood.

Fifty Dollar Recipe for Tanning Fur and other Skins.—Remove the legs and useless parts, soak the skin soft, and then remove the fleshy substances, and soak it in warm water 1 hour. Now take for each skin borax, saltpetre, and Glaubersalt, of each ½ oz., and dissolve or wet with soft water sufficient to allow it to be spread on the flesh side of the skin. Put it on with a brush thickest in the centre or thickest part of the skin, and double the skin together, flesh side in; keeping it in a cool place for 24 hours, not allowing it to freeze. Then wash the skin clean, and take sal-soda, 1 oz.; borax, ½ oz; refined soap, 2 oz; melt them slowly together, being careful not to allow them to boil, and apply the mixture to the flesh side as at first. Boil up again and keep it in a warm place for 24 hours; then wash the skin clean again, as above, and have saleratus, 2 oz; dissolved in hot rain water sufficient to well saturate the skin; take alum, 4 oz.; salt, 8 oz.; and dissolve also in hot rain water; when sufficiently cool to allow the handing of it without scalding, put in the skin for 12 hours; then wring out the water and hang up for 12 hours more to dry. Repeat this last soaking and drying 2 or 3 times, according to the desired softness of the skin when finished. Lastly finish, by pulling and working, and finally by rubbing with a piece of pumice-stone and fine sand-paper. This works like a charm on sheep-skins, furskins, dog, wolf, bear-skins, &c.

The vapour of iodine may be heated to redness like a solid or liquid. It then emits the less refrangible luminous rays which furnish a continuous spectrum. A spiral of fine platinum wire is sealed in the interior of a glass tube eight millimetres in diameter. Pure iodine is then introduced, and the tube sealed after the air has been expelled. If the iodine be then volatilised and the wire ignited by a battery, the spiral appears surrounded by a flame of a very rich colour which yields the well-known interrupted spectrum.

HOW TO PUT UP A WATER CLOSET.

(From Scientific American.)

Our engraving represents sectional views of the water closet in the upper floor of a two story house. A A is the level of the surface of the ground at the back court and of the kitchen floor. B is a 6 inch vitrified fire clay siphon trap, with an open iron grating. C, at its top, which grating may be hinged. D is a 4 inch soil pipe from the water closet; it is here shown coming down inside the wall, in other cases it may be carried down the outside. One advantage of such pipes being carried down the inside is that they are more likely to be protected from frost. F is an ½ inch or 2 inch lead pipe for ventilating the soil pipe In this case it is carried through the wall, in other cases it may be carried up through the roof. G is the water closet trunk, made of iron, it being a pan water closet, which is here shown. H is a ¾ inch lead pipe carried through the wall and put in to ventilate the trunk, or that between the water in the pan, I, or basin, J, and the water in the siphon trap E. This ¾ inch ventilating pipe, H, is a very important one, and its use ought to be the rule in place of the exception, as is at present the case. It works as follows: When the handle of the water closet is lifted, then any foul air lying in the trunk, in place of coming out into the apartment, is sent outside with a rush through this pipe, H; besides, being open to the air, it tends to prevent the accumulation of such foul air in the trunk.

In order to keep the outer orifices of the pipes, F and H, always open, it is a good plan to so der on one or two pieces of copper wire across them. J is the water closet basin, and the two small circles shown, underneath K K, are the india rubber pipes. L is a 3 inch zinc ventilating pipe carried up through the roof to ventilate the space or inclosure in which the water closet is situated. M is the gas bracket right below it, helping, when lighted, to cause an upward current. The empty space at N is supposed to be the water closet window. O is the surface of the floor of the upper flat. No gas can accumulate in the soil pipe, for the pressure of the atmosphere on the surface of the open grating, C, tends to send a current of fresh air through the soil pipe and out at the ventilating pipe F.—*W. P. Buchan.*

USEFUL HINTS.

Rendering Deal Boards Incombustible.—Paint the boards with a diluted solution of waterglass, or soak it in a strong solution of alum and sulphate of copper, about 1 lb. of alum and 1 lb of sulphate of copper to 100 gallons of water, or whitewash it two or three times. To make the glue referred to mix a handful of quicklime in 4 oz. of linseed oil, boil to a good thickness, and then spread in the shade to harden. This may be dissolved over the fire, and used in the same manner as ordinary glue.—

Brilliant or Stucco Whitewash.—Take half a bushel of unslaked lime; slake with boiling water, keeping in the steam. Strain the liquor, and add to it a peck of clean salt, dissolved in hot water; 3 lb. of good rice, ground to a thin paste, half a pound of powdered Spanish whiting, and 1 lb. of clean glue, previously dissolved. Add 5 gallons of hot water, stir well, and let it stand seven days. It should be applied quite hot, from a kettle over a portable furnace. One pint of the mixture to a square yard. Colouring may be added to give any tinge required.

Fastening Marble to Wood.—Drill a hole in the underside of the table-top, ½ in. wide, by ⅝ in. deep. Take a good 3-in. wood screw, and screw it in the top of the pedestal, leaving the head to project rather more than ½ in., invert the table-top, fill the hole with Portland cement or plaster of Paris, and spread a little round the hole; then place the screw-head in the hole, see that it beds well, and leave it to set. A large table-top should have three screws, but for a small top one is sufficient.

Soldering Iron.—Clean the iron, moisten with solution of chloride of zinc, to which sal ammoniac (chloride of ammonium) has been added; this will be found to take soft solder readily when applied with the common copper bit. The iron should be washed well immediately afterwards to prevent injurious action from the acid.

THE VENTILATION OF SEWERS.

We commend the following remarks from the *London Builder* to the notice of the City Engineer, and Sanitary Committee of the city of Montreal, and to the Corporations of all cities. We shall have more to say in a future number on the important subject of city drainage, and trust the tax-payers of Montreal will not be more heavily burthened by expensive theoretical experiments, or costly surveys, until simple and common sense preventives to foul gases issuing from sewers is properly tested.—Ed.

"Might I trespass upon your valuable space in drawing attention to a very simple yet effective invention for thoroughly ventilating sewers of their poisonous gases?

"The system to which I refer is that known in this part of the country as "Stott's patent ventilator," a most useful and inexpensive apparatus, and one which might easily be adopted in all manufacturing towns.

"An air-tight sheet-iron door is fixed to the ash-hole of a boiler, and connected with the drain by stoneware pipes: the fire is thus fed by the noxious gases, and a continual flow of air drawn from all the adjacent sewers.

"For the last few years I have advocated open grates to admit the fresh air into the sewers; however, during long droughts these are objectionable, for unless the sewers are properly flushed with water, the gases generate, and escape into the streets, to the annoyance of those who live in the neighbourhood: this is at once obviated by applying "Stott's ventilator" for the untrapped gullies and openings (within a reasonable distance) become inlets for fresh air, instead of outlets for sewer gases.

"It is, however, necessary, in order to limit the number of ventilators, to trap all the openings within a radius of 300 or 400 yards; thence to the extent of the district the gullies might be open to admit air to fill up the partial vacuum formed by exhaustion.

"I have already four fixed in this town, and up to the present time I know of no system that, for simplicity, efficiency, and economy, at all equals Mr. Stott's invention.

"A model has been sent to the Manchester Exhibition, where I hope it will be carefully examined and considered by many of my professional friends.

(Signed) Edward R. S Escott,
Borough Engineer and Surveyor.

Halifax.

THE TREATMENT OF TOWN SEWAGE AT CROYDON.

Until circumstances force the world to utilize or to neutralise its waste matters, every new method proposed is pronounced impossible. At present we have not found it possible to make a profit out of sewage, the problem is rather how to treat at the lowest cost. Few persons are aware, perhaps, that the authorities of Croydon have for fifteen years thrown the whole sewage of the district on a farm of 500 acres, known as the Beddington Sewage Farm, and belonging to the Croydon Board of Health. During the show week at Croydon, at the invitation of Dr. Alfred Carpenter, the chairman of the Committee of Management, a party of nearly one hundred made an inspection of the farm, used their eyes and noses diligently, and listened to Dr. Carpenter's figures and explanations with great interest.

It is not within our province to go into the weight and value of crops. We are only concerned with the world at large in the question of how to dispose of the refuse of towns with the greatest regard to the health of the population and the purity of the streams at the smallest possible cost. Now, for fifteen years the authorities of Croydon have disposed of the sewage of the district on the farm in question, and the inhabitants now numbering some 70,000 souls, the quantity of sewage varies from three to ten million gallons according to the weather. The managers of this important experiment have laid down the sound rule that the sewage shall not have time to putrify; within three hours that from the furthest part of the district arrives at the farm. It passes immediately through Latham strainers, the solid matters are at once mixed with dry straw, garden refuse, and the contents of the dustbins of the town, and form a compost which is not offensive, and

which is worth half-a-crown a yard. The filtered sewage then flows away in an open sewer on to the farm, and from this mass of loaded water no smell is perceptible. All kinds of crops are grown upon the farm—rye-grass, cereals, mangold and other root crops, potatoes, and vegetables. No other but sewage manure is used; the stock is fed entirely on the produce of the farm, and the bread, milk, beef, veal, &c., were pronounced excellent. The effluent water finally falls into the river Wandle, and although it is not suggested that this water is fit for drinking purposes, it does not disagree with the trout of that stream, which are certainly excellent. The following is Dr. Hassall's, not our, analysis of the water in question:—Total hardness, 23·8; temporary ditto, 15 8; permanent ditto, 8·7; total solids, 41·0; nitric acid, 2 15; free ammonia, 0·0082; albumenoid ditto, 0·0297; chlorine, 3 0342. A recent analysis by Dr. Frankland is said to present a more favourable result.

The farm is not a model show farm in any sense, but a good example of practical value. It is not a paying farm; but that fact is not surprising when we are told that the rent of some portions is £10 an acre. It is not in high cultivation, for the board have no command of capital. Dr. Carpenter is assured, however, that at a moderate rent, and with the use of a fair amount of capital, it could be made to pay. What the doctor and his colleagues claim for it is:—"That a sewage farm is not a swamp or marsh; that it does not injure the health of a neighbourhood; that it does not damage residential property, except from the ideal point of view, that it turns poor land into land capable of producing luxuriant crops, that its produce is beneficial to cattle; that cattle fed on sewage produce are themselves healthy; that the food produced is fit for human consumption; that the experience of sewage irrigation on the same land for fifteen years will justify the capitalist in putting capital in sewage agriculture."

