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SCIENTIFIC CANADIAN
MECHANICS' MAGAZINE
AND
PATENT OFFICE RECORD

Vol. 9. APRIL, 1881. No. 4.

THE scheme for the improvement of the Montreal Harbour known as the Shearer Peninsular Scheme is beginning to take definite shape. The plan, as is generally known, involves the construction of a dam between Point St. Charles and St. Helen's Island, and the building of an iron bridge from the island end of the peninsula so formed to St. Lambert on the other side of the river. The gain merely in wharfage facilities to the city would be enormous, and in addition to this it is claimed that the railways and highways to be established over this section, will of themselves pay a very large interest upon the small sum of $3,400,000 which is all that will be required for the completion of the first part of the scheme. Beyond this however, the wharfing of the harbour side of the peninsula, and the building of warehouses and other facilities may be reasonably expected to pay for themselves, while in any case the value of the land itself would represent a considerable sum. The scheme is as yet however, scarcely enough before the public to admit of a detailed criticism, though it will in all probability be brought forward without delay.

COLONIZATION is the means by which it is now proposed to conquer the difficulties connected with the journey to the North Pole. Colonies are to be established amongst the Esquimaux as near as possible to the Pole, and gradually pushed to the north. Nothing could be more charming for everybody except the colonists and possibly the Esquimaux, who may have objections not hitherto published to being pushed pole-wards and made to do "all the hard work," as the proposal contemplates. The pleasures of the climate, the abundance of game and other luxuries, and the delightful sensations attending the three or four months during which it is not necessary to get up in the morning, or rather when there is no morning to get up in, will, it is expected, attract colonists in large numbers to this favored region. It is understood that a Syndicate has been formed for the purpose of providing proper means of transportation, and that alternate blocks of territory between Smith's Sound and the Pole will belong to them. This is expected to greatly encourage forthcoming settlers, and applications for allotments should be made early to insure attention.

THE Irish question is, if not absolutely solved, at least rendered comparatively easy of solution by Mr. Charles King. So soon as the said Mr. King can obtain the necessary means for carrying to a successful conclusion his schemes of geographical annexation, England and Ireland will be not two, but one country, over the government of which it would be, of course, the height of foolishness to dispute. The plan alluded to is the trifling operation of constructing an embankment road between England and Ireland. The distance is only nineteen miles and the depth 474 feet, so that obviously nothing could be simpler than tipping in enough earth to fill the aching void. Disagreeable persons of an engineering turn of mind may suggest that it will be necessary to dig up a county or two to provide the necessary amount of earth, and still more disagreeable persons are, out of pure curiosity, wondering what will become of the Gulf Stream. But Mr. King cares for none of these things, and why should we? or if we may make a suggestion, would it not be rather a good opportunity for the home Government to utilize recalcitrant townships? The threat of being used as ballast for an embankment would surely quiet even Tipperary.

So much attention has been called to the delay in the appearance of recent numbers of the Magazine, that a few words of apology seem becoming and even necessary. The delay has been owing to a variety of causes, amongst which we may mention the change in the editorial department, and the difficulties attending the issue under a new management. These difficulties have now, however, entirely disappeared. The present number will appear early in the month to which it belongs, while in future the magazine will be issued shortly before the first of that month.

AMONGST our illustrations this week will be found drawings of two remarkable objects in natural history, which have also appeared in the CANADIAN ILLUSTRATED NEWS. The Wolf-fish (*Anarrichas lupus*) is occasionally met with in the fish markets of London, but so far as we know, the present is the first specimen seen in Canada. It belongs to the family of the *gobies*. This strange repulsive fish has an elongated body covered with small scales, a long dorsal fin extends down the whole of the back. There are no ventral fins, and the pectorals are comparatively small, the head short and rounded, and the markings of it together with the position of the glaring eye and the long, sharp curved front teeth give it a fierce cat-like expression, The back teeth and those of the palate are specially adapted for crushing shell-fish, being close together and tubercular or rounded. In our engraving on page 124 a view of the inside of the mouth is given to shew the teeth. The present specimen measures three feet three inches, but the Wolf-fish attains occasionally to the length of eight feet or more. It is a native of the Northern seas, not uncommon on the shores of Greenland and Iceland, and occasionally appears on the North coast of Scotland and amongst the Orkneys. The Wolf-fish is really as ferocious as it looks, and often shews fight when imprisoned in a net, in a manner which renders its despatch exceedingly difficult. The general color is brownish gray with darker vertical bands on the back and intermediate spots, a whitish belly, and a triangular mark upon the top of the scull.

The other specimen alluded to is described in a letter from the Rev. V. Clementi of Peterborough, as follows:

FELIS LYNX.

This lynx, whose spoor, very different from that of the Canadian lynx, had been noticed for the last five or six years, was trapped in the middle of March, about 12 or 13 miles from the town of Peterborough.

It is small, fully seven or eight years old, and of the following dimensions: Length from ear to insertion of tail, 30 inches; height to shoulder, 20 inches; length of tail, 6½ inches. Color, reddish fawn, with indistinct blotches of brown; the inside of the legs lighter in color, with black stripes; a black stripe along the back; white spots at the back of either ear and under the chin and throat.

The animal was very fat and weighed 30 lb. It is known in the North-West as the "European Lynx."

Peterboro, March 29, 1881. VINCENT CLEMENTI, B.A.

ACTION OF AN INTERMITTENT BEAM OF RADIANT HEAT UPON GASEOUS WATER.—Such is the title of a book which Professor Tyndall has, within a few weeks, presented to the Royal Society. From the consideration of Mr. Alexander Graham Bell's experiment on the action of an intermittent beam of light upon solids by means of which musical sounds were produced, Professor Tyndall began a series of experiments upon the vapors of various chemical substances, such as the different ethers, ammonias, etc. The results were similar to Mr. Bell's, for in nearly every case sounds, ranging in their intensity with the different substances, were produced. After giving the results of his experiments in detail, he concludes: "With a very rude arrangement I have been able to hear the sounds of the more active vapors at a distance of one hundred feet from the source of rays. Several vapors other than those mentioned in this abstract have been examined, and sounds obtained from all of them. The vapors of all compound liquids will, I doubt not, be found sonorous in the intermittent beam. And as I doubt whether there is an absolutely diathermanous substance in nature, I think it probable that even the vapors of elementary bodies, including the elementary gases, when strictly examined, will be found capable of producing sounds."

Hints to Apprentices.

APPRENTICESHIP I.

The question of apprenticeship is one upon which there is still much difference of opinion, and it is one that in the past has caused many bitter contentions between employers and employed. Some portion of this strife was no doubt due to the restrictive rules of Trades Unions, by which they sought to limit the number of apprentices, and to prescribe the period for which they should be bound. But the restrictive rules alluded to were not invented by trades unionists; their origin must be sought far back in the pages of our history. To some extent these old customs survive to this day, as for example in the City of London and other ancient Corporate towns, where special privileges are accorded to the freemen thereof—not by purchase, as in the former case, but by servitude only, as in most of the latter—if not indeed in all, where that "freedom" is attainable under the Municipal Corporations' Acts. The freedom of a Corporate City or Borough at one time carried with it important privileges both political and social; in some cases these continue; in others the advantages are now chiefly social, but they are none the less important.

The primary object, and, indeed, the only real object, of the apprenticeship system was to ensure good craftsmen. As soon as it began to confer other benefits it became protective in its character. Later on, and incidentally as it were, it became mixed up with questions of wages, and here it was, mainly, that the disputes with regard to it first arose. The men regarded an influx of apprentices with aversion, inasmuch as they effected a displacement of adult journeymen, and afforded to the master a pretext for reducing, and a means whereby to reduce, wages. This led to disagreements, disputes, and strikes. When matters arrived at this stage the practical object of apprenticeship was unfortunately forgotten; "mastering the trade" was lost sight of, and the price to be paid for labour was dragged to the front. The consequence has been that learning a trade by a formal deed of apprenticeship or indenture has fallen into disuse, and nothing, comparatively speaking, has as yet been substituted in its stead.

It may be affirmed that the proportion of *skilled* men, in any given trade, is not so great now as it was formerly. Say that the percentage fifty years ago was in the ratio of 75 in the 100, the number would scarcely reach 50 in the 100 at the present time; indeed it is doubtful if the average reach anything like or near that mean. That we have in the mass a considerable body of thoroughly skilful and competent workmen no one can deny; that some of them far excel those of fifty years ago may also be true; but the question is, could an employer take at random any number of his men, and tell them off for a particular job, with the full confidence that all and each of them could undertake any and every part of the special branch of trade at which they worked, and by which they got their living? They reply would be in the negative in every department of industry in this country. But it might be said that the division of labour being now so much greater than it was formerly, a man is only expected to be an expert in one department of his branch. In some business this is so; but it does not apply to all; and it scarcely applies at all to the building trades generally, and where it does the cases are somewhat exceptional. For example, we should think a man a very poor mason who could not fix the stones that he had previously worked on his own banker. Yet it is well-known that a "stone-setter" acquires greater skill and expertness by doing fixing only, and on all large jobs fixers do nothing else, indeed a large number of them could not "take a banker" and work the stone which he is called upon to fix. So with the joiner, if is he constantly employed in making doors, or sashes, or other special work, he becomes more and more expert in this particular line; but as "a craftsman" he ought to be able to fix the frames and hang the doors or sashes that he has made if called upon to do so. But then he would be called a carpenter, and this, to a shop-joiner, would be considered *infra dig.*

If the division of labour is carried out to a great extent, it is evident that the time required for learning a section only of one branch is not so great as it would be if the learner had to acquire a knowledge of, and practical familiarity with, the entire branch of that trade; therefore, the term of apprenticeship ought to be shortened accordingly, or he ought to learn fully every branch of his own particular handicraft in all its essential details. This, however, is not practicable for an apprentice to do under existing circumstances, unless it be in very exceptional and favourable cases.

The difficulties in the way of learning a trade are at present both great and numerous, and a boy must be clever to pick up a sufficient knowledge of the craft to be able to take his place as a journeyman, and command the current wages of that trade. The reasons for this state of things are many and various ; in the first place, the absence of formal apprenticeship by indenture or agreement has had the effect of loosening if not destroying that bond which in former times existed between master and apprentice ; the latter is, so to speak, simply a little journeyman, working the same number of hours as other journeymen, but earning less wages. The master cannot teach him the trade, for few of them, comparatively, know it ; and if they did their duties are more in the counting-house than in the shop. The foreman cannot do it ; he has enough to do in setting out the work for the men, keeping their time, looking after them while at work, and in providing the material from day to day and week to week with which they have to work. In fact, the full-fledged journeymen occupy the whole of his time.

The boy's only chance, therefore, is with the workmen employed, and these have no interest, direct or indirect, in teaching him the rudiment of his trade ; on the contrary, their *interest* lies quite the other way. If the boy's father is in the shop, or even in the firm, he fares better ; but none, except the father, have any obligations, moral or pecuniary, with regard to that boy. If, however, he is a sharp and a clever lad he will soon make friends, and create for himself those conditions that are essential to his success. Few men are altogether insensible to the hopes, aspirations, and struggles of a shrewd and willing boy, and he soon finds some willing helper in the shop. But there is the feeling that this very lad will one day supplant them, and take their wages ; or by active competition assist in reducing their pay. In a few trades some provision against this state of things is made by giving to the foreman and to the workman either a part of the premium, if one be paid, or a small portion of the apprentice's wages for the first year or couple of years ; a direct responsibility is thus created by giving to the teachers a pecuniary interest in the lad's progress. This principle might be extended with advantage.

It is of the utmost importance that the youths who are growing up to take positions in life as artizans shall be well trained in the principles of the handicraft for which they are destined in life ; the keen competition of foreigners is making the fact more apparent year by year. And it is a mistake to suppose that they are our competitors only on their own soil. The thousands who now find a place in our workshops attest the fact that they are fast elbowing their way into our midst. And where this is not done they find employment in our colonies and in America, to our displacement and sometimes to our disadvantage. In the building trades we have not yet suffered much in this respect at any rate at home ; but in more artistic work of carving and gilding, decoating and upholstering, they have managed to get a firm footing, and no doubt other branches will in due time be open to and be filled by them. Our only chance, therefore, is by superior workmanship to enable our artizans to hold their own. How this is to be done except by an improved method of apprenticeship, which shall be free from antagonism, and mutually beneficial to employers and employed, it is difficult to see. Education is preparing the ground for future triumphs ; technical instruction is gradually sowing the seed ; but nothing can take the place of practical tuition in the workshop ; then and there only can a youth acquire skill in manipulation, experience in details, and that expertness and dexterity which is the distinguishing characteristic of the workman—skilful in his trade.

It appears that the wine-production of France for 1880, amounts to 29,677,742 hectolitres ; this is 4 million hect. more than in 1879, but less by 22 million hect. than the average production of the last ten years. In the departments but slightly affected by phylloxera, the yield has been over the average. Phylloxera last year destroyed 30,000 hectares of vines. The deficit of wine produced in France stimulates importation ; thus, while in 1878, the importation was hardly 1 million hectolitres, it rose to 6 million (odd) hect. in the first eleven months of last year. Spain furnishes most (4 million hect. out of the 6) ; a good deal comes from Italy. The manufacture of wine from raisins continues to increase, the importation of raisins rose from 29 million kilogs in 1878, to over 62 millions in 1880. The production of cider, chiefly concentrated in Normandy and Brittany, shows a steady decrease. Last year it was 5 million hectolitres less than the average of the last ten years.

POLAR EXPLORATION.

The steam whaling bark, *Mary and Helen*, recently purchased by the Government for $100,000, has been taken to Mare Island, to be refitted for the search expedition after the missing *Jeannette*. Her whaling outfit is to be taken out of her, that not being included in the purchase. By the time the vessel is refitted at the navy yard, she will have cost the Government a good round sum. Her actual value was perhaps $35,000 to $40,000, without taking into account the contingency of profits for the season ; but, of course, like all Government purchases, two prices had to ba paid. Not that the vessel is not a good one in her way, as she is new, strong and well built. It is probable, however, it will be found that she is much too large for the purpose intended. Speed is of little object where sometimes they do not make a mile a year ; but size is a very important factor where the vessel has to be worked in narrow leads, and often "tracked" or hauled along by the men. A vessel the size of the *Corwin* which went up last year, would be much more convenient.

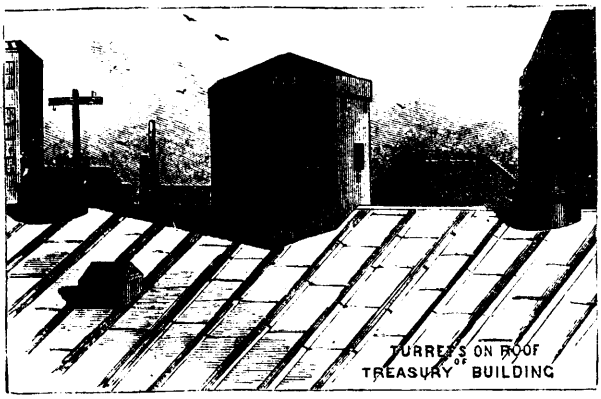
The selection of officers and men for this expidition will be made in Washington, and it is generally believed that Lieut. A. G. Berry, U.S. Navy, will command the expedition.

We do not know what Mr. Berry's experience may have been, but think that a very careful selection should be made of some one with experience in Arctic waters. Capt. Hooper, of the *Corwin*, who went up last year, would have been an excellent choice, as his researches and experience would have been invaluable. His ice pilot, Capt. Smith, now on a whaling voyage, we believe, would also have been a valuable assistant. The assistance of one of the experienced whaling captains would also be of great service. Dr. W. H. Dall, of the Smithsonian Institution, who has spent so many years in coast survey work in Alaska, on his schooner, *Yukon*, would be among the best men that could be found if he would be willing to go. His great general knowledge, scientific ability, and experience with the currents, etc., of the coast, make him eminently fitted to command the expedition. Among others, Lieut. Schwatka was an available man. It is to be hoped that the expedition will not be given in charge of some one who has yet to gain his experience in the Arctic, as much valuable time will be lost if such is the case.

In this connection it may be stated that among the stories current in New York, is one that James Gordon Bennett is seriously contemplating an Arctic expedition. Larry Jerome, who is in Europe with him, has recently written to a friend that, while Bennett is enjoying himself greatly as master of a hunt somewhere in England, he is very much depressed and anxious over the Arctic expedition which he equipped and sent out in the name of the *Herald*. He conceived it to be his duty to fit out another expedition in search of the last one, and take command of it himself. He has already telegraphed to stop work on a new yacht he contemplated building in this country, and thinks the money he proposed to spend that way shall be devoted to the building of a vessel to be speedily constructed with the view of encountering ice in the Northern seas. Already he has had some interviews with Scotch ship-builders on the subject. Therefor, the news that Bennett has seriously entered upon this new project may be expected at any time. It is characteristic of Bennett that execution follows closely upon the heels of conception.

News comes from Washington that two polar expeditions are to be fitted out and sent north in the coming summer, under the direction of General Hazen, Chief Signal Officer, for purely scientific purposes. One, to Lady Franklin's bay, is to be under the command of Lieut. Greeley, one of the most trusted officers of the Signal Corps ; the other will sail from San Francisco and will establish itself at Point Barrow, on the north coast of Alaska. The commanding officer of the second expedition has not yet been designated.—*Mining and Scientific Press.*

It is reported that a government officer has discovered a city buried in the shifting sands of South Algiers. He had previously opened up a subterranean river, which led him to make further explorations, which were rewarded by the appearance of a second Pompeii, with inscriptions, vaulted passages, and other architectural remains of great beauty. At the latest report a mosque and nine houses have been unearthed, and the hidden river gave promise of supplying enough water to redeem a considerable domain of fertile land from the desert.



THE STEEL FORTRESS ON THE ROOF, AS MANNED TO REPEL AN ATTACK FROM NEIGHBORING STREETS AND HOUSE-TOPS.

NEW YORK CITY.—HOW UNCLE SAM'S MONEY IS GUARDED IN THE SUB-TREASURY BUILDING.

THE TREASURY BUILDING NEW YORK.

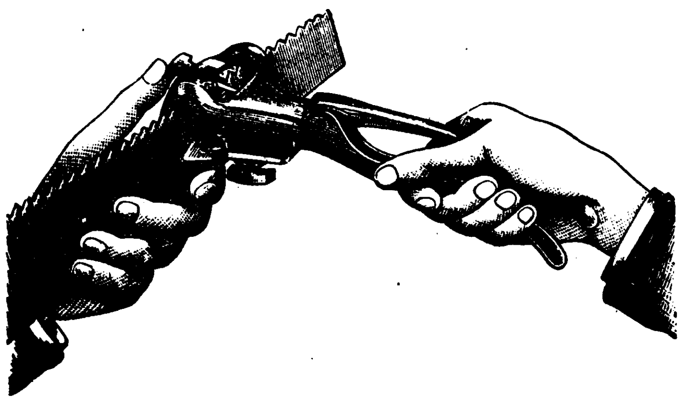
Uncle Sam has completed arrangements to protect most thoroughly the millions of money stored in the vaults of the Sub-Treasury at New York. The vaults themselves have been considerably enlarged to accomodate the vast amount of bullion sent there for storage and the great bags of coined money, and new doors have been provided, with a most intricate network of horizontal and perpendicular bars, operated by time locks of the most ingenious construction.

There have been many occasions when alarm has been felt lest an attack might be attempted upon the building by a mob. This apprehension is now overcome by the practical conversion of the building into a formidable fortress. As shown in our engraving, and as may be seen by pedestrians, the heavy shutters of the various windows have been perforated to admit of a pretty accurate sharp-shooting exercise from within, in case the building should be surrounded by a strong body of rioters. Upon the roof, however, is the chief innovation, consisting of steel turrets, fitted with loopholes for rifle firing, and larger ones for the destructive work of improved Gatling guns. There are four of these combination guns, so mounted that they can sweep the neighboring house-tops, or, by being depressed, scatter their scores of bullets into the street. Above the apertures for the Gatlings are loopholes for riflemen, by which every angle of approach can be readily covered. The greatest secrecy is maintained concerning these means of defense, and our illustrations are the first that have been published of the cidatel, and the only ones that will be given to the public, for the strictest orders have been issued prohibiting the inspection, either of the fortress on the roof or the great vaults, by the public.

Morrill's Perfect Saw Set.

The accompanying engraving represents a machine for setting every kind of saw perfectly, hand, band, scroll, circular or mill.

The inventor of this instrument has had thirty years' practical experience in the use of all kinds of saws. The result has fully convinced him of the importance of having the saw perfectly set in order to work free, cut smooth, and do good work. He disagrees with many that the saw must be set wide; neither does he concur with another class that the saw should not be set at all.



MORRIL'S PERFECT SAW SET.

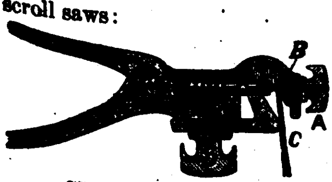
He contends that there is no saw that does not want setting, however scientific it may be made.

The saw, by constant use, wears on the side of the teeth, at the points, and causes friction that is only overcome by frequent filing, which consumes time, files, and a constant wear on the saw, besides the liability of rucking.

With the proper use of this set, saws need not be filed but once, where they are now filed three times, as the saw teeth should be set or pressed into line whenever they bind; by so doing the mechanic will find that he can do his work better, with more ease, and with greater rapidity, besides saving his files and the wear and bending of his saw, which is one of the greatest evils that can befall that ever useful tool, the saw.

This saw set is universal; it will set all kinds of saws that are in general use, even band and scroll saws, with the precision of a die.

Directions for using No. 1 for setting hand, band and scroll saws:



SECTIONAL CUT.

Hold the saw as seen in the diagram, the saw and set level, with the teeth upwards; adjust the die B, by means of the screw A, in the end of the set, so as to have the angle on the die B come near the base of the tooth on a fine saw. On a coarse saw have the angle of the die strike the tooth about two-thirds down from the point. Set the guard E on the under side of the set forward, to about three-sixteenths of an inch from the die B, then let the set hang loose on the saw.

When thus held the space between the tooth and the die shows the amount of set you will be giving the saw. To increase the set, move the guard E still closser to the die. To decrease the set, move the guard back. Be careful and not set your saw too wide, as the set will be so accurate that you will not want it one-half as wide as if done in any other way. These sets will last for years, being made of the finest quality of steel and refined iron.

Directions for using the No. 2 for mill and other large saws: Hold the saw plumb, the set level, with the teeth upwards; adjust the die by means of the screw in the end of the set, so as to have the angle on the die come down about three times the thickness of the saw from the point of the tooth. Regulate the amount of the set with the movable guard on the under side of the set; the space between the tooth and the die shows the amount of set you will be giving the saw. To increase the set, move the guard still closer to the die. To decrease the set, move the guard back. Be careful and not set your saw too wide, as the set will be so accurate that you will not want it as wide as if done in any other way.

Circular saws set with this set will never heat in any kind of wood. Every set is guaranteed to give entire satisfaction in all respects, and every part is interchangeable. These sets have been tested and approved by some of the best sawyers in the country. Price, No. 1, for hand, band and scroll saws, $1.25 each. No. 2, for mill and other large saws, $3.50 each. Sent free on receipt of price by J. H. Kerrick & Co., Indianapolis, Ind., or Minneapolis, Minn.

THE entire cost of transporting the obelisk, with its pedestal and steps, from Egypt to New York, and of their erection in Central Park, was recently paid by Mr. Wm. H. Vanderbilt to Commander Gorringe. Originally Mr. Vanderbilt promised only to pay the cost of transportation, as it was not then known that the obelisk would be placed upon a pedestal, but when it was learned that a pedestal and steps were conneeted with it, and an extra cost of about $30,000 was incurred, that amount as well as the other was promptly paid as stated.

Educational.

THE LOGARITHMIC SLIDE.*

To those who have acquired a knowledge of the capabilities of the logarithmic slide, it is ever a matter of surprise and regret that an instrument combining such unexampled rapidity, ease, and accuracy in performing all ordinary business calculations should be so little known. By its assistance the drudgery of computation is avoided, and the time and trouble expended on mere arithmetical workings proved to be a waste of effort; in short, its aid mentally may be safely compared with the advantages derived from mechanical appliances in diminishing the wear and tear of manual labour. The intellect is freed from the distraction of tedious processes, for the statement of each question, the operation and the result, are simultaneous and apparent in their connection. The laws that govern its operation are few and simple and easily understood; a preliminary knowledge of decimals being all that is required, and the curiosity of the uninitiated may be stimulated by learning, that on an instrument as portable as a pocketbook we have the whole gamut of numbers; and that whether, as a means for self-instruction or advancement, for unsurpassed utility in business, or for profitable amusement, its study is well rewarded in its capabilities for varied application. Scientific men estimate its value, the man of business appreciates its utility, and it will be well for the practical mechanic and engineer when he learns how to employ it intelligently, instead of carrying it in his pocket, as thousands do, yet unable, through a deplorable ignorance, to avail himself of its extraordinary powers.

Small as is the knowledge of it in our own country in which it was invented, it is less known and less used upon the Continent. But it should be recorded to the credit of the "heathen Chinee," that he is not altogether in the dark respecting its merits, the writer being credibly informed that it is frequently seen in the hands of educated Chinese merchants, to the great amazement of many an Englshman, who doubtless regards it as a Pagan device, about as well adapted for its purpose as the slender chopstick for the conveyance of food to the mouth.

A French writer upon mathematics, half a century ago, wrote that "in England the use of the slide-rule is taught in the schools at the same time with the letters of the alphabet," a statement which, it is needless to say, must be taken with more than the usual reservation. One writer has said of it, and justly, that "for a few shillings most persons might put into their pockets many hundred times as much power of calculation as they have in their heads; for the use of the instrument is attainable without any knowledge of the properties of logarithms on which it is constructed."

The labour and fatigue of manipulating long series of figures for nautical and astronomical purposes had long been felt to be irksome to those engaged in it. One of the earliest attempts by mechanical means to lessen and facilitate this labour was made more than 250 years ago, by the immortal Baron Napier, of Murchiston, in Scotland; and as this attempt was the precursor of logarithms, and the subsequent slide, it is necessary to allude to it. The invention consisted of a number of flat bone or ivory slabs, one of which was called the "index-rod," and also ten others, one for each of the digits, headed at top with its own digit. By placing these rods side by side, so that the top figures exhibit the multiplicand, and deriving from the index a line of figures corresponding to each number of the multiplier, the quotient is obtained by simply adding these figures together, no knowledge of the multiplication table being necessary. Division was effected in a somewhat similar manner, but even with these aids arithmetical calculations were tedious operations. It was not that the rods were esteemed because of their saving so much labour, for they did not do so; but it was that from the simplicity of the operation, more accurate results were likely to be obtained, than by the ordinary methods of multiplying and dividing. From the circumstance of the rods being made of bone or ivory, they were called "Napier's bones," and they have been more frequently noticed in historical works than in those relating to their use.

It would be altogether beyond the purpose of this sketch to enter minutely into the construction of logarithms, but it may be briefly said that they are a series of numbers in arithmetical progression, corresponding to others in geometrical progression, by means of which complex and lengthy calculations can be made with lightning-like rapidity, combined with perfect accuracy and ease. As a practical illustration, it may be mentioned that the innumerable and tiresome processes for obtaining numbers in a series, which would have to be resorted to were it not for their aid, would almost preclude the possibility of such works as the *Nautical Almanac*, and many kindred works. The radix, or root 1, from which Napier started, being found to be an inconvenient one, Mr. Henry Briggs, mathematical professor at Gresham College, in the year 1615, and, shortly after Napier's invention, adopted the number 10 for the root, as being preferable, and on this basis logarithmus have since been constructed, and upon this method huge volumes of nothing but tables of logarithms of various kinds have been calculated, and remain ready for the use of astronomers and others, who thus find the drudgery of their labour obviated; and an easy, pleasant, and unerring mode of calculation made ready to their hands. The discovery was looked upon by the learned as the great one of the age. Mr. Briggs, it is recorded was "beside himself for joy"; and Kepler, the great astronomer, "regarded it as a miracle." Napier's invention was not, like those of Kepler and Newton, connected with any analogies or coincidences which might have led him to it, but was the result of unassisted reason and science; and, says his biographer, "we shall be vindicated in placing him in one one of the very highest niches in the Temple of Fame. "Kepler," he goes on to say, "had mademany successful attempts to discover his canon for the periodic movements of the planets, and Newton had applied the palpable tendency of heavy bodies to the earth to the system of the universe in general; but Napier wrought out his admirable rules by the slow scientific process arising from the gradual evolution of truth."

In the early part of the seventeenth century Mr. Edmund Gunter, also a professor at Gresham College, invented the sector, and several other very useful instruments, including the surveyor's chain of 100 links for land measuring. He it was who first conceived the idea of marking out, on a scale, spaces whose lengths vary in exact proportion to the logarithmic value of numbers placed over against them.

This scale, so marked, he termed the "line of numbers," and it is in all respeets identical with that now in use upon the slide-rule. All the various operations of multiplication and division of numbers, &c., can be performed on this single scale by means of a pair of compasses, but these were subsequently abolished a few years afterwards by the Rev. William Oughtred, an eminent mathematician, who first adopted the plan of placing one scale against another, and sliding them together as might be required, and hence the term "slide-rule." He was a man who set little value upon instrumental aids, unless in the hands of those who had previously learned the principles on which they were constructed. A pupil of his—William Forster—says that in the year 1630, he spoke to him of a Gunter's rule he had, six feet long, to be used with a pair of "beame compasses"; upon which he answered that "the use of the compasses was a poor invention, and the performance very troublesome." "But," said he to Forster, "seeing you are taken with such mechanical wayes of instruments, I will show you what devices I have had by mee these many yeares; and first he brought mee two rulers of that sort, to be used by applying one to the other without any compasses." Mr. Forster then goes on to speak of the "great expediteness of this method, which farre excelleth any other instrument which hath bin knowne." The inconvenience of having two detached scales or rulers was soon found; and they were joined together by brass clips; and presently afterwards the slide in a groove, as we now have it, was devised by a Mr. Everard.

It may be supposed that at first the sliding-rule was not much used, if only from the difficulties experienced in its construction. This may be judged of somewhat from the following extract from the interesting diary of Mr. Pepys. Under the date of Aug. 10, 1664, Pepys says: "Abroad to find out one to engrave my tables upon my new sliding-rule with silver plates, it being so small that Brown, who made it, cannot get one to do it. So I got Cocker, the famous writing master, to do it, and I set an hour beside him to see him design it all; and strange it is to see him, with his natural eyes, to cut so small at his first designing it, and read it all over, without any missing, when, for my life, I could not, with my best skill, read one word or letter of it." To this entry Pepys adds, the next day, "Comes Cocker with my rule, which he hath engraved to admiration for goodness and smallness of work. It cost me 14s. the doing." The prices of those days were high, as compared with those of our own time, when, for a few shillings, a rule may be obtained of greater accuracy, and in a more convenient form than was then charged for merely marking the division.

* From an article in the *St. James' Magazine.*

Engineering, Civil & Mechanical.

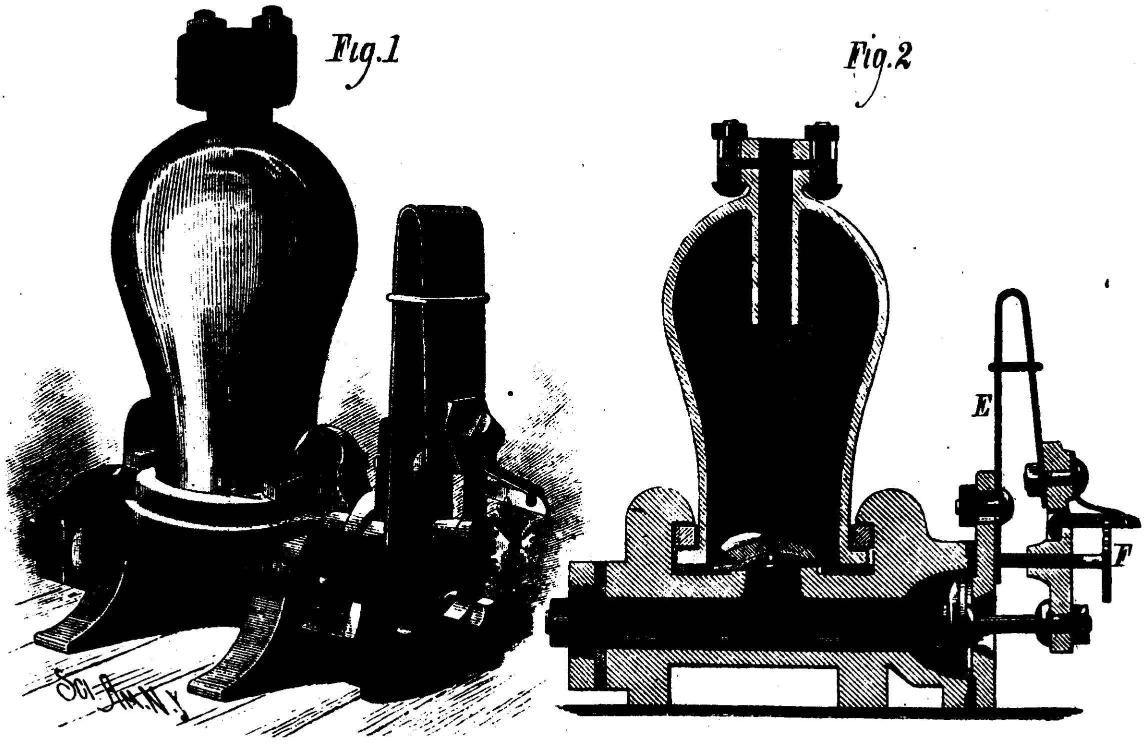
HIGH SPEEDS AND THE MECHANICAL THEORY OF HEAT.