We think that the claims must be admitted. The farm is situated in the vicinity of some of the most charming residences in Surrey, the air is certainly not tainted, the land is productive, and the food produced excellent. With regard to cost, the sewage has to be dealt with, and against the cost of the farm we have to set the cost of other modes of diverting it from the rivers. The long and determined efforts of Dr. Carpenter deserve the highest praise, and the results demand careful examination.—*Engineer.*

CABINET MAKERS, PAINTERS RECEIPTS.

Finishing with One Coat of Varnish.—*Valuable Process.*—Give the furniture a coat of boiled linseed oil, then immediately sprinkle dry whiting upon it, and rub it in well with your hand or a stiff brush, all over the surface; the whiting absorbs the oil, and fills the pores of the wood completely. For black walnut, add a little burned umber to the whiting; for cherry, a little Venetian red, &c., according to the color of the wood. Turned work can have it applied while in motion in the lathe. Furniture can afterwards be finished with only one coat of varnish.

Wood-filling Composition.—Boiled linseed oil, 1 qt.; turpentine, 3 qts.; corn starch, 5 lbs.; Japan, 1 qt.; calcined magnesia, 2 oz. Mix thoroughly.

Improved Wood-filling Composition.—Whitening, 6 oz.; Japan, ½ pt; boiled linseed oil, ½ pt.; turpentine, ½ pt., corn starch, 1 oz. Mix well together and apply to the wood. On walnut wood add a little burned umber, on cherry a little Venetian red, to the above mixture.

To Remove Old Paint.—Sal soda, 2 lbs.; lime, ¼ lb.; hot water, 1 gal.; rummage all together and apply to the old paint while warm. It will soon loosen the paint so that you can easily remove it. Another simple method is to sponge over your old paint with benzine, set it on fire, and you can then flake off the paint as quick as you like. Do not attempt to go over too much surface at a time, otherwise you might get more to do than you can attend to.

Refuse Paint and Paint Skins.—Dissolve Sal soda, ¼ lb., in rain water, 1 gal.; cover the refuse paint for 2 days, then heat it, adding oil to reduce it to a proper consistence for painting and straining.

Farmers' Paint.—Farmers will find the following profitable for house or fence paint: skim milk, 2 qts; fresh slacked lime, 8 oz; linseed oil, 6 oz., white Burgundy pitch, 2 oz.; Spanish white, 3 lbs. The lime is to be slacked in water, exposed to the air, and then mixed with about one-fourth of the milk, the oil in which pitch is dissolve to be added, a little at the time, then the rest of the milk, and afterwards the Spanish white. This is for white paint. If desirable, any other color may be produced; thus, if a cream color is desired, in place of part of the Spanish white use the ochre alone.

Silver Polish Kalsomine.—Take 7 lbs. of Paris white and ¼ lb. of light colored glue. Set the glue in a tin vessel containing 3 pts. of water, let it stand overnight to soak. Then put it in a kettle of boiling water over the fire, stirring till it is well dissolve and quite thin. Then, after putting the Paris white into a large water pail, pour on hot water and stir it till it appears like thick milk. Now mingle the glue liquid with the whiting, stir it thoroughly and apply with a whitewash-brush, or a large paint brush.

To use Smalts.—For a gold lettered sign, lay out on a lead color or white surface the line of letters, and roughly size the shape of each letter with *fat oil size.* This must be allowed at least 12 hours to get tacky and ready for gilding. After the gold leaf is laid and perfectly dry, mix up (for blue smalts) Prussian blue and keg lead with oil, adding a little dryer Outline carefully around the letters, and fill up all the outside with blue paint; then with a small sieve sift on the smalts, allowing the sign to lay horizontally. Cover every part with plenty of smalts, and allow it to remain unmolested until the paint is dry Then carefully shake off the surplus smalts, and the work is done.

LEATHER WORKERS, &c., RECEIPTS.

Best Color for Boot, Shoe, and Harness Edge.—Alcohol, 1 pint; tincture of iron, 1½ oz; extract logwood, 1 oz.; pulverized nutgalls, 1 oz.; soft water, ½ pint; sweet oil, ½ oz.; put this last into the alcohol before adding the water. Nothing can exceed the beautiful finish imparted to the leather by this preparation. The only objection is the cost.

Sizing for Boots and Shoes in Treeing Out.—Water, 1 quart; dissolve in it, by heat, isinglass, 1 oz; adding more water to replace glass, by evaporation; when dissolved, add starch, 6 oz; extract of logwood, bees'-wax, and tallow, of each, 2 oz. Rub the starch up first by pouring on sufficient boiling water for that purpose. It makes boots and shoes soft and pliable, and gives a splendid appearance to old stock on the shelves.

Best Harness Varnish Extant.—Alcohol, 1 gallon; white turpentine, 1½ lbs.; gum shellac, 1¼ lbs.; Venice turpentine, 1 gill. Let them stand by the stove till the gums are dissolved, then add sweet oil, 1 gill; and color if you wish it with lampblack, 2 oz. This will not crack like the old varnish.

To Tan Raw Hide.—When taken from the animal, spread it flesh side up; then put 2 parts of salt, 2 parts of saltpetre and alum combined, make it fine, sprinkle it evenly over the surface, roll it up, let it alone a few days till dissolved; then take off what flesh remains, and nail the skin to the side of a barn in the sun, stretch tight, to make it soft like harness leather, put neat's-foot oil on it, fasten it up in the sun again; then rub out all the oil you can with a wedge-shaped stick, and it is tanned with the hair on.

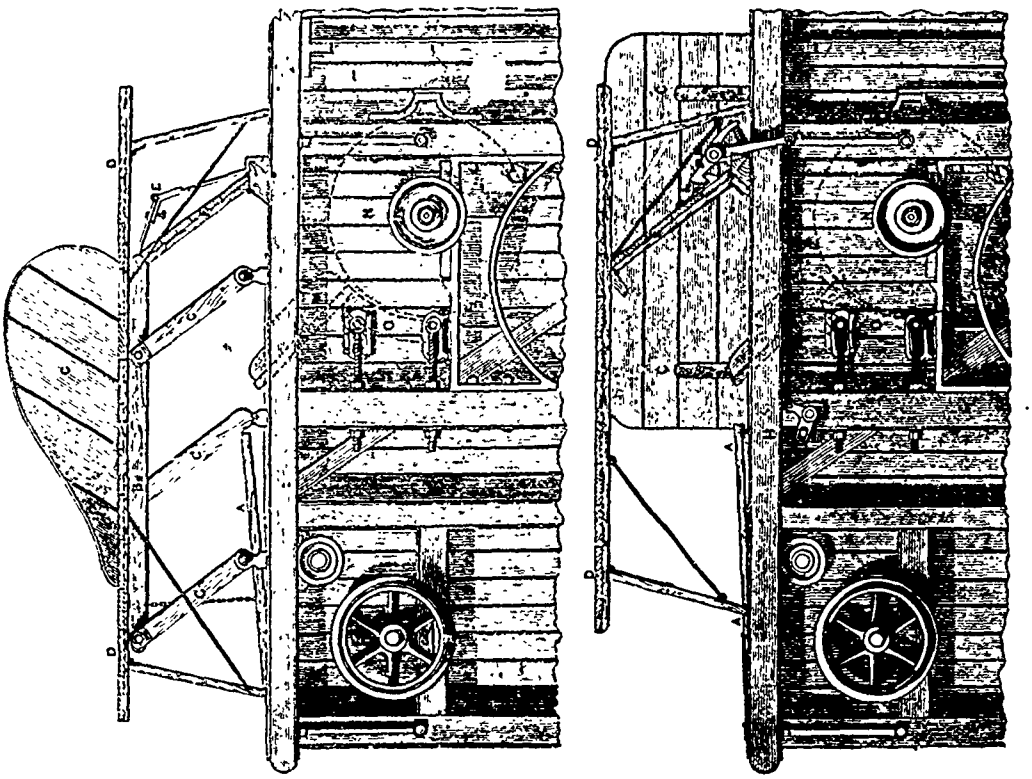
French Finish for Leather.—Take a common wooden pailful of scraps (the legs and pates of calf-skins are best), and put a handful each of salt and alum upon them, and let them stand three days; then boil them until they get a thick paste; in using, you will warm it, and in the first application put a little tallow with it, and for a second time a little soft soap, and use it in the regular way of finishing, and your leather will be soft and pliable, like French leather.

Liquid Japan for Leather.—Molasses, 8 lbs.; lampblack, 1 lb.; sweet oil, 1 lb.; gum arabic, 1 lb.; isinglass, 1 lb. Mix well in 32 lbs. water; apply heat; when cool, add 1 quart alcohol; an ox's gall will improve it.

DRUM PROTECTORS FOR THRASHING MACHINES.

CONSTRUCTED BY MESSRS. MARSHALL, SONS, AND COMPANY, ENGINEERS, GAINSBOROUGH.

(For Description, see Page 278.)



RECEIPTS FOR MACHINISTS, ENGINEERS, MILL-OWNERS, BLACKSMITHS, LOCOMOTIVE BUILDERS, AND METAL WORKERS OF EVERY KIND.

BELTING FRICTION.—The friction by belting on pulleys is 47 for greased leather, when run on wood drums or pulleys; 50 for dry leather on wood; 38 for oiled leather on cast-iron pulleys; and 28 for dry leather on cast-iron pulleys.

TEMPERING SAWS.—A late improvement consists in tempering and straightening the saws at one operation. This is done by heating the saws to the proper degree, and then pressing them with a sudden and powerful stroke between two surfaces of cold iron. A drop press is employed for the purpose. The mechanism is quite simple and inexpensive. Its use effects an important economy in the manufacture of nearly all kinds of saws, and also improves their quality.