Amongst engineers in the United States there has lately sprung up a great desire for high speeds or for high revolution numbers, a desire which is mainly the outcome of a study of the mechanical theory of heat. That theory points clearly to the fact that to increase the theoretical efficiency of any kind of heat-engine, the temperature of the fluid at its entrance to the cylinder, or at the time when it commences to do work, should be raised as high as possible, while the temperature at exhaust should be lowered as much as possible. The application of this principle to steam-engines involved the use of high pressure and great expansion; but when these were tried within limits, the results expected were not realized to the extent desired and theoretically possible. We need not recapitulate the reasons why compounding did not prove so efficacious as was expected; why the steam jacket is not so practically efficient as it ought to be theoretically; nor why high speeds have failed to yield the results expected. They are well known to engineers, and though not entirely satisfactory, they have all greatly reduced the loss from condensation, and are not likely to be given up. A study of the mechanical theory of heat discloses the fact that it is only by the use of super-heated steam we can entirely prevent the loss arising from condensation. But there are mechanical reasons why super-heated steam is not more extensively used, just as there are mechanical reasons why the air-engine—theoretically the most perfect of all—has never been extensively adopted. Difficulties discovered in the workshop and in the engine room seem to say—"thus far, and no farther," but so far as we have the theory to teach us the possibility, the probability will remain that better engines, whether steam or gas, air or fluid, will in time be built. For certain purposes, the tendency of engine designers in this country is towards high speeds, but at least one noted firm in America make a speciality of engines running at a very high rate, and claim that they are adapted for all kinds of work. Mr. Edison's new dynamo-machine, for instance, is to be driven by an engine making the extraordinary, not to say excessive, number of 600 revolutions per minute; and lately, Mr. Barnet Le Van proposed, in a paper read before the Franklin Institute, to run a train at the rate of 90 miles an hour between Jersey City and Philadelphia. It will be seen that, even if the driving wheel of the locomotive is 7ft. in diameter, it must make 360 revolutions per minute, that is 720 strokes of the piston and the other reciprocating parts; and if the driving wheel is smaller, this number will be propotionately increased. Mechanics, nowadays, work with skill so admirable, and with such accuracy, that it would be absurd to say that an engine could not be made to travel at that speed, or even a higher one; but it is clear that the risk of a breakdown would be largely increased, while it would also be of the first importance to provide a very firm and strong road-bed. We shall probably give the details of Mr. Barnet Le Van's proposals in a future number; but as they involve the laying out of a new line between the points above-mentioned there is no immediate likelihood of their being carried out. Still, there are several other indications that the Americans are not at all satisfied with existing arrangements, and it is not improbable that before long we shall hear of some developments in the speed of locomotives, as we have already in connection with stationary engines. So far as locomotives are concerned, we, in this country, have little to learn from American engineers, whether as regards speed, tractive-power, or durability; but there will unquestionably be some little curiosity about the "90 miles an hour," should it be attempted. The distance from New York to Philadelphia is, in a straight line, not quite 81 miles, and the rivalry between the competing lines now running trains between those places has whetted the appetite of American travellers for still higher speeds. It is confessedly impossible to do much more on the existing roads, for although the lines may be described as practically level, curves are abundant. For instance, on the Pennsylvania line there are 84 curves in the 88½ miles between Philadelphia and Jersey City, and the longest length of straight line does not exceed 10 miles. On the Bound Brook, a rival route, there are 43 curves, one of which is on the bridge crossing the Delaware. Mr. Le Van says that on a curve of three degrees radius, with the standard gauge, the super-elevation required is less than 5in. for 50 miles an hour, but would require to be 16in. at 90 miles an hour. One of the competing lines allows 1in. of super-elevation for each degree of curvature, but draws the line at 5in., beyond which super-elevation is not allowed to be practised. The speed must be reduced to suit the curve: hence there is a limitation to speed on the existing roads. After a careful study of the question and of the country, Mr. Le Van said he was satisfied that a paying road could be built to run in a straight line from New York to Philadelphia, reducing the distance by about 10 miles, and enabling trains to be run through in sixty minutes, allowing for the slow speed at the ends. The only curves would be two of 10,000ft. radius, and no roads would be crossed at grade. Mr. Nystrom thought there would be no difficulty in accomplishing the distance in less time than Mr. Le Van had stated, so far as driving the engine was concerned. These statements derive importance from the fact that they were made before the most scientific institution in America, and in a city which is interested in the subject.

So far as high speeds are concerned in stationary engines the problem is much simplified, as any speed may be said to be possible, short of knocking the engine to pieces. The Edison engine is of the Porter-Allen type, a simple reciprocating piston in a cylinder, having a diameter nearly equal to its stroke, and, as mentioned above, is to run at 600 revolutions per minute. A high-speed rotary engine, the invention of M. Tagnander, has been recently introduced for driving dynamo-machines, and that runs at 800 revolutions per minute. The cylinder has four chambers and pistons, and the steam acts on the bottom and top of each alternate piston in such a way that the moving parts are balanced with nicety, and their weight concentrated on the central line of the frame. The engine is said to have run for eight months perfectly steam-tight without the packing being touched. In principle it is of a very old type, and has been frequently re-invented. It is generally known as the disk engine, and will probably be found in Reuleaux's "Kinematics of Machinery," under the head of "Chamber-crank Trains," a chapter of which contains nearly all the rotary engines ever devised. For the special purpose of dynamo-machines and for propelling small yachts, the rotary principle may possibly come into some favour, especially where high speed is the essential, and disadvantages are disregarded if that can be maintained. But it is doubtful if it can be worked with economy.—*British Mechanic.*

THE PROPOSED IRON AND STEEL ASSOCIATION.

The proposal has been made that those interested in iron production in Canada should form themselves into an association, the object of which would be the promotion by all lawful means, of such legislation as will create a basis of security for the investment of capital in the business. We need scarcely enlarge upon the power of the associate and concerted action of many to bring about results for which invividual unconnected effort might labour everlastingly in vain. The English Anti-Corn Law League lives in history as the first great example of combination for a specific economic purpose, conducted in such a way as to harmonize with the genius of a free people and free institutions. Since that first great success there have been many smaller ones, all showing what can be effected by men who are in earnest, and combined for a purpose. That the Dominion would benefit by millions annually were its vast treasures of ore in course of being transmuted into merchantable iron at home, is what nobody denies; but just as clearly does it appear that without legislacion for the express purpose, no beginning worth speaking of will ever be made. All hope of any large extended development of iron production in Canada without tariff charges such as will give confidence to capitalists may be dismissed as utterly vain and futile; and it is but idle talk which would encourage it. Under exceptional circumstances an individual like Mr. McDougall of Three Rivers, or a company like that of Londonderry, may make a limited business in special lines; and the enterprising men engaged in those ventures deserve high credit for the value of their example before the country; but it is plain that without more N. P. legislation they will have few imitators. The Government which gave Canada a National Policy is doubtless able to bring iron production as well as other industries within the sphere of its vivifying influence; but for further steps a strong and unmistakeable backing of public opinion is imperatively required. It is for those who are specially interested in the development of iron making in Canada to appear and show cause before the public in the matter. If they want the Government to do something, and public opinion to sustain the Government in doing it, they should be able to give the reason why. In order to do this, association is necessary; the work is beyond the power of any individual. Association for all sorts of purposes is an old story with us now; and it should not require much urging to show the application of the principle to the present case. The latest and nearest example for us is that of the American Iron and Steel Association, some particulars regarding which we will at an early day lay before our readers. —*Industrial World.*



MORROW'S HYDRAULIC RAM.

IMPROVED HYDRAULIC RAM.

The hydraulic ram is one of the simplest and most desirable devices for raising water where a fall of a foot or more is available, providing its construction be such as to insure continuous and uniform action under equable conditions. A ram which seems to embody every essential feature without being unduly complicated is represented by the annexed engraving, in which Fig. 1 is a perspective view showing the exterior, and Fig. 2 is a vertical section showing the interior construction.

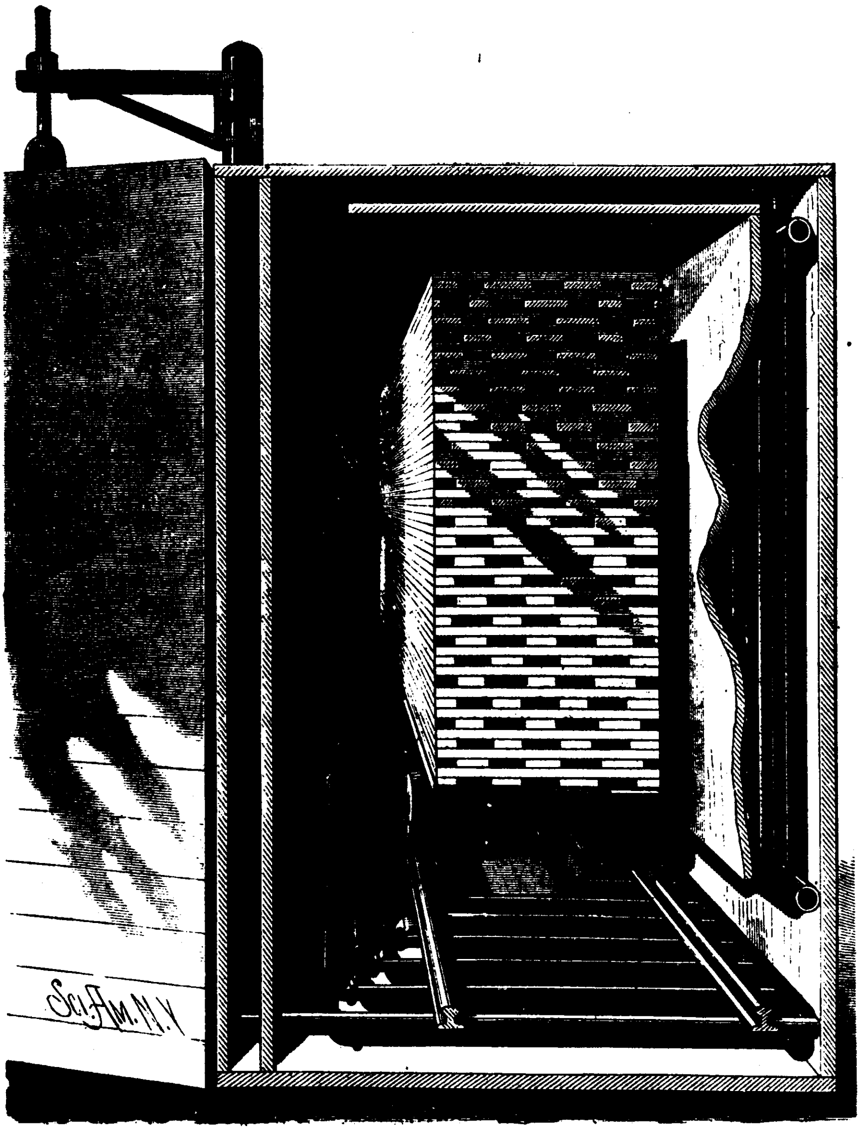
The base of the ram has a horizontal passage, A, with a discharge valve, B, at the top, and an overflow valve, C, at the end. Covering the discharge valve there is an air chamber, held in place by keys or wedges, and furnished with a discharge pipe at the top, which projects a short distance downward and serves the double purpose of a discharge for water and an escape for the surplus of air in the chamber. One of the greatest troubles with all rams, aside from this one, is the gradual increase of water in the air chamber until the chamber is filled and the ram stops. The ram shown in the engraving airs itself, and drives off with the water any surplus air when the quantity is more than sufficient to fill the space above the lower end of the tube, D.

The discharge valve, B, is attached to a flap formed on a disk of leather which also forms the packing of the lower end of the air chamber. The valve is concaved to receive the head of the rivet or bolt which secures it to the leather, and the leather touches the valve seat a short distance from the edge of the valve opening. By means of this construction the valve is always kept free from ridges, and whether or not it always strikes exactly in the same place it is always tight.

The overflow valve, C, is hung upon a casting attached to the lower end of the spring, E, and its stroke is regulated by the screw, F, which bears against the body of the ram. The screw, F, carries a toothed head which may be secured in any desired position by a stop or pawl. This construction admits of regulating the overflow valve to the 1-448 part of an inch, and effectually prevents it from jarring out of adjustment. The valve can be regulated to make from 30 to 300 strokes per minute, and the ram may be adjusted so delicately as to raise water 10 feet on a 9 inch fall, or it may raise water 200 feet with less than 4 feet fall. for irrigating lands, supplying dairies, farms, barnyards, dwellings, factories, engines, railroad stations, villages, etc., this ram is invaluable, as its extreme simplicity enables it to be set up or repaired by any one likely to use it.

This improved form of hydraulic ram is the invention of Mr. H. F. Morrow, of Chester, Pa., who has a patent for it and an application pending.—*Scientific American.*

A Beaumont compressed-air locomotive was tried on the Metropolitan Railway last week. The engine was not large enough to draw a complete train, the wheels being only 30in. in diameter. The inventor, Colonel Beaumont, R.E., was present, together with Mr. Tomlinson, chief engineer of the line; Colonel Frank Bolton, Major Ardagh, of the War Office; and several other gentlemen. A start was made from the Chapel-street works of the railway company near the Edgware-road Station. The engine ran to Baker-street, where it was shunted on to the St. John's Wood line to pick up a carriage, then ran from Baker-street to Moorgate-street. On the return journey, after a halt at King's Cross, the engine ran without a stop to Edgware-road, the distance between the two stations—which is for the greater part an ascent of 1 in 100—being performed in eight minutes. The total distance run, including the shunting, was about eleven miles, and the weight moved, including the engine itself, was about 20 tons. The engine commenced with an initial pressure of 1,000lb. on the square inch, and when the run was finished the gauge showed a remaining pressure of 300lb. in the cylinders.



HOLMES' DRYING KILN.

IMPROVED DRYING KILN.

A cheap and economical apparatus for drying lumber, staves, and other material, has been long needed, and a great deal of time and money has been expended in experiments in this direction without corresponding results. Messrs. E. & B. Holmes have perfected a dry kiln which seems to combine all the necessary requisites for a successful drying apparatus.

This dry kiln, which is represented in the accompanying engraving, is composed of several sections more or less as desired In the bottom of each of these sections are placed two sets of steam coils of novel construction, one above the other, for radiating the heat, and on the side of each section is a thin apartment containing condensing pipes filled with cold water, supplied by a pump or otherwise.

The air in the bottom of the kiln, being heated by the steam coils, passes up through the material to be dried, to the top of the kiln, carrying the moisture with it. Here it enters the thin condensing apartment and passes down, leaving the moisture upon the condensing pipes, and, being cooled again passes downward under and through the steam coils, where it is reheated, when it again rises up through the material, and so on. In this manner a very rapid circulation is secured, which carries the moisture from the material to be dried and deposits it upon the condensing pipes, from which it runs into a conductor and passes out of the kiln, the same air being used over and over.

Car tracks pass through the kiln, and extend far enough in each direction outside of the kiln to allow of loading, drying, and unloading at the same time. In this way the kiln is kept open only long enough to pass one car out and another in, and as only one section is opened, the others are not affected or cooled by it.

The doors of the kiln are made double thickness with an air space between, and are swung on cranes, so that one person can handle them with ease.

Messrs. E & B Holmes who are the inventors and patentees of this kiln, claim for it better results that can be obtained by anything else in use, having tried others and abandoned them, and they have now kilns of this kind that hold about 200 000 staves which they are using in connection with their barrel factory, the latter being filled with the Holmes barrel and stave machinery. This firm has an auxiliary apparatus invented by them for taking the condensed water from the dry kilns and returning it to the boiler without the aid of pumps.

Any further information respecting either dry kilns or stave and barrel machinery may be obtained by addressing Messrs. E. & B. Holmes, Buffalo, N, Y.

THE RESISTANCE AND SPEED OF STEAMSHIPS.

The seventh of the series of lectures in connection with the Naval and Marine Engineering Exhibition was delivered on the 4th inst., in the Corporation Galleries by Mr. Frank P. Purvis, Leven Shipyard, Dumbarton, his subject being "The Resistance and Speed of Steamships." Mr. Purvis gave a sketch of the theories and discoveries of Beaufoy, the late Prof. Rankine, and Scott Russell, regarding the resistance of ships. He also gave an interesting account of the experiments made at Torquay by the late Mr. Froude. In conclusion he said: It has been suggested by several, and among them Mr. Pearce in the opening lecture of this series, that private ship-builders should establish an experimental tank similar to the one at Torquay. Such a suggestion is of the highest value, and well worthy of being carried into practice. If it had not been for the experiments made at Amsterdam by Dr. Tideman, supplemented as they subsequently were by the further experiments upon Lochlomond, how could any one responsible for the speed of the "Livadia," how could Mr. Pearce have been certain about the speed which that remarkable vessel attained? In this respect, in the matter of attaining and for exceeding her predicted speed, she was indeed a triumph. They knew what huge strides had been made in recent years in the direction of length. In the rooms below were models of the "Iberia," the "Arizona," the "City of Berlin," and the "Servia," ranging in length from 449 ft. to 515 ft.; while, not represented in the collection, but at present under construction at Barrow, is the "City of Rome," a ship which will have a length of 546 ft., or within 125 ft. of the length of the "Great Eastern." After detailing the results of the elaborate calculations, by which, with tolerable certainty, we can build a ship to travel at a given speed, Mr. Purvis said: In determining the foregoing, length is the dimension which in all cases has first been deduced, breadth and draught then following to make up the required displacement. It will be readily seen that the dimensions noted in these tables differ very largely from those of actual ships, both in the absolute length of ship, and also in the ratio of length to breadth. Compare, for instance, the dimensions of the 10,000 ton ship, intended to go 18 knots, with the dimensions of the "Servia," and the contrast will appear very marked. He believed the "Servia," was to have a load displacement of some 10,000 tons; in which case the length figure in the table would have to be some 20 ft. greater than it is, leaving a difference still of nearly 60 ft. between the figure and the length of the actual ship. The much greater breadth and the greater draught of the ship in the table are, it is true, decidedly open to objection, the former because it would involve extra weight of material if the ship were built to fulfil Lloyd's requirements, the latter because few ports would admit of the ship's entry. He did not attempt to answer these objections further than by saying that both Lloyd's rules and the depths of water in ports were intended to meet the requirements of ships as they were at present built, and not as they may be required to be built in the future. The author ventured to predict that when matters of speed have been more thoroughly investigated ships of very different dimensions from those at present in fashion will come to be built; ships, too, in which the breadth bears a much higher ratio to the length. Of late years much has been done on the Clyde towards getting careful data connected with speed. Mr. William Denny strongly advocated and himself adopted the plan of trying the ships built by his firm at several speeds (four or five in number), ranging between the lowest and the highest that the engines are possible of maintaining, two runs being in every case made for each speed, one with and the other against the tide. Previously one speed with each ship had to suffice, the data obtained from it—although now acknowledged to be inadequate—being all that was available for future use. Mr. Denny's plan has now been adopted by several other builders on the river.

Mining, Metallurgy, Mineralogy

UNDERGROUND SURVEYING.

Although several improvements have been made during the past few years in the construction of the theodolite and dial, and these instruments are now considered perfect for all practical purposes, there are, however, other instruments which the mining engineer and surveyor must use, and the much greater accuracy which is now necessary in making mining plans, to prevent encroachment and consequent litigation, makes it desirable to use the best instruments for securing precision. One of the defects of the present system of surveying is the method of transmitting a mark from the center of the dial to the roof of the tunnel or drift. The usual practice is to hold the line and plumb-bob with one hand above the instrument, and after getting the center the hand is removed to allow the mark to be made on the roof with the other hand. This method is too much dependent on guesswork, and for accurate operations, say, in the case where two headings have to meet, surveyors, although it sometimes entails a large amount of extra work, prefer to go over the whole distance again rather than rely on a mark made in this way. To overcome these difficulties, an English mining engineer, Mr. W. E. Garforth, of Normanton, has designed an arrangement of adjustable plumb-bob and holder, which we illustrate in the accompanying drawings, taken from the *Engineer*.

From this it will be seen that Mr. Garforth's new instrument, which is very ingenious and extremely neat in design, consists of a small brass box plate—with projections to prevent slipping when placed against the roof of the mine—on the under side of which the rack, *C*, is arranged to move backwards and forwards the projecting arm, which can likewise be worked at right angles by the second rack, *D*. By means of these motions the string connected with the plumb-bob can be moved to any required position by the wheels *A* and *B*, which, although placed on one hollow spindle, work independently of each other. At the extremity of the arm a duplex center or gimball motion—similar to that in use for suspending a ship's compass—is arranged to hold the rod, *R*, through which a string passes, to which is attached the plumb-bob which causes the rod, *R*, to hang in a perfectly vertical line whatever the inclination of the roof of the mine. The movable slide, *T*, which is bored to fit the rod, *R*, when lifted upwards either by a spring or by hand, as preferred, is consequently obliged to move in a perpendicular line. An adjustable screw cap, in which is placed the chalk or needle, is fitted to the upper end of the slide. The plumb-bob, *L*, is arranged with a lock nut, *H*, so as to allow the string between the instrument and the roof to be lengthened or shortened as required, and to obtain greater accuracy the plumb-bob has a long, adjustable, coarse-threaded screw, *K*, to enable the point of the plumb-bob to be brought in the closest contact with the glass of the instrument.

Now, assuming it is required to transmit a mark, the "dial center" is placed against the roof of the mine, the string adjusted first by the lock nut, *H*, and afterwards by the screw, *K*, the screws *A* and *B*, are then worked until the plumb-bob hangs exactly above the center of the dial, when the slide—which, for the reasons already explained, is caused to hang vertical—is next moved upwards, and the center mark made in the roof. To obtain even greater accuracy, and when the mark has to be made on timber, the screw, *M*, can be attached to the movable slide, and instead of a chalk mark a loose needle can be pressed and left in the plug or timber.

Mr. Garforth's "dial center" will, without doubt, prove a most useful adjunct to the dial, and a means of saving considerable time in setting out lines is now almost daily required, especially in those collieries where an extensive system of chain or rope haulage is at work, and where straight roads are found to work so much more advantageously, as compared with crooked roads. The plumb-bob used by itself will prove of service to architects and engineers, as there is often a loss of time in having to lengthen or shorten the line, which is so quickly adjusted by the arrangement shown.—*Mining and Scientific Press.*

ELECTRIC-METALLURGY.—SILVER PLATING.

For electro-silver plating the double salt of silver and potassium cyanide is almost universally employed. The baths are used either hot or cold. The latter method is generally adopted for articles which require great solidity. The hot process is used for small articles, and is preferable for steel, iron, zinc, lead and tin, which have been previously electro-coppered. The hot baths are generally kept in enamelled cast-iron kettles, and the articles are either suspended or moved constantly about in them. A somewhat energetic current is needed, especially when the articles are moved about in order to operate rapidly. A grey or black deposit indicates too strong a current, and when the surface becomes covered with bubbles of gas the same thing is indicated. The anodes are plates of silver or heavy silver foil. The wooden tanks for the cold baths are similar to those used in plating with copper and nickel, but should be very thoroughly coated on the inside with guttapercha.

THE BATH.

Water (soft).............. 1 gallon.
Cyanide of potassium (pure) 8 ounces.
Nitrate of silver.......... 5¼ "

Dissolve the nitrate of silver in a sufficient quantity of pure water (soft), and add to it gradually, with constant stirring, hydrocyanic (Prussic) acid until all the silver has been precipitated as cyanide, which may be known by the formation of no cloud in a portion of the clear liquid when a drop of the acid is added to it—avoid adding an excess of the acid. Throw the precipitate upon a fine cotton cloth filter, and as the liquid runs through, wash the precititate on the cloth several times with pure water. Dissolve the cyanide of potassium in the water, and stir in the cyanide of silver carefully removed from the cloth. If it does not dissolve in the liquid entirely, add more cyanide of potassium until it does, stirring continually. Let the impurities settle, and the bath is ready for use. Many electroplaters use a preliminary or silver "whitening" bath, which is the same composition, but contains less silver, more cyanide, and is worked with a somewhat stronger current. The cleaned article in some cases is first dipped for a few moments in a solution of nitrate of of mercury, one ounce in one gallon of water, and then in the whitening bath for a few minutes, and after brushing is transferred to the silver bath proper.

The vessels containing the cold bath are sufficiently high to allow about four inches of liquid above the immersed objects, whose distance from the bottom and sides should be nearly the same to give a regular deposit of metal at both ends of the object. The upper ledge of the trough carries two brass rods all around, which do not touch one another, one above the other, so that other metallic rods placed transversely will rest upon the higher or lower series of rods only. The upper rods are connected with the zinc, the lower with the carbon or copper end of the battery, or with the corresponding poles of the dynamo-electric machine. The transverse rods resting upon the lower set support the silver anodes ; those resting on the upper set, the work. The work suspended from an upper transverse is placed so as to face two anodes suspended from two lower transverse rods. As the lower layers of the bath are apt to become denser (richer) than the upper, it is often necessary to reverse the articles during the operation to obtain a perfectly uniform thickness of deposit. For the same purpose small articles should be kept in motion as much as possible. The deposit is finer and denser if obtained with a weak battery and long exposure than if a strong current is employed. A sufficient quantity of silver may be deposited in three or four hours, but it will be of much finer quality and more easily burnished if the work is left in the bath for twelve or fifteen hours with a few cells of battery. When the articles, especially coppered iron, etc., have acquired a coherent film of silver, they are sometimes re-brushed, cleansed in alcohol, or preferably in a hot silvering bath, thence again passed through the mercurial solution and finished in the cold plating bath. The first scratch-brushing, which is not always necessary, obviates the tendency of certain alloys to assume a crystalline appearance and corrects the imperfectione of the cleansing in process. Should the anodes become black during the passage of the current the solution contains too little cyanide. In this the deposit is adherent, but too slow ; and the bath loses more silver than it can gain from the anodes. If the anodes remain white during the passage of the current the bath contains an excess of cyanide, and the deposit does not properly adhere ; correct by adding cyanide of silver until it dissolves with difficulty. When in good working order the anodes present a grey appearance while the current is passing, becoming white when circuit is broken.

The specific gravity of the bath may vary from 5° to 15° Baumé's hydrometer and still furnish good results.

Electro-silvering baths do not generally work so well when freshly prepared. If properly used and cared for they improve by age. At first the deposit is often granulate, bluish or yellowish.

It is customary to mix portions of an old bath with a freshly prepared one. Some platers introduce small quantities of ammonia instead to age the liquid.

Bisulphide of carbon in small quantities imparts a bright lustre to plated articles. An ounce of the bisulphide is put into a pint bottle filled with a strong solution of the cyanide of potassium and silver, briskly shaken, and a few drops of this liquid poured into the bath occasionally until the work appears sufficiently bright. An excess of bisulphide must, however, be avoided, as it will spoil the bath.—*Scientific American.*

Scientific Items.

PERAZOTIC ACID.

The discovery of a new compound of oxygen and nitrogen has been announced by MM. Hautefeuille and Chapuis. It contains more oxygen than azotic acid, and has been named by the French chemists perazotic acid. It is well known that on passing an electric current through oxygen a portion of the oxygen is transformed into ozone. If the ozone be mixed with nitrogen, the spectrum indicates the presence of a body characterized by black bands. The bands disappear when the gaseous compound is mixed with water, and the latter is acidified. The application of red heat to the gaseous mixture also causes the black bands to disappear. The experimenters are now endeavoring to isolate the new acid in order to study its properties. M. Berthelot some time since suspected the existence of the body in question during some experiments which he has not published. Its presence was indicated to him, however, merely by phenomena of coloration which appeared and disappeared during the passage of an electric current through a mixture of hypoazotic acid. His observations were communicated to Messrs. Hautefeuille and Chapuis, who, by obtaining the spectrum, have placed the existence of the new acid beyond doubt. The discovery is the more surprising, as oxygen and nitrogen, being constituents of the atmosphere, have so long been the objects of what might have been considered exhaustive study.—*Design and Work.*

COLLODION FILMS.

According to M. E. Gripon, if a layer of collodion, such as is used by photographers and surgeons, be poured upon a plate of very clean glass, it will be found, after the layer has dried, that an extremely thin and transparent film is formed, which, with a certain amount of care, can be separated from the glass, and may then be stretched upon a frame. This film, so placed, is seen to have some curious physical properties, which the author just named describes as follows: In the first place he finds that this delicate thin membrane reflects light exactly as glass does, and polarizes it both by reflection and by transmission of the rays of light through its substance.

Mr. Gripon has also found that films obtained in this manner may be procured as thin as 0·01 of a millimeter, and that when no thicker than this they transmit a very large proportion of radiant heat. Polarizing piles, he tells us, may be formed of these layers of collodion film, which are much more transparent than the piles of mica usually employed by physicists for this purpose, and necessary in studying the properties of heat ; and although they are, of course, much more fragile, and require more careful handling than mica piles, they are also more easily replaced than the latter when destroyed.

SPIDERS AND TUNING-FORKS.—In a recent number of *Nature*, some curious observations concerning the behaviour of spiders towards the vibrations of a tuning-fork are given. It appears that when a fork is made to touch lightly a leaf or any support of a spider's web, the insect will immediately face the fork, and feel with its fore feet which radial thread of its web has been touched. If the fork is held near the web, the spider will seize it and embracing it run along the legs of the fork as often as it is struck, seeming to recognize in its buzzing its natural food. Strange to say, by means of a tuning-fork a spider can be made to eat things which it would otherwise avoid ; thus, for instance, by fixing its attention by the constant vibration of the fork, he consumed a fly dipped in paraffine.

A remarkable nugget of platinum found on land near Plattsburg, New York, has been described by Mr. Collier. It was found to be composed entirely of native platinum and chromite disseminated through it, the chromite being 54 per cent. by weight, and the platinum 46 per cent. The dimensions were, length 4ctm., width 3ctm., thickness 2¼ctm. The weight was 104·4 grammes, and the specific gravity of the whole 10·446. The nugget was found in an extensive drift deposit, and platinum was not previously known to exist in the locality.

A telephone arrangement has been recently fitted up at St. James's-place U. P. church, Edinburgh, so that an elder who has been unable to attend for many years, might hear the services. "Sounding-chambers" are placed on each side of the pulpit and one in the gallery, and it is said that the words of the preacher, and the sounds of the singing are heard with distinctness.