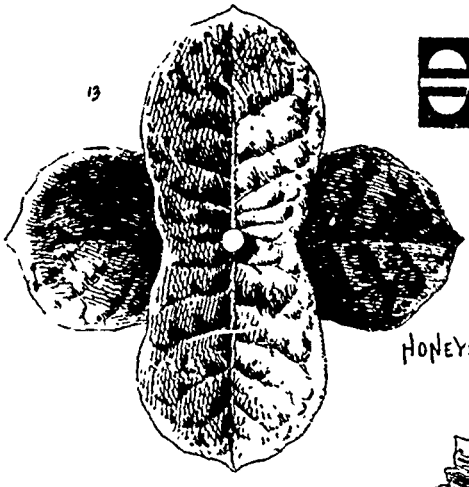
TEMPERING LIQUID.—Water, 3 gals.; soda, 2 oz.; saltpetre, 2 oz.; prussic acid, 1 oz., or oil of vitrol, 2 oz.

TEMPERING.—The article, after being completed, is hardened by being heated gradually to a bright red, and then plunged into cold water: it is then tempered by being warmed gradually and equably, either over a fire, or on a piece of heated metal, till of the color corresponding to the purpose for which it is required, as per table below, when it is again plunged into water.

	Corresponding temperature.	
A very pale straw....	430	Lancets
Straw.....	450	Razors
Darker straw.....	470	Penknives, All kind of wood
Yellow	490	Scissors, tools, Screw taps.
Brown yellow.....	500	Hatchets, Chipping Chisels,
Slightly tinged purple	520	Saws.
Purple.....	530	All kinds of percussive tools.
Dark purple.....	550	Springs.
Blue.....	570	
Dark blue.....	600	Soft for saws.

VELOCITIES OF WOOD WORKING MACHINERY.—*Circular Saws* at periphery, 6000 to 7000 feet per minute; *Band Saws*, 2500 feet; *Gang Saws*, 20 inch stroke, 120 strokes per minute; *Scroll Saws*, 300 strokes per minute; *Planing Machine Cutters* at periphery, 4000 to 6000 feet. Work under planing machine one-twentieth of an inch for each cut. *Moulding Machine Cutters*, 3500 to 4000 feet; *Squaring-up Machine Cutters*, 7000 to 8000 feet; Wood Carving Drills, 5000 revolutions; *Machine Augers*, 1½ in. diam, 900 revolutions; ditto, ¾ in. diam., 1200 revolutions; *Gang Saws* require for 45 superficial feet of pine per hour, 1 horse power. *Circulars Saws* require 75 superficial feet per hour, 1 horse power in oak or hard wood ⅗ths of the above quantity require 1 horse power; *Sharpening Angles of Machine Cutters*. Adzing soft wood across the grain, 30°; *Planing Machines*, ordinary soft wood, 35°; *Gauges and Ploughing Machines*, 40°; *Hardwood Tool Cutters*, 50° to 55°.

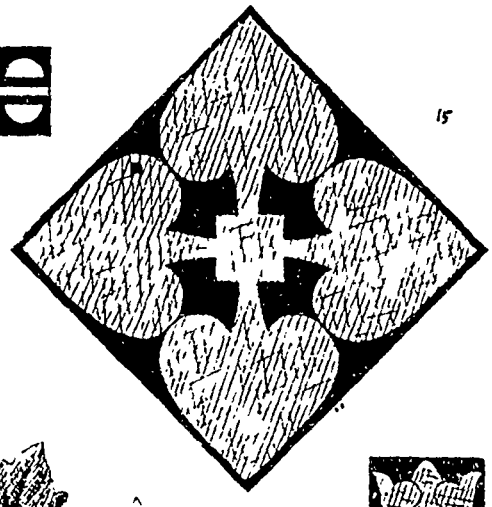
THINGS WORTH KNOWING.—1. *Rust joint quick setting:* Sal ammoniac, pulverized, 1 lb.; flour of sulphur, 2 lbs.; iron borings, 80 lbs, mix to a paste with water in quantities as required for immediate use. 2. *Quick setting joint better than the last, but requires more time to set.* Sal ammoniac, 2 lbs.; sulphur, 1 lb.; iron filings, 200 lbs. *Air and water-tight cement for casks and cisterns:* Melted glue, 8 parts; linseed oil, 4 parts; boiled into a varnish with litharge hardens forty-eight hours. 4. *Marine Glue:* India rubber, 1 part; coal tar, 12 parts; heat gently, mix, and add 20 parts of powdered shellac, poor out to cool, when used, heat to about 250°. 5. *Another ditto:* Glue, 12 parts; water sufficient to dissolve; add yellow resin, 3 parts; melt, then add turpentine, 4 parts; mix thoroughly together. 6. *Water-proof varnish for harness:* India rubber, ½ lb.; spirits of turpentine, 1 gal.; dissolve to a jelly, then take hot linseed oil, equal parts with the mass, and incorporate them well over a slow fire. 7. *Blacking for harness:* Beeswax, ½ lb.; ivory black, 2 oz.; spirits of turpentine, 1 oz.; Prussian blue, ground in oil, 1 oz.; copal varnish, ½ oz; melt the wax and stir it into the other ingredients before the mixture is quite cold; make it into balls, rub a little upon a brush, apply it upon the harness and polish lightly with silk.



13.

HONEYSUCKLE.

14.



15.

GUELDER-ROSE.

16.

18.

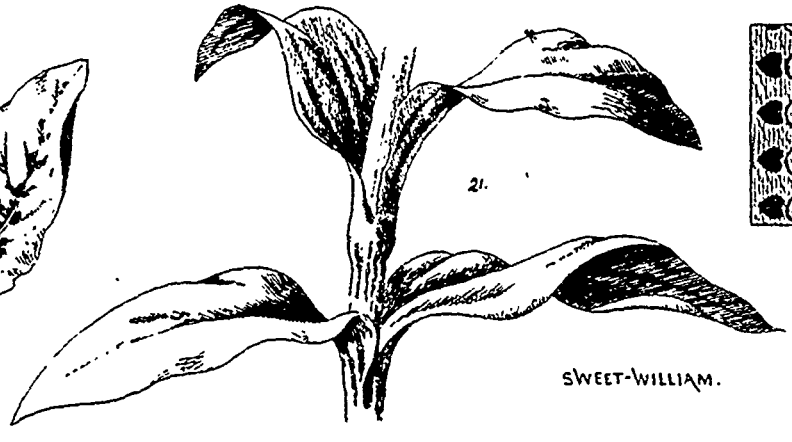
17.

20.

HONEYSUCKLE.

19.

22.



21.

SWEET-WILLIAM.

SUGGESTIONS IN FLORAL DESIGN BY F. E. HULME, F.S.A.(See page 279.)

DRUM PROTECTORS FOR THRESHING MACHINES.

See illustration, page 276.

In the arrangement shown in the illustration, a platform D D is fixed, at a suitable height over the drum, and within reach of the feeder, and to this platform is attached by a spring E, a projecting board F. A handrail B C surrounds the feeder. The projecting board is hinged to one ledge of the drum month, and is also connected to the handrail. During ordinary working, the drum month has a clear opening for the grain, which falls down the machine M, but in the event of one of the attendants falling against the platform, or the handrail, or of the man feeding the machine wishes to leave the box, the spring E is released by the action of his pressing his hands on the rail B, and the protecting board falls on the drum month, effectually protecting its entrance.

In addition to the arrangement just described, a lower platform A is also placed round the feeding box, and is attached to the handrail, so that the feeder in stepping out of the box, places his foot on the platform, which presses A down, pulling with A the handrail, to which the cover is connected, and in this manner the drum month is closed. The platform D may be fixed on either side, opposite to that on which the grain is being passed to the hands of the feeder.

The second apparatus by the same makers, which we illustrate by the lower figure, is intended to act in a similar manner, as regards closing the drum month, but in the place of a handrail a pair of bell cranks I are employed, working on fixed studs, one on each side of the main frame, and connected by a rod to a lever J on each end of the spindle K, which turns in the bracket K¹, on the centre of the rod is placed a lever L of the form shown in the engraving. The feeding table is shown at D, which can be shipted at either of the machine, or placed in the front of the feeder. It will be seen that the table bears upon the guard board F, and if any undue pressure is thrown upon D, the trip lever L is released and the guard falls. The same thing happens if the board A is depressed, since it strikes a lever coupled to the crank I, and drawing M forward releases the catch of the lever L.

DULL TIMES IN GREAT BRITAIN.

The English manufacturers are greatly alarmed at the sluggishness of trade generally. The hardware trade, as well as the iron manufacture, seems to be very slack throughout England, and some of the newspaper writers, in complaining of the lack of orders from the United States, warn their manufacturers against expecting as many orders from this side of the water as formerly, and suggest that they find new markets for their products. One of our English contemporaries mentions Japan as a good market for their hardware, remarking that the Germans and French now monopolize most of that trade. "In Staffordshire," says one of our exchanges, "the market possesses an element which militates against its general healthiness. In many branches makers are experiencing very keen competition from foreigners. The United States is a formidable business antagonist. By Pennsylvania, padlock and currycomb makers in particular are very hotly pressed, and transatlantic firms are underselling us in bright-headed bolts and nuts to the tune of 20 to 25 per cent. By Belgium we are being undersold in railway spikes to the enormous extent of $25 to $40; and Barcelona (Spain) makers are turning out door locks and hinges at rates which, on this side, seem mythical. And the competition we experience is not restricted to other countries. As in the minor industries, so likewise in the heavier trades, sharp rivalry is seen. Notably, the steam and boiler tube makers are being hard pressed by those of Scotland."

A VARNISH has been prepared from mica, which promises to become a useful article in the workshop, though at present it has been applied only to plaster casts and similar articles. Mica, calcined by fire or cleaned by boiling in hydrochloric acid, is reduced to as fine a powder as possible and mixed with collodion, when it can be laid on in successive coats like paint, giving the articles a silvery appearance. It may be colored by carefully grinding in the required pigment. The varnish adheres well to porcelain, glass, metal, wood, and plaster, and may be washed without injury.

THE FOREMAN.

The duties of the foreman are (like the busy housewife's work) never done. If he is alive to the interests of his employers, he is not the last man in the factory in the morning, neither is he the first one out at night. To him belongs the duty of knowing that every operative is at his work in the morning. To him belongs the duty of knowing that every operative renders unto his employer a just and equitable day's labor To him belongs the duty of knowing that every operative performs his work to standard perfection. To him belongs the duty of arbitrating justly and fairly between operatives; in fact, he is or must be, as nearly as possible, an omnipresent *factotum*. He knows of all the little domestic troubles of his subordinates, and has to advise and suggest means of bringing about (amicably) the marital relations of more than one of those under his control, not sufficiently burdened with his own troubles, he carries the troubles and secrets of subordinates securely locked within his own breast. If any of the operatives in his department meet with reverses, he is the first one appealed to; he is the first to add his name to the subscription list for a certain amount; no matter whether he is prepared or not, he must, to prevent calumny, subscribe. Thus we might speak of him on this subject for years, and fill volumes without end, and then not finish this portion of our story.

All employers or factors are not practical men. In such cases, the success of the manufacturing portion of the business devolves wholly upon the foreman. Not only is he held strictly accountable for the superiority of the work but he must ever tire his never resting brain in producing fresh novelties: novelties which will bring the work to a greater state of perfection, and novelties which will cheapen the production, without lessening the wages of the operatives If it becomes necessary to reduce force, to the foreman belongs the unpleasant task of saying: "We will have to dispense with your services." If a reduction of wages be determined upon, the foreman becomes the agent for promulgating the same, and if he is not possessed of the necessary amount of tact and eloquence to present the same in such a phase as to prevent the immediate withdrawal of a part or the whole of the operatives employed, his fate is *anathema*.

To become a thorough foreman does not necessarily imply that he should be a thoroughly practical mechanic, or thoroughly skilled in that branch of handiwork over which he is to preside. That he must have a thorough theoretical knowledge of the same is absolutely necessary. He must be intelligent, affable, and favored with an even-tempered disposition. In fact, he must be so favored with an even-tempered disposition. In fact, he must be so favored with all the features that make up the character of man, which will allow him at once to be the engineer, general preceptor, counsellor, judge, spiritual adviser, and friend. He must be above temptation of every kind. His disposition must be such as will allow him to chide a man gently for any fault unwittingly done. He must have firmness enough to demand that justice be done his employers, and courage enough to defend his subordinates against encroachments by his employers. He must be generous enough to advance others' claims or inventions, without coveting them or stealing them. He must be wise enough to know right from wrong, and impartial enough to deal justly by friend or foe. He must be frank in all things, and liberal in all his expressions, and must be humble enough to be as courteous to his most humble subordinates as he is to his employer. Such are the duties and attributes which belong to a foreman. How many have them must be determined by others than ourselves.—*The Carriage Monthly.*

TO WATERPROOF FISHING LINES, apply a mixture of two parts boiled linseed oil and one part good size; expose to the air, and dry.

ARTIFICIAL GRINDSTONES have been made at Worms, Germany, of grit, soluble glass, and petroleum. The proportions are not given. It is said that they will bear a very high speed without becoming soft.

SUGGESTIONS IN FLORAL DESIGNS.

The foliage of plants is perhaps their most valuable ornamental feature, since the root, though very varied and beautiful in its modifications, does not, from its subterranean position appeal to the eye, nor would it always be a pleasing feature in a design. A line of foliage, or a stem giving off its leaves, might very fitly adorn a moulding, while a series of uprooted plants would convey a somewhat disagreeable idea to the mind, and would too quickly suggest the notion of a shelf in some out-house of the garden with its reserve store of spring bulbs or other plants laid aside till the next planting season should again call them into service. Flowers are no doubt in nature ordinarily the most attractive, and on those the eye rests at once; but ornamentally the foliage has the greater value, since the forms of leaves are richer and more varied than those of blossoms, while the beauty of colour that is the chief charm of the latter does not compensate for this richness of form in the foliage. The flowering season is, in addition to this, much briefer than that of the foliage, as a plant that displays its leaves for six months may be in blossom barely as many weeks, and in addition to this, many of the types of leaf of greatest ornamental value, such as the oak, maple, and ivy, belong to plants in which the blossom is, either from the dulness of its colour, or the smallness of its parts, a very subordinate feature. In the present sheet we do not propose to deal with the variation of form (though such variation is very noticeable, as the most cursory examination of the leaves of the honeysuckle, Fig 13; the guelder-rose, Fig. 16, and the sweet-william, Fig 21, will at once demonstrate), but rather with the arrangement of the leaves on the stem. All leaves follow in this respect very distinct laws, though in some cases these laws naturally appeal more rapidly to the eye than others. All the natural examples now before us have the leaves developed in what botanically is termed an opposite arrangement; its valuable ornamental effect is at once evident. In Fig. 22, the masses are in alternate arrangement; the difference of effect is sufficiently obvious.—F. Edward Hulme, F.L.S., F.S.A.

There are nearly 75,000 miles of railroad in the United States, consequently it would occupy a passenger five month's time, travelling continually at the rate of twenty miles an hour, to go once over it all.

We learn from the *Buenos Ayres Standard* that Mr. C. B——ton, Director General of Telegraphs, has been introducing improvements, one of which is the system of transmitting messages simultaneously from both ends of one wire.

According to the *New York Telegrapher*, a battery man, who has tried the experiment, says that to keep the jars of a sulphate of copper battery clean, coat the inner surface of the jar for about an inch at the top with common white paint. This, he says, will entirely prevent the sulphate of zinc from accumulating of the outside of the jar.

FOREIGN AND COLONIAL NOTES.

The Suez Canal.—The revenue of this great undertaking is well maintained, and, in fact, something more than maintained. The number of vessels which passed through the canal in May was 130, as compared with 108 in May 1874, and 112 in May 1873. The receipts of May were 100,112*l.*, as compared with 82,803*l.* in May 1874, and 83,729*l.* in May, 1873. In the first five months of this year, 714 vessels passed through the canal, as compared with 560 in the corresponding period of 1873. The aggregate receipts in the first five months of this year were 525,047*l.*, as compared with 447,303*l.* in the corresponding period of 1874, and 405,892*l.* in the corresponding period of 1873.

Ordnance Survey of Palestine.—Since the return of Lieutenant Conder to Palestine last autumn, the Ordnance Survey of the Holy Land has made satisfactory progress. Lieutenant Conder took the field in October 1874, and in November he was joined by Lieutenant Kitchener, R.E., as second in command. The hills near Hebron have been explored, and Beersheba, the southern limit of the survey, has been reached.

A TALK ABOUT SMALL TOOLS.

It is to be regretted that there are not schools to teach boys the initial principles of working hand-tools, since this knowledge is essential to the proper understanding of how to use them. Simplicity in the form of an implement by no means implies facility in its use; indeed, it may be said that the more simple the tool, the greater is the skill required to use it properly and with maximum effect. Not every operator excels with pocket-knife, axe, or saw; and, with the use of every tool, there is involved the demonstration of a definite principle.

Jack knife.—Too much was never said in praise of a "jack-knife." It is a master tool for more kinds of work than can be named in any one handicraft, unless it be that of a farmer,—a sort of *vade mecum* with every man from boyhood to old age, whether he is a worker or a drone. We may take it as the *type* of every-wood-working implement, and by it illustrate every tool in the shop.

Scriber.—The *scriber* is merely a straight-pointed piece of steel used on wood or metal for a marker, as in a pencil on paper. It must be held at a certain angle inclined to the surface, and moved by a ruler, straight-edge, or curved guide. The carpenter's gauge has a sliding guide and set-screw affixed to the bar which carries the scribing-point, and determines the angle.

Brad-awl.—The *brad-awl* is the next simple form of a tool speedy in its action, and of universal use where small holes are to be made in wood or other soft substances. Like a miniature chisel, when its edge is placed *across* the grain, it acts only as a wedge, and elastic fibres close on again on its removal. This effect must be borne in mind, as well as its greater efficacy when driven by a hammer or mallet than when worked by hand. It makes a poor *drill*, since its edge is not adapted to the work.

Scraper.—The most common *scraper*, if not a knife, is a piece of glass, for soft substances; but being soft itself, it is not durable. The secret of its keen edge is, that the natural fracture is at right angles to the surface, which we imitate in making steel scrapers used by cabinetmakers. These are only small, thin plates like a saw-blade, upon which the edge first made by grinding being worn off is again turned on by passing along it the rounded back of a gouge, the stem of a large brad-awl, or any similar piece of hardened steel, which, if well applied, produces a uniform burr, or sometimes a wire edge. The keen scraper, by its fine shaving, reminds us of a knife-blade effect: the paring-chisel, and the plane are modifications, much limited by this angle of the edge.

Axes.—But for the amount of effect compared with the amount of energy expended, the various forms of *axes* stand first among tools, combining as they do the cleaving power of the wedge, the cutting edge of the knife, and the percussive force of the hammer. Their edges, however, having but small amount of guiding surface, necessitate a high degree of skill on the part of the operator. They should be as thin as is consistent with strength to resist the shocks to which they are subjected. Their cutting angle is from 25 to 40 degrees, according to circumstances. Thus, like the *adze*, might be called a tool of precision, since, by the accuracy of repeated blows, proportionate effect is produced. Greater accuracy can be obtained with the adze by steadying the inner hand and the end of the long handle against the body of the operator as a fulcrum. A good workman may split the sole of his slipper, when standing upon his work, without fear of grazing the skin of his toes.

Chisel.—Using a *chisel*, we dispense with the cumbrous weight of the axe, and more readily modify the percussive (beyond the knife-like) effect, by graduated blows of a hammer or mallet. The "guide-principle" of one large, flat surface is here utilized in the "paring-chisel," and by keeping this closely pressed against the work, the tendency of the tool to run into the wood is controlled. The "firmer" and the "mortice" chisel differ in shape only for their special applications. To drive all of them, a mallet is prefered to a hammer, because it does not mar the chisel handle and make it rough to the hand for other purposes, though it is less effective, since wood of both tools "cushion" the blow.

To be continued.)

HOLIDAY PASTIMES. SWIMMING.—(See page 282.

FIG. 1.—BEFORE THE STROKE.