Fig. 1

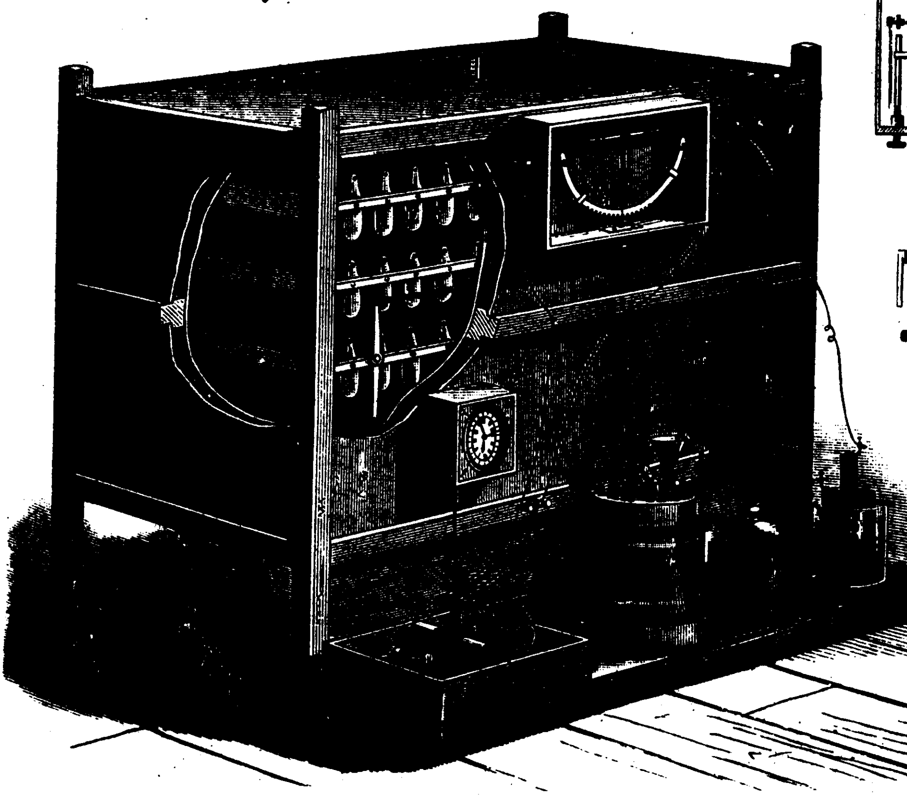
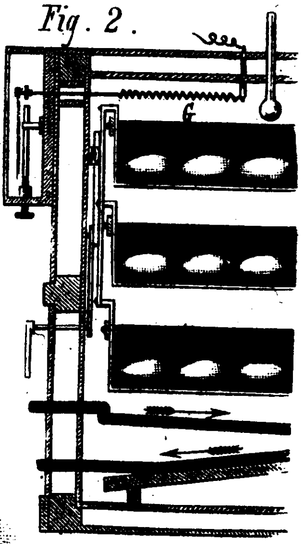


Fig. 2.



IMPROVED INCUBATOR.

IMPROVED INCUBATOR.

An improved incubator, which regulates its temperature and shifts the eggs automatically at regular intervals, is shown in the annexed engraving. It is provided with a series of longitudinal cloth hammocks or egg receivers, attached to end pieces pivoted to rigid supports and to movable bars, which are automatically moved so as to shift the eggs at regular intervals by suitable levers controlled by clock-work. The gas or oil cock of the flame of the boiler for heating the incubator is controlled by means of a pair of electro-magnets, connected with a battery, and with a metal thermometer provided with an adjustable scale so that the temperature of the incubator is regulated automatically.

In the engraving, Fig. 1 is a perspective view, and Fig. 2 is a vertical section. The box is constructed with rabbeted corner posts and a double casing, the space between being filled in with non-conducting material. The box is also provided with a shelf, upon which the boiler and automatic regulating devices rest. The boiler, C, is provided with pipes for conducting steam to and from the heating tubes arranged in such a way as to gradually pitch back to the boiler. The boiler has a tube F, for filling it, also a water gauge and a safety valve, and is heated by means of a flame of gas or of an oil lamp provided with an Argand burner. When oil is used, an oil tank, D, connected with the burner by a tube is placed on the shelf.

It is of the greatest importance to maintain a uniform heat in the incubator, and mechanism provided which automatically regulates the temperature. A spiral metal thermometer, G, of well known construction, is attached at one end to a binding screw, fastened to the ceiling of the box, and connected with the battery by a wire, and the other end of the thermometer is attached to an index pivoted in the centre of a curved scale at the side of the incubator, which can be adjusted by means of a journaled endless screw.

The index is provided with rectangular arms, which are hinged in such a manner that they can only bend upward, and can never form less than a right angle with the hand, so that if the thermometer continues to rotate the needle or hand, after the ends of the arms rest on the end pieces of the scale, the arms will not break, but will incline at the joint or hinge.

By means of the endless screw the scale, and consequently the thermometer can be made to correspond with the mercury thermometer at the top of the incubator. The end pieces of the circular scale are connected with the electro-magnets by the wires, and the magnets are in turn connected with the battery.

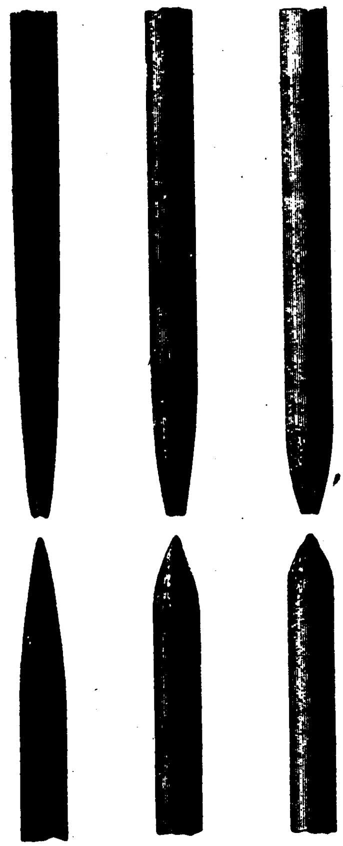
The armature of the magnets is attached to a spring which holds it in a central position in relation to the two magnets. This mechanism controls the gearing, which operates a horizontal shaft driven by clock-work and acting upon the burner. The eggs are placed in longitudinal hammocks or receivers, made of canvas, attached to bars which are fastened to end pieces, which are pivoted to fixed bars and to movable bars. The movable bars are acted upon by the works of the clock, which are constructed similar to the striking mechanism of an ordinary clock, so that the receivers are moved at regular intervals.

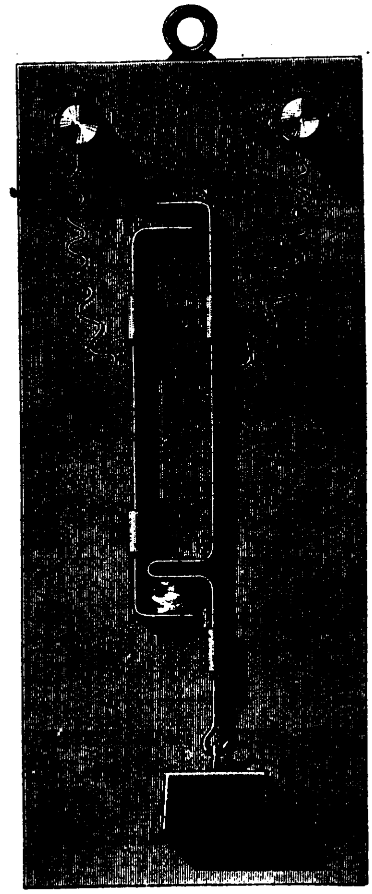
The eggs having been placed into the hammocks, the metal thermometer, G, is regulated and adjusted according to the liquid thermometer. If the flame of the burner under the boiler is too large, too much steam will be generated and the air in the box will become overheated. The thermometer, G, expands, and, moving the index, the electric circuit is closed, operating the mechanism which turns down the flame of the burner. If the air in the box is too cold the above operation is repeated, but all parts move in the inverse direction, and in this manner the temperature can be controlled automatically. If desired, alarm bells may be arranged to ring when the temperature rises too high or falls too low.

Shallow vessels containing water will be placed above the steam tubes for the purpose of supplying the air in the incubator with necessary quantity of moisture.

This invention was lately patented by Messrs. Chas. L. and Henry S. La Barge, 22 Nicholson Place, St. Louis, Mo.

Fig. 1. Fig. 2. Fig. 3.





ELECTRICAL FIRE INDICATOR.

Dimensions	State of the surface.	Consumpt'on per hour in millimeters.			Length of the consumed part in millimeters.		Light in Carcel burners.
		+	−	Total.	+	−	
Diam., 7 millimet'r	Naked, Fig. 1	166	68	234	58	23	947
	Coppered, Fig. 2..	146	40	186	24	10	?
	Nickeled, Fig. 3..	106	38	144	12	7	947
Diam., 9 millimet'r	Naked	104	50	154	45	22	523
	Coppered	98	34	132	27	7	553
	Nickeled	68	36	104	21	7½	516

COMPARATIVE EXPERIMENTS MADE WITH NAKED AND METALLIZED CARBONS.

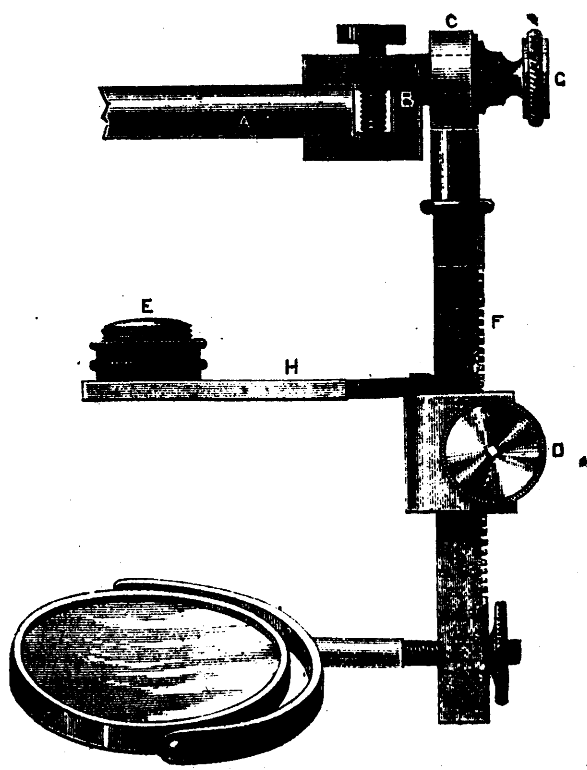
BY E. REYNIER.

These experiments were made at the works of Lautter & Lemonier, using a Gramme machine of the type of 1876, and burning Carré carbons. The positive carbons covered with copper gave a very good shape, and an excellent one when covered with nickel; with the negative carbon the shape was a little too short when nickeled. Independently of the improvement of the shape positive carbon, the nickel increased the duration of carbons nine millimeter diameter *fifty per cent.*, and those of seven millimeter *sixty-two per cent.* The coppered carbons thus occupy a position mid-way between the naked carbons and the nickeled ones.

For equal section the metallization does not modify the illumination.

Among the refractory metals, nickel is to be preferred, especially for the positive pole (iron being very difficult to apply in thin coats.)

The figures represent the shapes of the naked and metallized carbons: Fig. 1, the naked carbons; Fig. 2, copper covered; Fig. 3, those covered with nickel.—*La Lumière Electrique.*



ELECTRICAL FIRE INDICATOR OF M. G. DUPRE.

A large number of electrical fire indicators have been devised and constructed, but the one represented in the engraving is one of the simplest and most practical of any that we have examined.

It consists of a small mahogany board upon which are arranged two small copper rods, one, A B, fixed, connected with the binding post, R; the other, C D, movable, connected with the binding post, Q, and supporting a weight, E. A battery and bell are inserted between the binding posts, R and Q, and a small lump of tallow is placed between the horizontal bends of the rods, the movable rod, C D, resting upon it.

When the temperature of the locality where the apparatus is placed rises above the melting point of tallow it melts, and the movable rod descends under the action of the weight, E. An electrical contact is then established between the two branches, B and C, and the bell is set in motion.

By replacing the tallow with any other fusible non-conducting material the apparatus may be employed to indicate the precise instant when a given temperature is reached.

A metallic substance may be placed between the points, A and D, the fusible metal of Darcet, for example, on condition that the rod, A B, be cut at some point in its length, in such a manner as to interrupt all metallic communication between the two parts of the rod.

The apparatus is simple, inexpensive, compact, and may be used in connection with the domestic batteries and bells without other adjunction to the apparatus, because when the temperature at which the apparatus is set has been reached the bell will sound until the fusible substance has been replaced, and consequently those interested have been duly informed.

A system of this kind has been in use by M. Hellesen, of Copenhagen, for a number of years.—*La Lumière Electrique.*

THE ELECTRIC DISCHARGE IN INSULATING LIQUIDS.

With a simple kind of apparatus Herr Holtz has recently examined electric discharges in insulating libuids. Wires were connected with the two conductors of the Holtz machine, and terminated in points within the insulating liquid to be tried, which was contained in an insulated glass vessel and freed as much as possible from air and from vapour. With this apparatus both the spark and the brush discharge were obtained and studied.

The length of the spark in air depends, it is known, on the quantity of accumulated electricity. In liquids, on the other hand, the spark could not be made larger by increasing the quantity of electricity; it was only stronger, louder, and more luminous, with a greater quantity of electricity than with a less. A change of the length of spark with the density of the electricity was indeed generally preceptible. But this relation could not be accurately measured, and the separate observations of a long series varied considerably.

With similar experimental conditions the following maximum values for the length of spark were obtained in the insulating liquids named: In petroleum, 68mm., benzine, 60mm., oil of turpentine, 58mm., pine-tree oil, 58mm., sulphide of carbon, 53mm., olive oil, 48mm., almond oil, 38mm., and sulphuric ether, 20mm.

With regard to the influence of unequal electrodes and the polarity of the electrodes, the liquids presented the same behavior as air. Longer sparks were always obtained when a point stood opposite a surface, and the latter was the negative electrode; and the polarity was of greater importance, the greater the spark-length in general. The difference was different in different liquids, but never reached the value it has in air.

Of other phenomena of the spark, which Herr Holtz observed in insulating liquids, and which are more or less similar to those in air, we may only say, that the spark, throughout the whole of its extent, presents innumerable, and for the most part, extremely small dark spaces; further, that the spark, at least with long striking distance, never appears alone, but always within a greatly branched brush of light.

Brush discharges in liquids have not hitherto been described, except by Faraday. Herr Holtz obtained them easily, when he placed the electrodes so far apart, that no spark appeared. He got them better by placing the electrodes not quite so far apart, when, naturally, between the brushes, there occurred intermitent spark discharges.

The size and form of the brushes were different in different liquids, both generally, and as regards their two-sided character. Peculiarly large, and nearly of the same size, were the two brushes in petroleum, in which there was on the whole little branching. In the other liquids named above, the negative brush was considerably smaller than the positive, and the branches of the former always tended more to be at right angles to the directions of the electrodes. There was a specially noticeable difference of size in benzine, the negative brush being merely like a glow.

The color of the brushes, especially next the electrodes, was not, indeed, exactly similars, in the different liquids, but, on the whole, it presented the same gradations of color as are found in air.

Each brush discharge was accompanied by a singing noise, and might thus be detected though not itself directly perceptible.

These researches of Herr Holtz are described in a recent number of the *Annalen der Physik.*

SWINGING SUB-STAGE FOR THE MICROSCOPE.

The swinging sub-stage is one of the most important modern developments in the construction of microscopes.

Our figure shows a simple and inexpensive plan by which the application of the swinging sub-stage can be made to many of the cheaper forms of stands. The suggestion is due to Mr. J. Mackenzie, from whose drawing and description in the *Journal* of the Quekett Microscopical Club [vi. (1880), p. 170] we have copied with such modifications as appeared to us of practical moment. These modification, are four in number. (1) The application of metal jaws for clamping the swinging bar on to the stage at pleasure, instead of the permanent fitting in one position by screws. (2) The *sliding* movement on the arm H, instead of the fixed arm carrying the condenser. (3) Similar sliding movement to the mirror. (4) The rack-work is carried much higher up the bar for greater convenience of focussing the illumination with a condenser of short focal length.

A is a part of an ordinary fixed stage of a microscope. B, metal jaws clamping upon A by means of the milled head shown above; the fitting of these jaws is so arranged that the axis at the back, on which the whole bar, C, swings laterally, is (approximately) in the plane of the object supposed to be on the stage. The swinging bar, B, is provided with rack-work on which the bar, H, carrying the condenser, E (which might be a 1in. or 2in. objective), can be moved up or down by the milled head, D. The arm, H, is fitted to slide for convenience of centering with the optical axis; the mirror, L, is also fitted to slide for the same purpose: these sliding movements also permit the use of slightly eccentric pencils, which are found to give increased power of revolution in particular cases.

The condenser, E, can be racked to focus the illumination on the object; the lateral swing of the arm, C, will then provide the whole range of oblique illumination concentric with the object, by suitable adjustment of the mirror. The swinging bar also permits the condenser and mirror to be used *above* the stage for "opaque" illumination.

If a hemispherical lens be fitted in the stage-opening so that its plane face may be placed in immersion-contact with the base of the slide, and its spherical face exposed to receive the oblique light, every degree of obliquity can be obtained either for dry or immersed objects.

We see no difficulty in the construction of this appliance that need involve any but a very moderate expense, and we hope some of our optician friends will give it a trial.