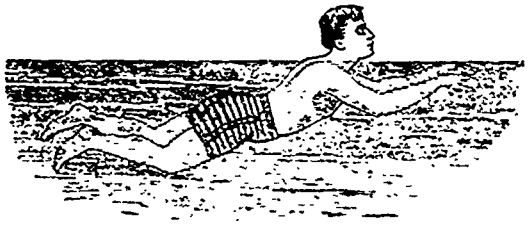


FIG. 2.—AFTER THE STROKE.

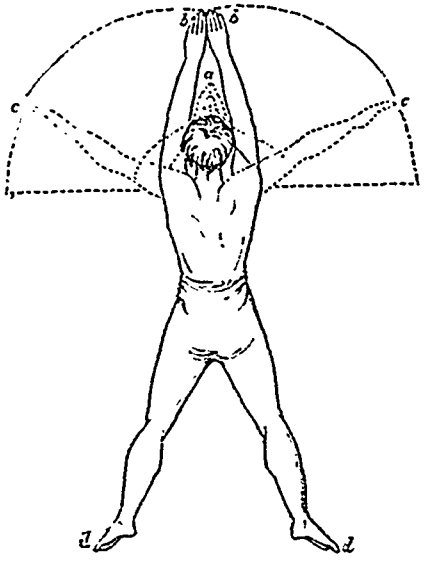


FIG. 3.—THE ACTION OF THE LIMBS.

CAUSES OF THE LOSS OF SHIPS AT SEA

A Board of Trade Surveyor, who is also a practical seaman, has just published a remarkable pamphlet on this subject. He shows among other things, that uninsured ships are rarely lost, as it is then the owners' manifest interest to have them properly laden, well found, well manned and commanded and officered by skilful men. It is otherwise when ships are fully or over insured. Their loss is then a "benefit to the owner," says the writter, "as he has nothing to lose, and "many owners, for the sake of a few more tons of freight, do "not mind hazarding the lives of all on board." The practice of over working the men during the day, so that they are unable to keep a proper outlook at night, is also deprecated. Building steamships with a view chiefly to their freight, carrying capacity is pointed to as the great cause of disaster, as also is the indiscriminated lengthening of steamers, with little or no strengthening. Want of a proper supply of lifeboats and under manning are also fertile causes of loss of life at sea. The under manning is attributed largely to the manner in which sailors are lodged, and fed, and treated by their officers, while the great and increasing proportion of foreign seamen in our mercantile marine would prove an important element of weakness in case of a general war.

PETROLEUM IN TURNING HARD METAL.

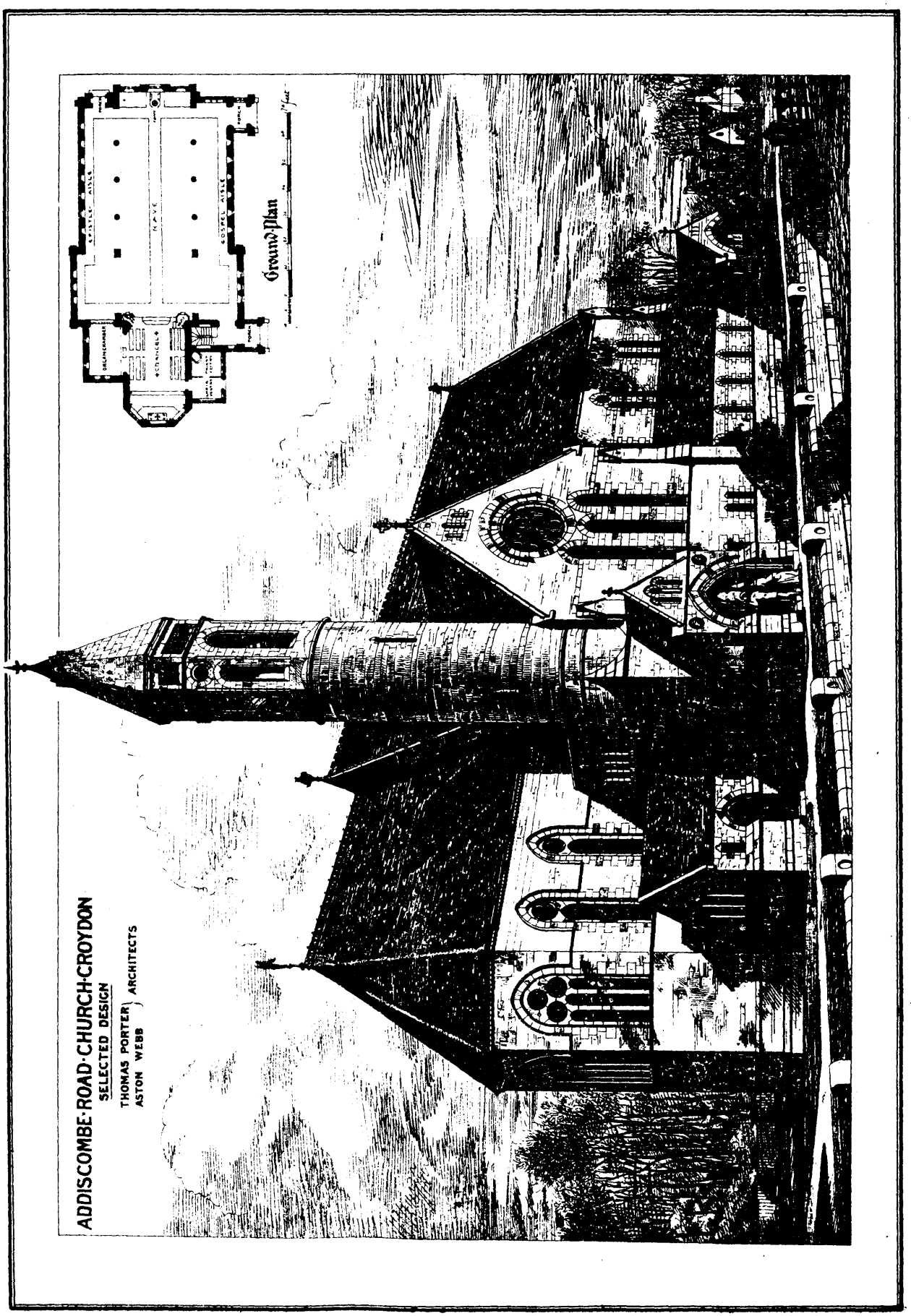
Mr. L. Bechstein reports that it was required to turn with the greatest precision, a piece of 29 centimetres in diameter, composed of a very hard alloy of seven parts copper, four parts zinc, and one part tin. Every ordinary mode was tried without success, when Mr. Bechstein had the idea of trying the effect of petroleum constantly applied to the cutting tools, and the alloy was then turned with about the same ease as steel tempered to straw colour; the latter, says Mr. Bechstein turns with the greatest ease when the cutters are kept moistened with a mixture of petroleum and turpentine.

NEW FACTORY

An exchange says:

The erection of the new cotton factory at Valleyfield is being rapidly carried on, there being at present over 150 men employed in connection with it. The building is 200 feet in length, 45 wide, and will comprise five stories. The beams of the second story are supported by a number of strong iron pillars, and the whole building is based upon a solid rock. The quarries are adjacent thereto, the material being an excellent limestone; the upper strata is well adapted for building purposes, and the under for manufacture of lime. The company have two steam derricks at the quarries, by which means the stones, after being blasted, are raised and placed in a convenient position for being removed to the building. From the *debris* they manufacture their own lime; the sand is brought from Chateauguay Basin. The building is beautifully situated on the north bank of the small channel which comes from the river above that portion of the town, hemmed back by an extensive embankment.

SHOEING OF HORSES.—As many parts of the horse's hoof are more tender than others, in the case of such animals as have very tender feet, it is the province of the shoeing smith to give ease to such parts and to throw the weight more upon those parts which are better calculated to support it, thus assisting nature in all her operations, in the animal economy. The horse in raising the fore foot for extension, the stress is put upon the flexor muscles,—in particular, the *Flexor pedis perforans*, the tendon of which is inserted into posterior part of the os pedis, or bone at the foot. The longer the toe of the shoe, and straight, the greater leverage is required against the unyielding edge of the toe. By keeping the toe a moderate length, and turning up the toe of the shoe a little, is allows the foot to be easily rotated, consequently less strest is thrown upon the flexor muscles and tendons, and more particularly upon the tendon at that part when it passes over the navicular bone, it thus lessens the tendency to navicular disease, and, if so affected, this mode of shoeing will give great relief.


ADDISCOMBE·ROAD·CHURCH·CROYDON
SELECTED DESIGN
THOMAS PORTER
ASTON WEBB
ARCHITECTS
Ground-Plan
EPISTLE AISLE
NAVE
GOSPEL AISLE
ORGAN CHAMBER
CHANCEL
VESTRY

HOLIDAY PASTIMES.

Swimming.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(*To be continued.*)

PROFITABLE BEE-KEEPING.

Mr Pettigrew gives an account in the *Journal of Horticulture* of his financial experience of bee-keeping. He says for the encouragement of working men, I will here state that from 1870 to 1874 my profits from bee-keeping, after deducting all expenses, amount to £220. The first three years of this period were considered unfavourable for bees. These facts and figures are named here to help young apiarians to look hopefully to the future. Bee-keeping is an easy and profitable pastime. Where shall we find anything living that requires less attention than bees? They clean and furnish their own houses, and in ordinary seasons store up more honey than they need—honey enough for the market or their owner's use A few hives in a garden indicate recreation, not toil—profit, not expense. What less costly to keep than bees? With sugar at 3d. per pound bee-keeping is not a loosing game even in unfavourable seasons. The expense of feeding during unpropitious weather is as nothing now compared to what it was fifty years ago, when sugar cost from 9d to 1s. a pound. Four or five shillings' worth of sugar given as syrup to a swarm will enable it to fill, or nearly fill, its hive with combs and store up food enough for the winter months, thus making a stock-hive worth 30s. Once in possession bees may be managed on any system their owner likes. On the multiplying principle one will become three, and ten will increase to thirty in one season. Swarms from small hives under good management or kindly treatment will fill larger hives. In this way stocks increase not only in number but in value. With good stocks of bees, and a little knowledge of them, progress and profit will be made. To working men bee-keeping is more than a hobby; it is an aid to bread-winning in his family—a perennial source of income.

LECTURE TO LITTLE FOLK.

We see no reason why a column of our *Magazine* should not be appropriated to the youngsters of a family who are old enough to be instructed, and we feel certain that few of our elderly readers will accuse us of deviating from the character of a "Scientific Magazine" when we endeavor to instil into the minds of children a taste for study, by introducing in each number a short lecture on scientific subjects in a form comprehensible to their young minds

LECTURE I.

My dear boys,—

We intend to give you some very pleasing and instructive lectures, for we wish you to love knowledge and virtue, because thereby you will be made happy and prosperous in your future lives. We hope in each number of this *Magazine* to tell you something to please and much to understand. In these days it is a very bad thing to be without knowledge. There was a time when there were no books, no paper, no pens or ink, things now brought to light were then unknown, people used to believe in false gods, worshipped wooden images, and were in dread of wicked spirits which they supposed to exist. They had no comfortable houses wherein to dwell: no glass to admit light, yet shut out the wind and rain; they had no fine places with chimneys to carry away the smoke, but used to live more in the style of gypsey tribes, roaming from place to place having no dear spot to call their home. They were in danger from wild beasts, which they often killed, however, for food. The people too were rude, and very cruel, and instead of loving one another, they used to quarrel, fight, and kill each other, and why did they do this? why were they always suffering from cold and hunger? Simply because they were *ignorant*: they knew not what it was good and profitable for them to do. But now, through knowledge, we enjoy peace, we have all the comforts of life easily within our reach, and it lies within the power of every child if properly instructed in knowledge and in the duties and obligations of life, to grow up prosperous and happy. We are happy to say that the number of wicked men who do their fellow-creatures wrong, are comparatively few, and are generally ignorant and idle like those of old, they did not love knowledge and virtue which we wish you above all things to prize.

We do not intend to give you a lecture in science this time, but merely a few words of introduction, promising in our next number to give some illustrations and the methods of making experiments which we feel sure will give you pleasure, and we wish you to study these things, that you, in your turn, may try to discover useful things to do good to your fellow creatures. For as others have laboured and done good for you, you should delight to labour for the good of others. Watts who discovered the steam engine, Harvey who discovered the circulation of the blood. Newton, the great astronomer, Sir Humphrey Davy the great chemist; Stephenson and Brunel, the great engineers. Howard and Wilberforce, the kind-hearted good men, were once playful boys like you, and knew but little; they turned their minds to good purpose and became wise and good men, and did much for the well-being of their fellow creatures.

A NEW ELECTRIC RAILWAY SIGNALLING APPARATUS.

A new electric interlocking and blocking signalling apparatus, which has been invented and patented by Mr W. R. Sykes, an electric engineer in the service of the London, Chatham, and Dover Railway Company, has this week been introduced in working the traffic of the Metropolitan Extension of that Company's line, the apparatus having for some time been in course of construction at the Brixton works of the electric and signal department. It is claimed for the invention that whilst it will be the means of preventing collisions arising out of the present imperfect system of signalling between station and station, it will at the same time relieve to a considerable extent, both the physical and mental labours of signalmen, and that by the electric connexion of the apparatus between station and station, the moving of levers, and starting or passing trains by mistake on the part of signalmen, will be rendered almost impossible.

MECHANICAL DRAWING.

For Young Mechanics.

The present condition, and the future, of Engineering and Mechanical Construction, make it necessary that Mechanical Drawing should form a part of elementary education.

There are however, many young mechanics, who have been instructed only in the use and manipulation of the tools and machinery employed in their trade; to them, therefore, the elementary courses we purpose giving in the various branches of mechanical trades, we feel confident, will be particularly acceptable.

Commencing with copies of the simplest forms used in construction, we purpose arranging the lessons so that the finished machines may be arrived at by a gradual progression.

The subjects are selected so as to give the pupil ideas in form and application of machinery, as well as practice in drawing what is most useful. These will, in some measure, represent all branches of Construction where Mechanical Drawing is necessary, by subjects in Land and Marine Engineering, Building and Carpentry, Civil Engineering and Machine Making.

As almost all forms in machinery are geometrical, a series of simple problems in Constructive Geometry will be given in future numbers for the pupils' practice.

In workshop practice, drawings sometimes require to be formed full-size, on floors and places where ordinary drawing implements are inapplicable, and the methods taught by Constructive Geometry are necessary. The ordinary workman, too, in finding centre lines, marking off centres, and raising perpendicular lines, to guide him in constructing and erecting machinery of various descriptions, is regularly called upon to display a knowledge of Practical Geometry. In Mechanical Drawing, its various resources should always be at hand.

Workmen employed on the construction of machinery are guided, mostly, by drawings made to one-eighth of full size—scale, one inch and a half to the foot;—but, from want of training, many of them experience much difficulty in working to the drawings, and cause their foremen much extra labour in directing them.

These instructions and illustrations (from Vere Foster's Drawing Books) will, it is hoped, supply materials for such a knowledge of Mechanical Drawing, and the scales used therein, as will train the young, so that, on entering the large manufactories, working drawings shall be easily understood.

Our space will not admit of copying the drawings of the full size, which, however, is of no consequence to the student, in fact it is rather an advantage to him, as by enlarging the figures he is compelled to study with more care the proportions, curves, and method of construction.

The learner should carefully avoid proceeding with any drawing when he has committed an error, but at once, if possible, correct it or commence entirely anew.

Drawings of the more complicated machines should not be attempted until the detailed copies shall have been thoroughly mastered.

To acquire proficiency in finish, and quickness in forming drawings, it will be necessary to use good drawing instruments, and to acquire the habit of keeping them clean and in order. The drawing pens, when not in use, should always be kept clear of ink by means of a piece of cotton cloth or wash leather. Flat rulers and squares should be well tested, and their edges kept in good order; and compass legs and pencils should be kept well pointed.

In operating with compasses, hold them erect and press on them as lightly as possible, so as to avoid making holes in the paper.

The pencils should be flattened their whole length, parallel to the joint of the wood, which prevents them rolling, and gives a better grip in handling them to aid in forming the points. The points should be formed by cutting away the wood along the flat sides to a moderate distance from the point, and paring down the other two sides, taking care to leave the wood thick enough to support the lead against the side thrust produced when drawing.

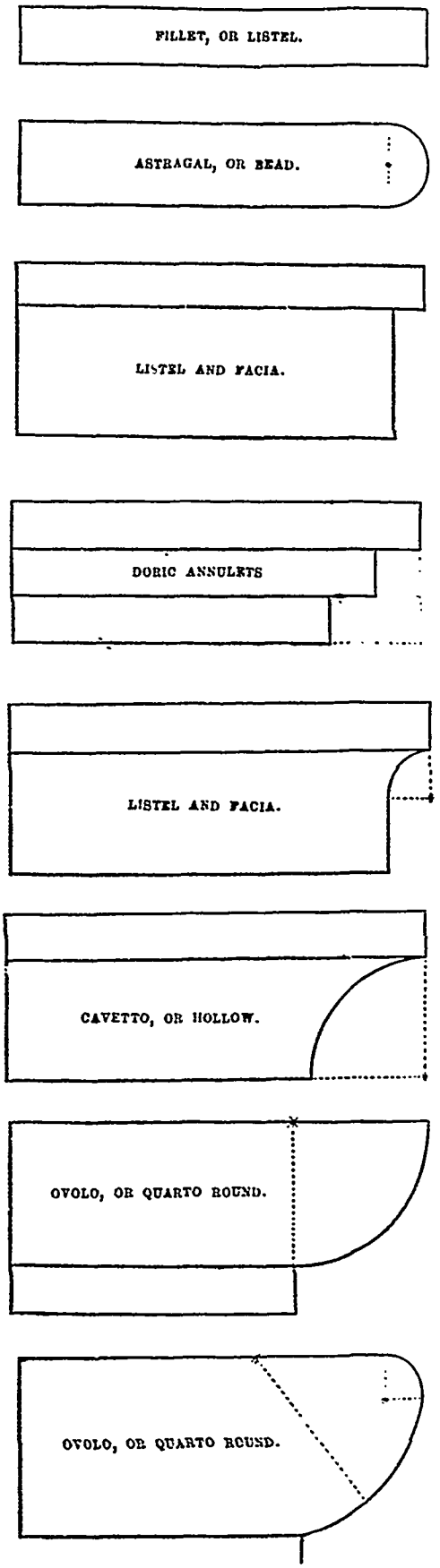
See page 264.

All centre lines should be first drawn in. They are imaginary lines drawn through the object required to be delineated, and form the axis of it and the parts belonging to it.