It is only fair to M. Léon Jaubert, of the Trocadéro observatory, Paris, to mentian that he has, for some years past, manufactured a swinging device of this kind to act concentrically with the object, though we believe his apparatus carries the mirror only—not a condenser with rack-work. To Mr. Mackenzie the credit is due of this particular application.

A NEW USE OF ELECTRICITY.—A recent number of the *Comptes Rendus* tells how M. Grandt has constructed an apparatus for giving movement to ships. An ordinary steam-engine will set in motion several electro-dynamic induction machines. The current is transmitted to a voltameter containing acidulated water which is decomposed into oxygen and hydrogen. These two gases are conducted into a tube, and escape by an aperture near the keel. A little above this aperture there are two platinum-points, isolated from each other and in communication with an induction-coil. When the gas escapes a spark explodes it, and this explosion moves the ship.

Chemistry, Physics, Technology.

THE TELESTROSCOPE.

By M. Senlecq, of Ardres.

This apparatus, which is intended to transmit to a distance through a telegraphic wire pictures taken on the plate of a camera, was invented in the early part of 1377 by M. Senlecq, of Ardres. A description of the first specification submitted by M. Tenlecq to M. du Moncel, member of the Paris Academy of Sciences, appeared in all the Continental and American scientific journals. Since then the apparatus has everywhere occupied the attention of prominent electricians, who have striven to improve on it. Amongst these we may mention MM. Ayrton, Perry, Sawyer (of New York), Sargent, (of Philadelphia), Brown (of London), Carey (of Boston), Tighe (of Pittsburgh), and Graham Bell himself. Some experimenters have used many wires, bound together cablewise, others one wire only. The result has been on the one hand confusion of conductors beyond a certain distance, with the absolute impossibility of obtaining perfect insulation; and, on the other hand, an utter want of synchronism. The unequal and slow sensitiveness of the selenium likewise obstructed the proper working of the apparatus. Now, without a relative simplicity in the arrangement of the conducting wires intended to convey to a distance the electric current with its variations of intensity, without a perfect and rapid synchronism acting concurrently with the luminous impressions, so as to insure the simultaneous action of transmitter and receiver, without, in fine, an increased snsitiveness in the selenium, the idea of the telestroscope could not be realised. M. Senlecq has fortunately surmounted most of these main obstacles, and we give to-day a description of the latest apparatus he has contrived.

Transmitter.

A brass plate, A, whereon the rays of light impinge inside a camera, in their various forms and colours, from the external objects placed before the lens, the said plate being coated with selenium on the side intended to face the dark portion of the camera. This brass plate has its entire surface perforated with small holes as near to one another as practicable. These holes are filled with selenium, heated, and then cooled very slowly, so as to obtain the maximum sensitiveness. A small brass wire passes through the selenium in each hole, without, however, touching the plate, on to the rectangular and vertical ebonite plate, B, Fig. 1, from under this plate at point C. Thus every wire passing through plate A has its point of contact above the plate B lengthwise. With this view the wires are clustered together when leaving the camera, and thence stretched to their corresponding points of contact on plate B along line CC. The surface of brass A is in permanent contact with the positive pole of the battery (selenium). On each side of the plate B are let in two brass rails, D and T, whereon the slide hereinafter described works.

Rail E communicates with the line wire intended to conduct the various light and shade vibrations. Rail D is connected with the battery wire. Along F are a number of points of contact corresponding with these along CC. These contacts ought to work the apparatus, and to insure the perfect isochronism of the transmitter and receiver. These points of contact, though insulated one from the other on the surface of the plate, are all connected underneath with a wire coming from the positive pole of a special battery. This apparatus requires two batteries, as, in fact, do all autographic telegraphic—one for sending the current through the selenium, and one for working the receiver, etc. The different features of this important plate may, therefore, be summed up thus :—

D. Brass rail, grooved and connected with the line wire working the receiver.

F. Contacts connected underneath with a wire permanently connected with battery.

C. Contacts connected to insulate wires from selenium.

F. Brass rail. grooved, etc., like D.

Receiver.

A small slide, Fig. 2, having at one of its angles a very narrow piece of brass, separated in the middle by an insulating surface, used for setting the apearatus in rapid motion. This small slide has at the points D D a small groove fitting into the brass rails of plate B, Fig. 1, whereby it can keep parallel on the two brass rails D and E. Its insulator B, Fig. 2, corresponds to the insulating interval between F and C, Fig. 1.

A, Fig. 3, circular disc, suspended vertically (made of ebonite or other insulating material). This disc is fiked. All around the inside of its circumference are contacts connected underneath with the corresponding wires of the receiving apparatus. The wires coming from the seleniumised plate correspond symmetrically, one after the other, with the contacts of transmitter. They are connected in the like order with those of disc A, and with those of receiver, so that the wire bearing the No. 5 from the solenium will correspond identically with like contact No. 5 of receiver.

D, Fig. 4, guttapercha or vulcanite insulating plate, through which pass numerous very fine platinum wires, each corresponding at its point of contact with those on the circular disc A.

The receptive plate must be smaller than the plate whereon the light impinges. The design being thus reduced will be the more perfect from the dots formed by the passing currents being closer together.

B zinc or iron or glass plate connected to earth. It comes in contact with chemically-prepared paper, C, where the impression is to take place. It contributes to the impression by its contact with the chemically-prepared paper.

In E, Fig, 3, at the centre of the above-described fixed plate is a metallic axis with small handle. On this axis revolves brass wheel F, Fig. 5,

On handle E presses continually the spring H, Fig. 3, bringing the current coming from the selenium line. The cogged wheel in Fig. 5 has at a certain point of its circumference the sliding spring Fig. 5, intended to slide as the wheel revolves over the different contacts of disc A, Fig. 3.

This cogged wheel, Fig 5 is turned, as in the dial telegraphs, by a rod working in and out under the succesive movements of the electro-magnet H, and of the counter spring. By means of this rod (which must be of a non-metallic metallic material, so as not to divert the motive current), and of an elbow lever, this alternating movement is transmitted to a catch, G, which works up and down between the cogs, and answers the same purpose as the ordinary clock anchor.

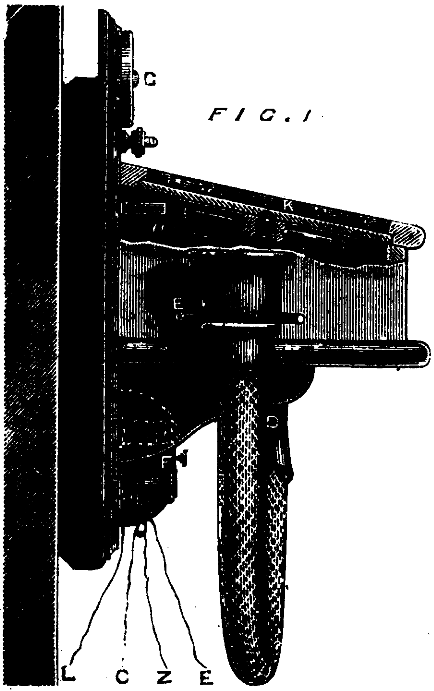
This cogged wheel is worked by clockwork inclosed between two discs, and would rotate continuously were it not for the catch G working in and out of the cogs. Through this catch G the wheel is dependent on the movement of electro-magnet. This cogged wheel is a double one, consisting of two wheels coupled together, exactly similar one with the other, and so fixed that the cogs of the one correspond with the void between the cogs of the others. As the catch G moves down it frees a cog in first wheel, and both wheels begin to turn, but the second wheel is immediately checked by catch G, and the movement ceases. A catch again works the two wheels, turns half a cog, and so on. Each wheel contains as many cogs as there are contacts on transmitter disc, consequently as many as on circular disc A, Fig. 8, and on brass disc within camera. Having now described the several parts of the apparatus, let us see how it works. All the contacts correspond one with the other, both on the side of selenium current and that of the motive current. Let us suppose that the slide of transmitter is on contact No. 10, for instance, the selenium current starting from No. 10 reaches contact 10 of rectangular transmitter, half the slide bearing on thip point, as also on the parallel rail, communicates the current to said rail, thence to line, from the line to axis of cogged wheel, from axis to contact 10 of circular fixed disc, and thence to contact 10 of receiver. At each selenium contact of the rectangular disc there is a corresponding contact to the battery and electro-magnet. Now, on reaching contact 10 the intermission of the current has turned the wheel 10 cogs, and so brought the small contact O, Fig. 5, on No. 10 of the fixed circular disc.

As may be seen, the synchronism of the apparatus cuuld not be obtained in a more simple and complete mode—the rectangular transmitter being placed vertically, and the slide being of a certain weight to its fall from the first point of contact sufficient to carry it rapidly over the whole length of the transmitter.

The picture is, therefore, reproduced almost instantaneously; indeed by using platinum wires on the receiver connected with the negative pole by the incandescence of the wires according to the different degrees of electricity we can obtain a picture, of a fugitive kind, it is true, but yet so vivid that the impression on the retina does not fade during the relatively very brief space of time the slide occupies in travelling over all the contacts. A Rhumkorff coil may also be employed for obtaining sparks in proportion to the current emitted. The apparatus is regulated in precisely the same way as dial telegraphs, starting always from first contact. The slide, should, therefore, never be removed from the rectangular disc whereon it is held by the grooves in the brass rails, into which it fits with but slight friction, without communicating any current to the line wires when not placed on points of contact.

THE NEW GOWER TELEPHONE.

The following description and illustrations of the new Gower telephone, in which a microphone is employed as a transmitter, and which is so constructed that it can be used with or without a battery, will be of interest at a time when the Post-office authorities are making preparations for supplying telephonic communication in all parts of the country. The invention, which has been recently patented by Mr. F. A Gower, of Paris, consists in the combination of what is known as the Gower telephone with a microphone inclosed in the same case. This arrangement affords all the advantages obtained by the employment of a battery for the purposes of telephonic communication, without its accompanying objections, and without destroying the effect of the telephone when it is employed as a transmitter in the case of a



battery failing to act or becoming exhausted. Fig 1 is a side elevation of the apparatus partly in section, a portion of the side of the box being removed in order to show the communication between the microphone and the principal circuit. Fig. 2 is a plan, the microphone being removed in order to show clearly the arrangement of all the parts of the interior of the box. Fig. 3 is a plan of the underside of the microphone shown in Fig. 1. This microphone is connected with the principal circuit by means of wires which are broken off in Figs. 2 and 3.

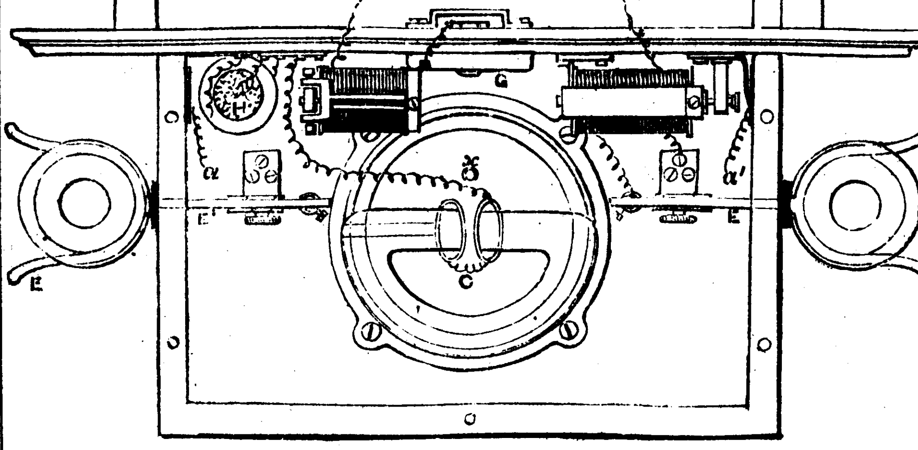
It will be readily understood that when the plate of the microphone is in the position shown in Fig. 1, so as to close the box, the wire *a*, Fig. 3, is joined to the wire *a*, Fig. 2, and the wire a_1, Fig. 3, is joined to the wire a_1, Fig. 2. In constructing the apparatus according to this invention a microphone B, of any suitable construction (but by preference having at least six contact points) is attached to the upper part K of a box, the lower part of which box is provided with a Gower telephone C constructed in the form known as the chronometer telephone. This telephone is provided with a bifurcated acoustic or speaking tube D, having two branches, in order to enable the operator to listen with both ears if required. Commutators E are provided at the side of the box for the purpose of interrupting the passage of the current from the battery and opening the circuit of the call-bells. After working the apparatus the extremities of the acoustic tubes D are placed in holders connected with the commutators E, and the circuit is thereby interrupted. An electric call-bell F is provided underneath the box, and a knob G for working the call-bells is placed at the upper part of the apparatus, but this arrangement is not essential to the working of the invention. An induction coil H is placed inside the box, and the microphone B and the battery are connected to the primary circuit, whilst the Gower telephone and the line are connected with the secondary circuit. In speaking against the upper part K of the box, which part may be of wood, iron, brass, or other suitable material, and near or upon the under surface of which the microphone is placed either with or without attaching the microphone to the box top directly, the sound-waves from the voice form electrical undulations in the primary circuit through the action of the microphone, and these undulations are reproduced in the secondary circuit by induction, and are thus repeated in the Gower telephone at the receiving station.

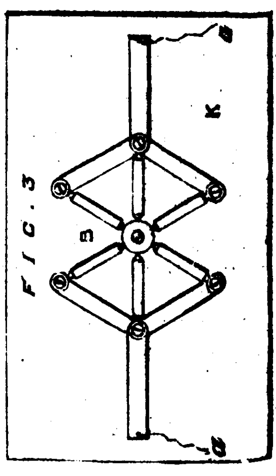
Especial attention is directed to the fact that the microphone in this combination is not necessarily attached to the box top, but that it may be carried upon a framework of wood, metal, or other suitable material attached at any convenient point of the combined apparatus.

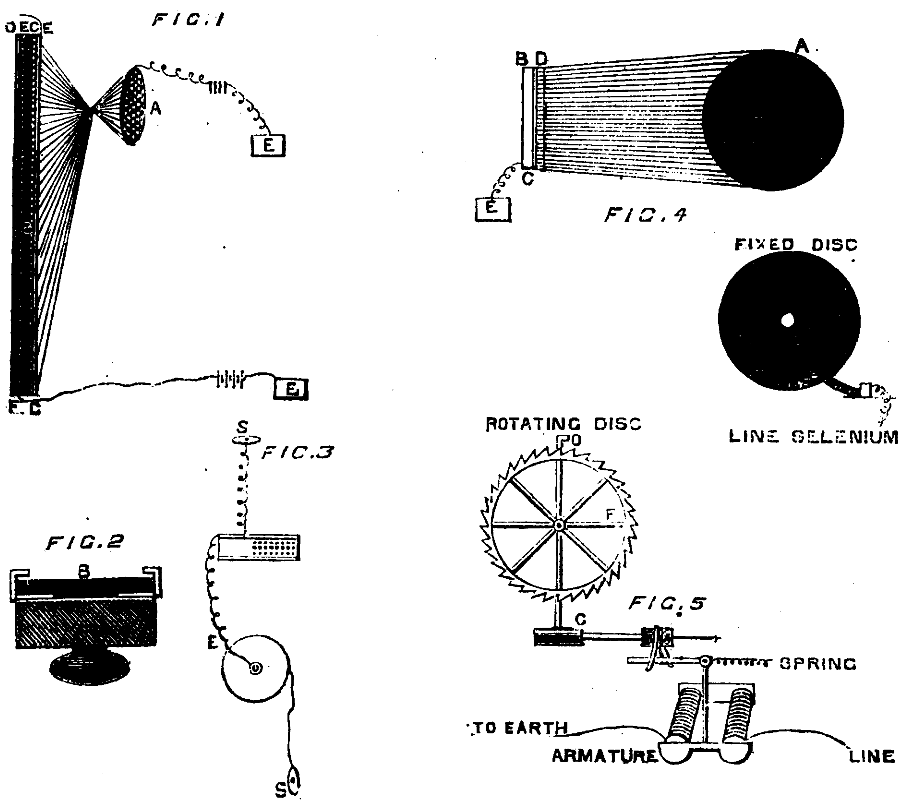
The undulations, however, when so reproduced are intensified to such an extent by the great power of the magnet in the Gower telephone, that they act upon the microphone in the same case with such effect as to set up corresponding undulations in the primary circuit of the receiving station, and these undulations are again reproduced in the Gower telephone with increased intensity.