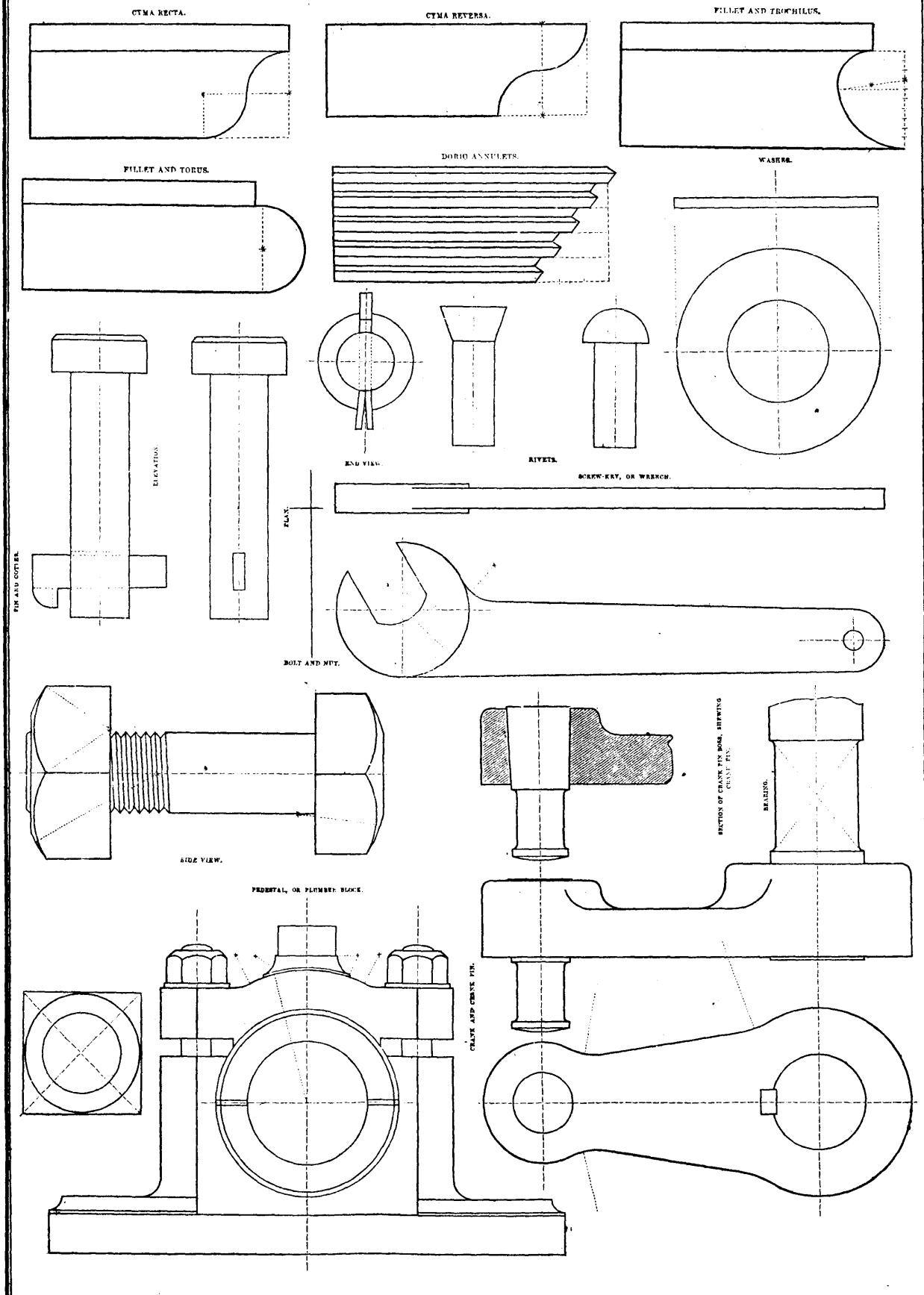
The centre line of a cylinder is also central to the piston, rod, gland, crosshead, &c.; that of a crank-shaft is also central to the pedestal, fly-wheel, &c.;—and these parts cannot be accurately drawn and adjusted to each other independent of their centre lines.

After drawing the centre lines, draw in the outlines of the *larger portions* of the machine, making all lines the greatest length they may be required.

The drawing should be completed in pencil before inking in any part. When ready for inking, commence with all the circles and curves first; and, when the drawing is complicated, ink in those parts which are foremost or nearest the eye first; and proceed with the remainder in rotation, taking care to finish one part before commencing the next.



MECHANICAL DRAWING.



DOMESTIC.

THE HOUSEWIFE'S FRIEND.

THE FAMILY WASHING DAY.

Where the married man who does not dread a "washing day." Where the housewife, participating in household labours, who does not feel "worked off her legs" once a fortnight? Where the house in which smoke steam, heat and barricades of washing-tubs, do not constitute a petty revolution, whenever *Cleanliness* assumes its supremacy over *Dirt*? Will not our lady readers, yes, and the "Lords of Creation" also, feel thankful for these suggestions in our Magazine by which a six weeks wash (washing only of course) may be accomplished before breakfast for less than fifteen cents, and without a washerwoman! The recipe we give is an English one—nor is it a secret—but not being generally known in this country and having used it in our own household for the last fifteen years with perfect satisfaction, we feel we confer a boon in making it more generally known, for any recipe that will save labour and expense in these days to overworked wives, is indeed a boon which they will much appreciate.

A prejudice will be found to exist with every hired washerwoman to the introduction of any new process that does not co-incide with her own ideas on the subject, but set this aside, there is no opposition greater to overcome than that which proceeds from an ignorant and prejudiced mind. The recipe has been tested and proved successful for years past in England and we can positively assert that it will *not injure* linen or cotton fabric, that it will remove every kind of stain, and that it will supersede the rending and tearing of cotton by hard rubbing and pounding on wooden washing boards or other mechanical contrivances for easy washing.

The following is the recipe:

Half a pound of soap, half a pound of soda, and a quarter of a pound of *quick* lime (stone lime fresh from the kiln) pour half a gallon of boiling water over half a pound of soda, and a sufficient quantity of boiling water over the quarter of a pound of quick lime to cover it Then put the dissolved lime and soda together and boil them twenty minutes. After which pour them into a jar to settle.

1st. Set apart all flannels and coloured things, *as they must not be washed in the same way*. They may be washed in the usual way, in the intervals while the other things are boiling.

2nd. Soap the collars and wristbands of shirts, the feet of stocking, &c., &c., and rub them a little. This must be done the previous night, and the clothes set to soak until the next morning.

3rd. Next (i e. in the morning) pour ten gallons of water into the copper, and having strained the mixture of lime and soda well, taking great care not to disturb the settings, put it, together with the soap, into the water, and make the whole boil before putting in the clothes A plate must be placed at the bottom of the copper, to prevent the clothes from burning.

4th. Boil each lot of clothes from half an hour to one hour. After taking them out, rince them well in cold blue water When dry, they will be beautifully white.

5th. The same water will do for *three lots*. The finer things should be done first, the coarse and dirtier afterwards.

The mixture after having been used for the clothes, may be employ to clean silver, brass, copper, tin, or any other description of metal. After washing, they should be dried, and polished with leather. The liquid may then be used for scouring floors, or cleaning paint. Thus it undergoes a variety of transmutations, all essentially serviceable to the housewife.

HINTS FOR HUSBANDS.—When once a man has established a home, his most important duties have fairly begun. The errors of youth may be overlooked, want of purpose, and even of honour, in his earlier days may be forgotten. But from the moment of his marriage he begins to write his indelible history; not by pen and ink—but by actions—by which he must ever after be reported and judged. His conduct at home, his solicitude for his family; the training of his children, his devotion to his wife, his regard for the great interests of eternity these are the tests by which his worth will ever after be estimated by all who think or care about him. These will determine his position while living, and influence his memory when dead. He uses well or ill the brief space allotted to him, out of all eternity, to build up a fame founded upon the most solid of all foundations—*praiseworth*—and God will judge him accordingly.

HINTS FOR WIVES.—Perchance you think that your husband's disposition is much changed—that he is no longer the sweet-tempered ardent lover he used to be. This may be a mistake Consider his struggles with the world—his everlasting race with the busy competition of trade. What is it makes him so eager in the pursuit of gain—so energetic by day, so sleepless by night—but his love of home, wife, and children, and a dread that their respectability, according to the light in which he has conceived it, may be encroached upon by the strife of existence. This is the true secret of that silent care which preys upon the hearts of many men; and true it is, that when love is least apparent, it is nevertheless the active principle which animates the heart, though fears and disappointments make up a cloud which obscures the warmer element. As above the clouds there is glorious sunshine, while below are showers and gloom, so with the conduct of man—behind the gloom of anxiety is a bright fountain of high and noble feeling Think of this, in those moments when clouds seem to lower upon your domestic peace, and by tempering your conduct accordingly, the gloom will soon pass away, and warmth and brightness take its place.

HINTS ON DYEING.

It may be necessary to remark that every article to be dyed, as well as everything used about dyeing, should be perfectly clean.

In the next place, the article to be dyed should be well scoured with soap, and then the soap rinsed out It is also an advantage to dip the article you wish to dye into warm water, just before putting it into the alum or other preparation, through neglect of this precaution, it is nothing uncommon to have the goods, or yarn spotted. *Soft* water should always be used if possible, and sufficient to cover the goods handsomely.

As soon as an article is dyed it should be aired a little, then well rinsed, and afterwards hung up to dry.

When dyeing or scouring silk or merino dresses, care should be taken not to wring them, for this has a tendency to wrinkle and break the silk.

In putting the dresses and shawls out to dry, that have been dyed, they should be hung up by the edge so as to dry evenly

CHROME BLACK.—*For Woollen Goods.*—For 5 lbs of goods, blue vitriol, 6 oz.; boil it a few minutes; then dip the goods ¾ of an hour, airing often; take out the goods, and make a dye with logwoods, 3 lbs.; boil ½ hour: dip ¾ of an hour, and air the goods, and dip ¾ of an hour more. Wash in strong suds. This will not impart any of its color in fulling, nor fade by exposure to the sun.

BLACK ON WOOL.—*For Mixtures.*—For 10 lbs. of wool, bichromate of potash, 4 oz., ground argal, 3 oz, boil together, and put in the wool, stir well, and let it remain in the dye 4 hours. Then take out the wool, rinse it slightly in clear water, then make a new dye, into which put logwood, 3½ lbs. Boil 1 hour, and add chamber-lye, 1 pt., and let the wool lie in all night. Wash in clear water.

DOMESTIC ORNAMENTS.

A beautiful ornament for the sitting-room can be made by covering a common glass tumbler with moss, the latter fastened in place by sewing cotton wound around. Then glue dried moss upon a saucer, into which set the tumbler, filling it and the remaining space in the saucer with loose earth from the woods. Plant the former with a variety of ferns, and the latter with wood violets. On the edge of the glass also plant some of the nameless little evergreen vine, which bears red (scarlet) berries and whose dark, glossy, ivy-like foliage will trail over the fresh blue and white of the violets with beautiful effect Another good plan is to fill a rather deep plate with some of the nameless but beautiful silvery and light green and delicate pink mosses, which are met with in profusion in all the swamps and marshes. This can be kept fresh and beautiful as long as it is not neglected to water it profusely once a day. It must, of course, be placed in the shade, or the moss will blanch and die. In the centre of this a clump of large azure violets should be placed, adding some curious lichens and pretty funguous growth from the bark of forest trees, and a few cones, shells and pebbles.

DOMESTIC HINTS.

Eat slowly and you will not over-eat.

Keeping the feet warm will prevent head-aches.

Late at breakfast—hurried for dinner—cross at tea.

Between husband and wife little attentions beget much love.

Always lay your table neatly, whether you have company or not.

Put your balls or reels of cotton into little bags, leaving the ends out.

Dirty windows speak to the passer-by of the negligence of the inmates.

Whatever you may choose to give away, always be sure to *keep your temper.*

In cold weather, a leg of mutton improves by being hung a week or more.

When meat is hanging change its position frequently, to equally distribute the juices.

There is much more injury done by admitting visitors to invalids than is generally supposed.

Matches, out of the reach of children, should be kept in every bed-room. They are cheap enough.

Apple and suet dumplings are lighter when boiled in a net than a cloth. Scum the pot well.

When chamber towels get thin in the middle, cut them in two, sew the selvages together, and hem the sides.

When you dry salt for the table, do not place it in the salt-cells until it is cold, otherwise it will harden into a lump.

Never put away plate, knives and forks, &c., uncleaned, or sad inconvenience will arise when the articles are wanted.

Feather beds should be opened every third year, the ticking well dusted, soaped and waxed, the feathers dressed and returned.

CHOICE OF MEAT, POULTRY, AND FISH.

Beef.—The grain of ox beef, when good, is loose, the meat red, and the fat inclining to yellow. Cow beef, on the contrary has a closer grain, a whiter fat, but meat scarcely as red as that of ox beef Inferior beef, which is meat obtained from ill-fed animals, or from those which had become too old for food, may be known by a hard skinny fat, a dark red lean, and, in old animals, a line of a horny texture running through the meat of the ribs. When meat pressed by the finger rises up quickly, it may be considered as that of an animal which was in its prime; when the dent made by pressure returns slowly, or remains visible, the animal had probably passed its prime, and the meat consequently must be of interior quality.

Veal should be delicately white, though it is often juicy and well flavoured when rather dark in colour. Butchers, it is said, bleed calves purposely before killing them, with a view to make the flesh white, but this also makes it dry and flavourless. On examining the loin, if the fat enveloping the kidney be white and firm-looking, the meat will probably be prime and recently killed. Veal will not keep so long as an older meat, especially in hot or damp weather; when going, the fat becomes soft, and moist, the meat flabby and spotted, and somewhat porous like sponge. Large overgrown veal is inferior to small, delicate, yet fat veal. The fillet of a cow-calf is known by the udder attached to it, and by the softness of the skin, it is preferable to the veal of a bull-calf.

Mutton.—The meat should be firm and close in grain, and red in colour, the fat white and firm. Mutton is in its prime when the sheep is about five years old, though it is often killed much younger. If too young the flesh feels tender when pinched; if too old, on being pinched it wrinkles up, and so remains In young mutton, the fat readily separates: in old, it is held together by strings of kins.

(To be continued.)

PRESERVING GRASSES, FERNS, & FLOWERS.

The following details in the art of preserving flowers, &c. are given by a lady correspondent of the *Villa Gardener*:—"Grasses should be gathered early before too ripe. If we desire them to retain their bright hues without the aid of art. Gathered then, tied up in large bunches, and hung away in a dark closet, they come forth at our bidding, fresh and green as when plucked. Now, by brook-side or in shady places, we can find graceful grasses, which will prove additions to our winter bouquets, but they will lose their colouring, and require a dip into 'Green Dye.' Dry them again, and they will last for years. Wild oats, feather-grass, and all their various species are very ornamental in winter, and, mingled with the everlasting flowers— Acroclinium, Xeranthemum, and the white, yellow, and crimson Helichrysums— they vie with their more perishable sisters, whose glories are on the wane. We have just arranged two small vases for the coming winter. The brilliant pink and white Acroclinium add much to their beauty. The white Helichrysums can be dyed a brilliant purple or scarlet with Dyes, and exquisite bouquets can easily be manufactured. These 'everlasting' flowers should be gathered as soon as the outer leaves open. Tie them up in bundles as you pick them, and hang up, flowers downwards, to dry Treated in this way, the stems are straight, and more easily used. They can be hung to dry in one's chamber, not requiring a darkened place. Most of these flowers are allowed to remain too long upon the bushes, and their beauty is spoiled. As they become dusty under the frequent sweepings or carpets, we dip them in cold water, their petals close entirely. We dip the grasses also, to cleanse them, else they will acquire a dingy hue. Many persons like crystallised grasses. These are easily made by dissolving 1 lb. of alum in a quart of boiling water, suspending the grasses just over the steam—not to touch the water—and as it cools, the crystals gather. Grasses need not be dyed before they are crystallised. A few of them mingled with the green grasses and brilliant-hued flowers light up well Ferns are much sought after for floral decorations. Their feathery plumes, pinnated leaves, and graceful forms are very beautiful. They differ from the grasses, for those gathered late in autumn retain their colours better than the fresh ferns of June. The sap has hardened in their leaves. We have gathered them late in November, when they were surrounded by snow, and they have kept green all winter The running fern is a lovely decoration for walls and pictures. Its flowers add much to its grace and beauty, but it fades quickly, and by Christmas but a faint green remains. Dip them into Dye (following the directions given for dyeing ribbons), and you will keep their lovely colour. After they have been throughly pressed in heavy books, then dye them, spread on paper to dry in the shade, and then press again Thus treated, they will last for years Maiden-hair, the most graceful of our ferns, soon loses its colour, but dyed, it is an addition to every collection of grasses or ferns. Parsley fern is very beautiful; its soft feathery leaves are always sought after. These, if gathered late in the autumn, will retain their colour much better. The male fern, with its stiff stems, if well pressed, looks beautiful. We mingle it with the many-coloured leaves of autumn, or we pin it to the wall-paper, around pictures, or over lace or muslin curtains, and its effects are charming. Bunches of dyed mosses are to be purchased of all seedsmen in the cities; we dwellers in villages cannot avail ourselves of them if we would, but we can make them even prettier than those exposed for sale. Gather the mosses, pick out all the *debris*, cleanse from dirt, and dry in the sun; then dip into dye, spread on papers to dry by fire or sun-light We gathered last year a very finely fibred moss, dyed in a lovely green, and saved some of the original colour to mingle its brown hues with it.

DOMESTIC RECEIPTS.

Irish Stew.—Take 4 lbs. good breast of fat mutton, cut in small pieces; 2 large white onions; 10 large potatoes, well peeled and sliced; put all in saucepan together, with fine herbs, pepper and salt to suit; a little salt pork is a good addition, ½ lb. of flour; ½ lb. good fresh butter, well rubbed together, and let it boil for one hour, and have it well cooked.

Fish Chowder.—Fry a few slices of salt pork, dress and cut the fish in small pieces, pare and slice the potatoes and onions, then place them in the kettle, a layer of fish, then of the fried pork, potatoes, onions, &c., seasoning each layer with salt and paper. Stew over a slow fire 30 minutes.

NOVEL MODE OF SLAUGHTERING CATTLE.

The present mode of killing cattle, by striking the animal, with a hatchet or axe, is a cruel operation, as in most cases repeated blows are required to produce the death of the animal. Different methods have been recommended and tested for the purpose of executing the operation with the greatest possible dispatch, so that the animal be not unnecessarily exposed to protracted suffering. The device represented in the illustration is a French invention, and promises to meet all requirements, being so simple in construction that it may be readily employed anywhere. The head of the animal is covered by a kind of mask of suitable material, which closes the eyes entirely, and is at the centre provided with a circular plate of sheet iron, riveted thereto, which guides in a central perforation plate. The inner end of the sliding-bolt faces the head of part is provided with a large knob. The masked or blindfolded animal has no idea of his fate, a single blow of the hammer or club on the knob being sufficient to drive the bolt into the brain, and produce the instant dropping of the animal as if struck by lightning. The theory is, that the small quantity of air in the hollow end of the bolt is forced with the same into the brain, and, being heated by the compression, exerts a pressure on the brain, and causes thereby almost instantaneous death. The whole operation is completed within half a minute. Several cities of Germany and France have provided by special ordinances for the introduction of this device, which recommends itself to the attention of all humane persons.

TO ADVERTISERS.

Points in Advertising.—Advertising gives the impetus to trade, and tact holds the helm. As a matter of experience, it is beyond dispute that judicious advertising pays to an extent beyond any ordinary comparison with its cost. The progress of competition is so rapid that a "good old house" which does not advertise is in danger of losing much sound custom. Some people think it *smacks* of dignity to say they can live without advertising. They may *live* upon this kind of dignity, but life is one thing, and success to life is another. A good reputation in business means that you shall be *widely* as well as favourably known.

The objects to be kept in view by advertisers are :—1. That their announcements shall reach the class of people aimed at. 2 That they shall reach as many of that class as possible 3. That the advertisement shall come directly before the eye, and not be *lost* in a crowd. 4. That it shall be made as much to the interest of the buyer to look for the advertisement as it is for the seller to advertise.

The Selection of Periodicals.—A wide distinction must be drawn between advertisements intended for the million and advertisements intended for a class; for class advertisements are almost wholly thrown away in newspapers and magazines of a general character. Wholesale and manufacturing houses of all kinds should advertise in those periodicals *which are regularly consulted by buyers*. If a periodical circulates largely among any one class, you should expect to find it valuable and practical in its editorial features ; containing such information as your own judgement tells you the class will gladly and frequently consult. The numerical circulation of an advertising medium, though important, is not the only feature to be inquired into. Another question is : What class of readers does it go among—are they likely to become customers of the person advertising ? Another is : It is of a character that makes it pretty certain to be *read through with care* from beginning to end, or nearly so, or is it of an ephemeral character—a paper to be glanced at for the news and then thrown aside? Another is : It is likely, after being read through, to be destroyed, or to be preserved for reference ? And still another : It is likely to be referred to *frequently* or only once in a while ? And what weight do its opinions carry ?

It is a well-known fact that gum-arabic will not cause some kinds of blotting-paper to adhere. This may be remedied by adding to eight ounces of the concentrated solution, sixteen grains of aluminum sulphate. Alum answers also, but not so well.

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, 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 addresse 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.