Moreover, when the diaphragm of the telephone is provided with a vibrating reed *x*, Fig. 2, as is usual in the Gower telephone, it is simply necessary to close one of the branches of the acoustic tube and blow into the other branch in order to cause the reed to vibrate, and thus produce powerful vibrations of the plate before the magnet. These vibrations not only produce currents in the coils or the poles of the magnet, but also act with great power upon the microphone, the sound being produced in the interior of the same box, and thus double the effect of the signal current on the line wire without exhausting the battery to any greater extent than when speaking in the usual manner through the apparatus.

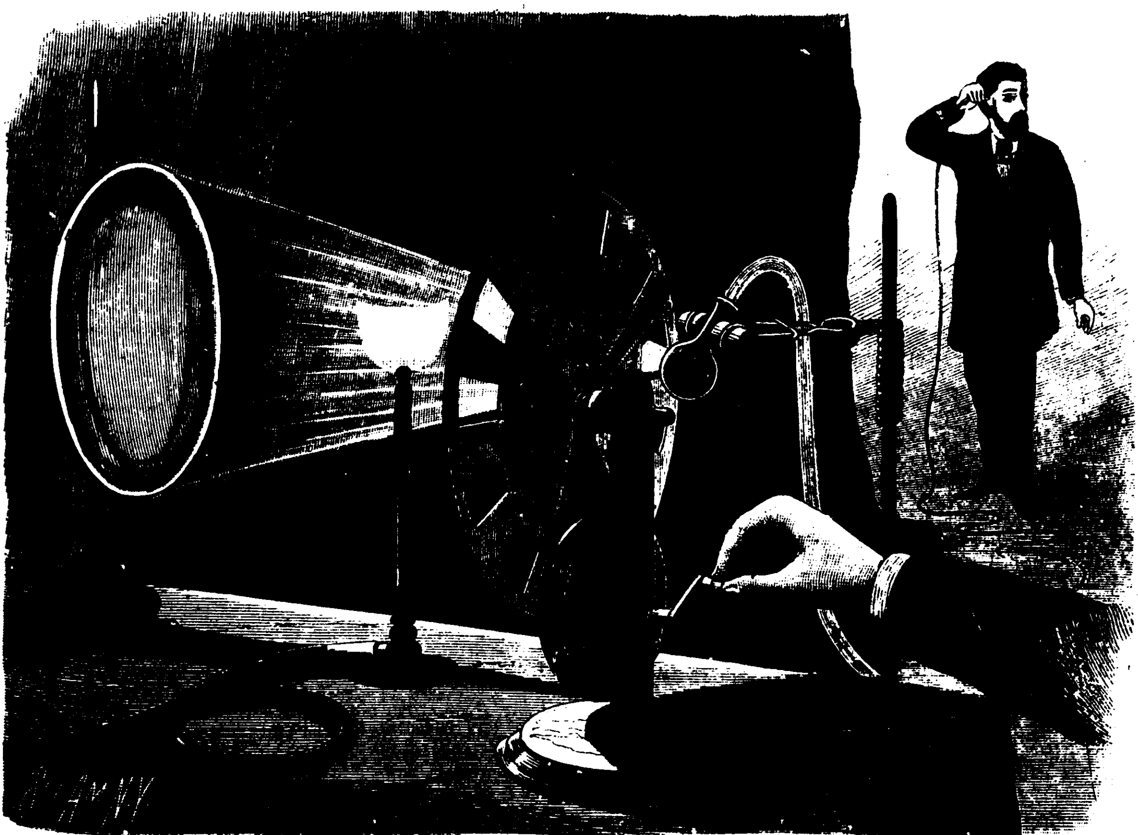
FIG. 2







THE TELECTROSCOPE.—(See page 111.)



APPARATUS EXHIBITING THE ACTION OF RADIANT HEAT ON GASEOUS MATTER.—(See next page.)

PROF. TYNDALL ON RADIANT HEAT AND GASES.

It will be remembered by those who read the article on the the Photophone on p. 315, that when Prof. Bell was in this country he visited Prof. Tyndall at the Royal Institution and there made some experiments, at the latter's suggestion, on the action of an intermittent beam of light upon gaseous matter. A beam of light transmitted through the slits in a rotating disc produced a musical sound in a glass-tube, in which various substance and certain vapors were placed. It was surmised at the time that the phenomena were not entirely due to light, and some French experimenters went so far as to rechristen them with the name of radiophony. M. Mercadier has, notably among Fornch experimenters, continued the the research on this line, and has demonstrated that the dark rays, when allowed to fall intermittently on an absorbent surface, cause it to undergo rapid expansions and contractions, producing sounds. It is thus clear that both light and heat are capable of producing the phenomena. Prof. Tyndall has long been engaged in researches connected with the interaction of heat and gaseous matter, and recently has resumed his labors with the improved apparatus which the march of discovery has placed at his disposal. The thermopile and the galvonometer were the instruments by means of which his earlier results were obtained: but ir occurred to him that those results might be checked by means of an apparatus which might be described as a gas thermometer. Just as he arrived at this conclusion he became acquainted with the "ingenious and original" experiments of Prof. Graham Bell, some of which were first made in the laboratory of the Royal institution at the suggestion of Prof. Tyndall. The latter, as he tell us in the paper recently read before the Royal Society, formed the opinion that the sounds were caused by rapid changes of thermometer producing changes in the shape and volume of the bodies impinged upon by the beam. If, then, gases and vapors really absorb radiant heat, they ought to produce sounds more intense than thsse obtainable from solids— *i. e.*, highly diathermanous bodies should produce faint sounds, while highly dthermanous bodies should yield loud sounds. The results obtained by the recent experiments lead to the conclusion that there is no absolutely diathermanous body in nature. The apparatus employed in the research were comparatively simple, not to say rough, compared with the beautiful instruments of Prof. Bell, for they consisted of a disc of zinc mounted vertically on a whirling table; a flask to which an indiarubber tube, having tapering ear-piece of ivory or boxwood, was attached; a few lenses to render the rays of light parallel, and then to converge them to a point; and a Siemens electric lamp. The zinc disc, which was provided first with radial slits and afterwards with teeth and interspaces, was caused to rotate rapidly across the beam of light near the focus, and the flask containing the gas or vapor to be examined was placed immediately behind the disc. With this arrangement the list of sounding gases and vapors was rapidly increased; but the lenses were found to withdraw from the beam its most effective rays. Accordingly, Prof. Tyndall fell back on the silvered mirrors employed in his previous researches, and with these he has obtained a remarkable series of results. The flasks used were of the ordinary bulbous type, and their bottoms as a rule were merely covered with the liquids, so that the inclosed air above was soon saturated with their vapor. Placed in the intermittent beam, sulphuric, formic, and acetic ether gave rise to loud musical tones, the pitch depending on the velocity of rotation of the zinc disc. Those are known to be the most highly absorbent vapors tried during the experiments, while chloroform and bisulphide of carbon are the least absorbent, the latter standing near the head of diathermanous vapors. Other volatile liquids helped to support the conclusion that the power to produce musical tones is expressed by the ability of the vapors to absorb radiant heat. No sound is produced when the beam falls on the liquid in an ordinary store-bottle of a volatile substance, but the musicol tone is heard more or less audibly when the intermittent beam traverses the vapor-laden space above. A rock-salt cell, filled entirely with a volatile liquid, produced no sound when inserted in the intermittent beam, but once, while experimenting with a highly athermanous liquid, a distinct musical note was obtained, which was found to be due to a small bubble at the top. The experiments with vapors demonstrated the truth of the hypothesis, and those with gases appear to completely establish the views propounded many years ago by Professor Tyndall, for he has demonstrated that dry air will not give more than a feeble sound, and is as incompetent to absorb radiant heat, while aqueous vapors will yield a powerful sound and will absord radiant heat. A small flask, heated to drive off moisture from its sides, and then filled with dried air, gave a feeble musical note when placed in the intermittent beam, and dry oxygen and hydrogen behaved in a similar manner. When carbonic acid was tested, however, the sound was louder than that yielded by any of the elementary gases; with nitrous oxide it became more forcible still, and with olefiant gas, if the beam was in good condition and the bulbous flask well chosen, the sound seemed as loud as that of an ordinary organ-pipe to the nnassisted ear. The amount of absorption of of radiant heat, and the intensity of the sound therefore proceed *pari passu*. So far back as 1859, Professor Tyndall proved that gaseous ammonia was extremely impervious to heat, and on putting a flask containing a little warmed liquid ammonia the "musical" test, a loud note was immediately produced. The vapor of water such as is given off when the liquid approaches the boiling point, gave a powerful musical sound when placed in the intermittent beam, and careful experiments proved that the musical sound was most intense when the vapor was perfectly invisible. Reducing the temperature of the flask to 10° C., the sound was still not only distinct but loud, in spite of the tenuity of the vapor. Empty flasks filled with ordinary air, placed in a freezing mixture for 15 minutes, and rapidly transferred to the beam, gave much louder sounds than dry air; but when warmed and filled by a current of dried air, the sound fell almost to silence, but a puff of breath sent into them restored the power of emitting sound immediately. Bottles containing sulphuric acid (which absorbs moisture from air in contact) emitted a faint sound if they had been in use recently, the removal of the stopper allowing the air to enter; but if the bottle had been undisturbed for a few days, and the air above the liquid was thus presumably perfectly dry, no sound could be obtained. The silence was perfect. A similar result was obtained, when with great care an ordinary flask was filled with perfectly dry air. In these experiments the flasks were first heated, and a current of air, freed from carbonic acid by caustic potash, and from aqueous vapor by sulphuric acid, was driven through until they were cooled. Connected with the ear-tube and exposed immediately to the intermittent beam, they were found to be qnite incapable of producing a sound. The results obtained with aqueous vapor pointed to the fact that an exceedingly small percentage of a highly athermanous gas diffused in air should suffice to considerably intensify the musical note produced, and an accidental experiment fully verified the theory. A flask filled with coal-gas and held bottom upwards gave a sound corresponding to the known absorptive energy of coal-gas, and this same flask, after being permitted to remain with its mouth open while standing upright for nearly an hour, was found to yield sounds far louder than could be obtained from common air—an observation which may be of some direct practical utility in enabling us to test the presence of fire-damp in the air of coal-mines.

A series of experiments with layers of liquids demonstrated the fact that it is the invisible heat-rays which are the principal agents in producing the sounds; for volatile liquids and vapours absorb the same rays, and a cell of the liquid being interposed in the beam, the latter is incapable of creating a sound when it reaches the flask containing the vapour, because the liquid has absorbed the rays which set up the action. This fact being demonstrated, the experiments were repeated with a lime-light and with a candle, with the result that, in the case of the former, the sounds of the stronger vapours increased in intensity, while they were also distinctly audible with such heat as is given off by a candle. In these latter experiments, however, the mirror was exchanged for one of shorter focus, so that the flasks tested were brought nearer to the source of the rays; but abandoning the mirror and bring the candle-flame itself close to the rotating disc the direct rays produced audible sounds. With a red-hot coal held near the disc the sounds in the flask at the opposite side were focible, while a red-hot poker produced strong sounds; the alternate removal and introduction of the poker producing corresponding alternations of silence and sound. The intensity of the sounds gradually ceased, as the temperature of the iron decreased, and when silence was reached the poker was found to have a temperature below that of boiling water. In some cases the sounds emitted are of extraordinary intensity, varying with the substance used. Thus, a small bulb, about a cubic inch in volume, gives a very loud sound when a little water contained in it is raised to boiling-point; and powerfully absorbent vapours, like those of cyanide of ethyl and of acetic acid, emit sounds of "extraordinary power" when warmed and exposed in a bulb of a cubic inch volume to the intermittent beam. The sounds produced by marsh-gas were also very powerful, as were those yielded by chloride of methyl. That the sounds are not entirely due to invisible heat-rays is demonstrated by the action of bromine vapour, which is an energetic absorber of the luminous rays. Between the flask containing the bromine and the rotating disc, Prof. Tyndall first introduced an empty glass cell; the sounds continuing, he filled the cell with bisulphide of carbon, a highly diathermanous body, with no result, and then replaced the transparent bisulphide with another sample which had been saturated with iodine. The latter substance cuts off the light-rays, while allowing heat-rays free passage, and therefore when placed between the bromine vapour and the rotating disc, the sounds immediately ceased. To complete the experiment, a cell containing a strong solution of alum was introduced in the path of the beam without producing any sensible abatement of the sounds with either bromine or iodine. Such experiments as these are doubly interesting, for while they corroborate the views held by Prof. Tyndall, they open a method of research which will be of considerable value to the investigator working in either the chemist's or the physicist's laboratory.—*English Mechanic.*

TYNDALL'S EXPERIMENT ON RADIANT HEAT.

BY GEO. M. HOPKINS.

In the entire range of Prof. Tyndall's investigations nothing possesses more timely interest (or affords a better test of the possible sufficiency of cheap appliances) than his recent experiments for testing acoustically the capacity of vapors and gases to absorb radiant energy. It often happens that students who would like to test experimentally the results arrived at by distinguished investigators are kept from such instructive pleasures by the notion that for delicate experimenting nice and expensive apparatus is required. Such apparatus is undoubtedly good to have and pleasant to work with; but where it is not to be had a little courage and ingenuity may provide cheap substitutes which will amply answer the student's purpose. The rude apparatus, herewith figured, illustrates this fact.

The interesting experiment referred to seems to have been suggested by Prof. Bell's photophonic experiment in which musical sounds are obtained by the action of an intermittent beam of light upon solid bodies. Referring to this Prof. Tyndall says:

"From the first I entertained the opinion that these singular sounds were caused by rapid changes of temperature, producing corresponding changes of shape and volume in the bodies impinged upon by the beam. But if this be the case, and if gases and vapors really absorb radiant heat, they ought to produce sounds more intense than those obtained from solids. I pictured every stroke of the beam responded to by a sudden expansion of the absorbent gas, and concluded that when the pulses thus excited followed each other with sufficient rapidity, a musical note must be the result. It seemed plain, moreover, that by this new method many of my previous results might be brought to an independent test. Highly diathermanous bodies, I reasoned, would produce faint sounds, while highly athermanous bodies would produce loud sounds—the strength of the sound being in a sense, a measure of the absorbtion. The first experiment, made with a view of testing this idea, was executed in the presence of Mr. Graham Bell, and the result was in accordance with what I had foreseen."

I have successfully repeated Prof. Tyndall's experiment with the simple apparatus shown in the illustration, and have verified the results obtained by him. Utilizing apparatus already at hand, I mounted a small sized bulbous glass flask, 1¾ inches in diameter, in a test-tube holder, and placed it behind a rotating pasteboard disk, 12 inches in diameter, having twelve apertures 1½ inches wide and 1¼ inches long. I provided several flasks of the same capacity, and filled them with the different gases and vapors, and stoppered them, to be used at convenience. Near the disk I placed a common gas flame, and into the mouth of the flask was inserted one end of a long rubber tube, the other end being provided with a tapering ear tube, placed in the ear of the listener, whose position was sufficiently remote from the apparatus to avoid any possible disturbance from the revolving disk or the operator. The disk being rotated so as to rapidly intercept the thermal and luminous rays of the gas flame and render the rays rapidly intermittent, the effect on the gases and vapors contained by the different bulbs was noted. Dry air produced no sound; moistened it yielded a distinctly audible tone, corresponding in pitch with the rapidity of the interruptions of the thermal rays.*

* The tone to be expected from the gas or vapor when acted on, may be determined by blowing through a tube against the apertured portion of the rotating disk.

Among gases tried, nitrous oxide and illuminating gas yielded the loudest sounds. Among vapors, water and sulphuric ether were most susceptible to the intermittent rays. A candle flame produced distinctly audible sounds in the more sensitive gases, and a hot poker replacing the gas flame yielded the same results.

By using an ordinary concave spun metal mirror the heat of the flame was satisfactorily projected from a considerable distance. Considering the crudeness of my apparatus and the delicacy of the action which produces the sounds, it appears remarkable that any satisfactory results were obtained, and the experiment shows that any one interested in the finer branches of scientific investigation may often, with the exercise of a little care, enjoy, without material expense, those deeply interesting experiments. I have not recounted, at length, the details of Prof. Tyndall's experiments in this direction, as they are accessible to the reader.—*Scientific American.*

ANCIENT WORKS IN NEW MEXICO.

New Mexico is perhaps the most noted country in the world for research. The historian, the wealth seeker and the "curious" can here find a rich field and reward for their labor. The Abo and Gran Quivira counties are perhaps the most renowed in the Territory for research. In the former there are evidences of great volcanic eruptions which overwhelmed cities and burnt the inhabitants in ashes and lava long ages ago. It is evident that these people, who are perhaps older than the Aztecs, were a prosperous race, with not a little advance in civilization, as the Abo ruins in the Manzana Mountains indicate; also some indications of fine art; rude figures and the images of animals being found upon the interior of the walls of the structures beneath the debris.

It is evident that this non-historic race were seekers after mineral, and evidences also exist that mineral was obtained by them in paying quantities, there being the ruins of many old smelters and acres of slag found near Abo. Here mines are found with the timbers so rotten with age that great difficulty is experienced and danger incurred in going down into the old shafts, where shafts are formed.

One of our informants gave as his belief that either the flow of lava or fallen leaves and dust had filled many of the shafts up, and the sand, earth and leaves so completely covered the ground that great care is required to find them, with but one or two exceptions—the Mount of the Holy Cross—(so named) being about the only one that could be easily discovered.

One especially was found where human hands or lava or falling leaves and dust had filled it level with the earth, no shaft being discernible, and would not have been found, perhaps, had not an old trail been discovered. This was dug inte, and at a depth of twelve feet a man could, in places, thrust his arm in up to the elbow between the granite walls of the mine and the earth which filled the old shaft. The mineral, unlike our White Oaks country, does not seem to outcrop, but seems to be deep in the earth, no float having been found as yet except near the shafts or around the old smelters. On the eastern slope of the Manzana Mountains no quartz has been found excepting in a very burned and blackened condition. This part of the country will perhaps yield immense mineral wealth in time, and further developments and prospecting is awaited with great interest to many.

The walls of some of the old ruins at Abo are six feet of solid stone—lime and red sand—the walls in places are yet six feet in height and in a state of perfect preservation. In the ruins are found vessels of various designs and sizes made of pottery—some representing birds and animals. Stone hammers are found here, but no indication that sharp-edged tools were used in this ancient period. In digging down in one place the remains of an old aqueduct was found, which was probably used, as in the present day by the Mexicans, for supplying the inhabitants with water.

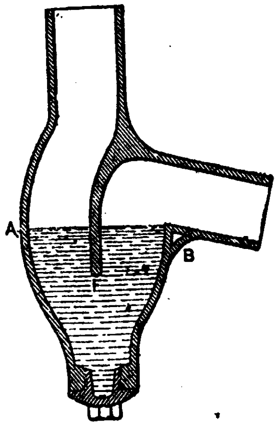
It is thought and believed, by specimens of ore found, that gold, silver and copper were found in paying quantities. All the rock is more or less copper stained, and some of it is so much so that some of the "country" rock has run as high as 37 per cent. copper.

Surely our bright, sunny land has been enjoyed long before the Anglo-Saxon made his appearance upon the scene. The future of New Mexico can only be surmised. Every day new evidences of untold wealth are thrust upon us, and the day is not far distant when the multitudes of the East will flock to our borders and assist in the development of the greatest mineral region in the world.—*Kansas City Review.*

Sanitary and Plumbing.

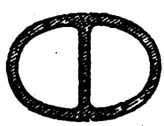
"OVAL" TRAP.

Occasionally our English friends bring out a novelty in plumbing goods which is interesting, to say the least. One of the latest things of the sort which has come to our notice is what is called an "oval stench trap." It is made by G. Claughton Forgley, near Leeds, England. These traps consist of enlargements or bulges of the pipe in which the necessary seal of water is



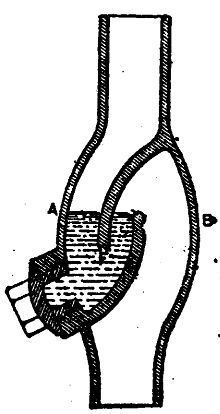
Oval Traps.—Fig. 1.—Vertical Section of "Angle" Trap.

placed. Fig. 1 shows what is called an angle trap. It is furnished with a tap screw at the bottom, with outlet D, which keeps the water level at E. The portion F is carried down below the surface, in order to get the proper amount of dip. Fig. 2



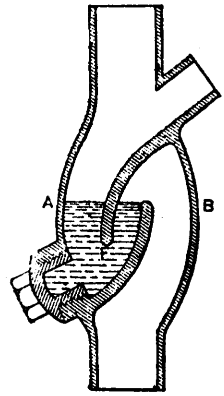
Oval Traps.—Fig. 2.—Horizontal Section of "Angle" on the Line A B in Fig. 1.

shows the plan or section of the trap on the line *a* B. This style of trap is made for 1¼, 1½ and 2-inch pipe. Fig. 3 shows the basin trap of this style. These are made in a somewhat different

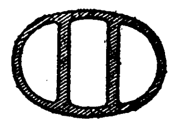


Oval Traps.—Fig. 3.—Oval Basin Traps.

pattern from the last. the trap screw being placed upon the side instead of the bottom, the outlet taking the lower position and the inlet the top. This style is made in all sizes from ⅞ inch up to 2 inches. In Fig. 4 we have a section of a "straight" trap, which appears to be only a basin trap with a branch, C. Fig. 5 shows a section of both of these traps.



Oval Traps.—Fig. 4.—Straight Trap.



Oval Traps.—Fig. 5.—Horizontal Section Through A B of Traps shown in Figs. 3 and 4.

In each case the water line terminates at E, or the top of the partition by which the seal is retained. F is the portion which dips into the water and forms the seal. These traps certainly make neat jobs so far as the external appearance goes, and are very convenient because they do not disturb the line of the pipe by making an offset. The trap screw is well placed for cleaning. Unfortunately, in none of the engravings which we have seen does it appear tha any arrangement can easily be made for ventilating them. If the outlet C had only been placed below the partition F, in Fig. 4, ventilation would have been easy. The cross sections do not give a favorable impression of the self-cleaning power of the trap. It appears to us that there would be considerable difficulty upon this point. From what we can learn, we think the trap is easy to cast and rather cheap, all things considered.—*Metal Worker.*

AN INTRICATE JOB OF PIPING.

The accompanying illustrations represent some features of plumbing work which will be of especial interest to our country readers. In Trinity Building, New York, the water-closets are arranged in sets of six, on each side of a passageway. At the end of this passage a urinal is placed on one side and a sink and basin on the other. These are between the closets and the main line of pipe. These connections are necessarily of lead, and as it was imperative, for the sake of economy, to waste several fixtures in one trap, very peculiar and somewhat intricate pieces of pipe work had to be made before any of the fixtures were set and the main pipes were in place. Fig. 3 shows in perspective one of the most complicated of these pieces, made up and ready for setting. Fig. 2 is a top view of the same piece to show the angles of the pipe. In each figure the same letters refer to the same parts. The body or main portions of this piece is a large lead trap with a trap-screw at C. This takes the water from the sink, whose waste pipes (E in Fig. 2) is, however, much smaller than the body of the trap. This is necessary, as the trap must do duty for several fixtures. The pipe D comes from a hand basin and enters the trap above the water line. B is the waste for a sink and the janitor's wash-trays; also, it is taken into the trap below the water line for the purpose of securing a constant seal. The branch C, when in place, will have a thimble soldered into it and then be calked into a branch from the cast-iron ventilating pipe. As the soil pipe A terminates in a "spigot end," it is necessary to calk a hub, F, upon the thimble in which the trap terminates. It will be easily seen that to make so many joints in so small a space is a somewhat difficult job, and hence the great advantage of wiping them all before putting the trap in position. As these fixtures are all placed in a separate well-ventilated apartment, it was considered unnecessary by the owners of the building to place a trap under each fix-

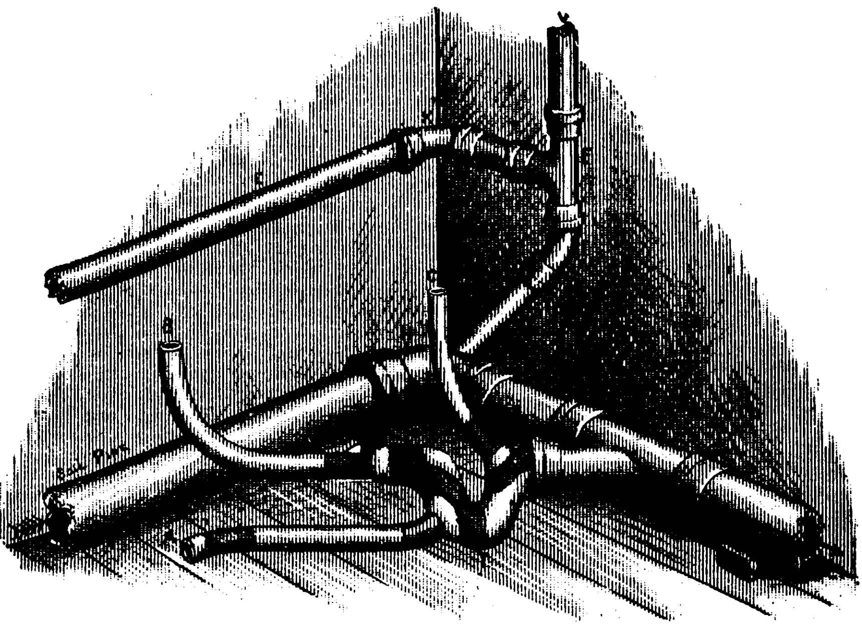


Fig. 1.—Pipes and Traps in Position without Fixtures.

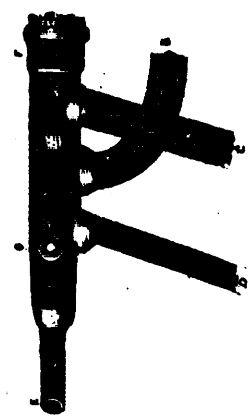


Fig. 2.—Top View of Trap shown in Fig. 3.

AN INTRICATE JOB OF PIPING.—WORK IN THE TRINITY BUILDING, NEW YORK.

ture. Under any other circumstances, this would have been done, because even one or two feet of foul pipe is amply sufficient to render the air of a room very impure. Indeed, the foul matters which accumulates in the first six inches of the urinal waste pipe is so offensive that many persons think it is impossible to keep a urinal sweet. This is a mistake. The urinals and closet in Trinity Building, if carefully flushed and the slabs washed off each day, will be free from offense. A piece of gum camphor should be kept in each urinal, and when it is dissolved a fresh piece should be put in. This does not simply mask the odor, but it is said by Dr. Bell to entirely destroy it by chemical combination.

In Fig. 1 we have rather a complicated arrangement of pipes. The plumber in charge found it cheaper to use single lines and carry his branches to them, than to cut through brick and iron floors, and run many separate lines of pipe from the cellar up.

The large pipe making a bend in the corner is the main soil pipe, which, on account of the original defective arrangement of the building, has to pass across the end of the room. Although it has only a slight fall, the verv heavy flush of water given by the "Sanitary" closets, with which the building is fitted, is so heavy, that this will not be found to be objectionable. The closets are connected on the left-hand side, and the main vertical pipe is on the right. The flow is from the left around the quarter turn H, and so on outward. D is a Y-branch which takes the waste from a sink and basin. The trap T is of lead, and is branched at C for ventilation. This branch is taken up into the pipe E K T V, E being the 3-inch main air pipe from the closets. A is the basin waste and B the waste from the sink. The two pieces of lead work shown are about all that is put under the floors, and these are so situated as to be easily examined. In one portion of the work, where a trap of lead was put under the floor, it was inclosed in a box which was filled with broken glass. The object of this was to prevent any possibility of the work being injured by rats. In many buildings these pests attack the lead water-pipes and do an immense amount of mischief. With a trap protected as we have described, vermin let it severely alone.

The Trinity Building in which this work was done, is old, and the arrangement of the water-closets was by no means such as would be adopted at the present day. On this account the difficulties encountered are the more interesting, as showing ingenuity which would not be called for in plain, straightforward jobs. The soil pipes are all very large, and the 5-inch iron traps of which we spoke in the previous article are so much larger than the openings in the closets that it is expected they will be always self-cleansing. The flush from the Zane patent closet, the "Sanitary," is, as we have said, very large and is probably ample, even for the large pipes.

All this work has been done under the immediate care and superintendence of Mr. W. S. Clarke, of 114 Maiden Lane, New York.—*Metal Worker.*

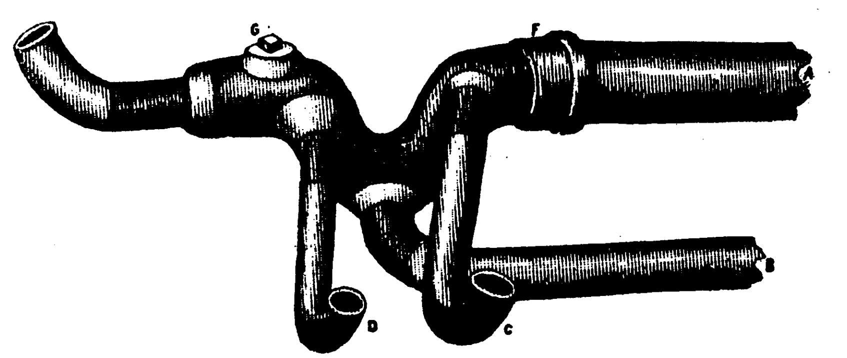


Fig. 3.—A Trap and Its Branches.

ADULTERATIONS OF WINES AND LIQUORS.

The spectacle of a wise looking gentleman ordering wine at a hotel, looking very learnedly over the list and gravely choosing champagne as the most fashionable wine, is a very ludicrous one to a person acquainted with the manner in which much of it is manfactured. There is more champagne bought and sold and drank in the city of New York in a single year than there is manufactured of the pure article throughout the world within the same time. The bogus article which is put forth at such an extravagant price is generally manufactured, about as follows: Fifty gallons of water two gallons of honey, five ounces of bruised ginger, five ounces of ground mustard. Boil this mass thirty minutes, add a quart of yeast, and let it ferment from ten to fourteen days, Add six ounces of bitter almonds, bruised, spirits and grains of paradise to suit convenience. The more spirit the champagne possess the greater will be its body. For coloring use cochineal, half an ounce to fifty gallons, or for pink champagne use a little more cochineal. The author furnishes also additional information for laying on the Dutch metal, printing and placing the labels to prove that it was obtained pure and genuine from any desired part of the world. Canadian lovers of the exhilirating fluid are not so subject to imposition, but it would surprise some drinkers to learn of the deeds which are done below the light of day in some of the disturbing centres. Notwithstanding the successful grape culture of recent years, here is the recipe for making the fine sparkling "Catawba" so popular in the United States. One hundred pounds of raisins, thirty-five gallons of sweet cider, one hundred gallons of water, three pints of yeast; ferment for twelve days, then add twelve gallons of honey, twelve gallons of clean spirit, one grain of ambergris, rubbed well with two ounces of sugar; then four gallons of Jamaica rum, twelve ounces of orris root, and fine the whole with three quarts of boiled milk, added while hot. Now for claret: Five gallons of boiled cider, two gallons of spirits, five gallons of water, two ounces of powdered catechu, or two drops of sulphuric acid to the gallon to suit the taste. Color with tincture of logwood. And, if you prefer sherry: Ten gallons of cider, four ounces of bitter almonds, one gallon of honey, two ounces of mustard. Boil for ten minutes, then add one half-pint of spirits of orris root, two ounces of essence of cassia, and three quarts of rum. It is stated in addition that Jamaica rum is to be preferred, as this wine is often preferred for the auctions, but the amount of spirit becomes an important item, owing to its cost; therefore, when this is kept in view, tincture of grains of paradise should be substituted for spirits. But here is the recipe for port, which is used so freely by the gentlemen of the old school, who "always get the best,"—the best prescribed so freely by physicians: Twenty gallons of cider, two gallons of honey, two ounces of carbonate of soda, one and one-half gallons of strong tincture grains of paradise, five ounces of powdered catechu. Color with logwood or burnt sugar. A small portion of spirit will improve it. The carbonate of soda is to neutralize the acid in the cider, which, if allowed to remain, would present too large a proportion of acid for good port. In addition to these recipes, "published for the trade," are others for manufacturing seven kinds of brandy, besides the cognac, some of which are really frightening, seven kinds of whiskey, two kinds of gin, five kinds of rum, and ten different kinds of wine —*Montreal Journal of Commerce.*

FOG SPECTRES.

A correspondent of London *Nature*, writing from Putney, says: "Having occasion to go into my garden about half past ten one night, recently, I found there was a thick white fog, through which, however, a star could be seen here and there. I had an ordinary bedroom candlestick in my hand, with the candle lighted, in order to find the object I wanted. To my great surprise I found that the lighted candle projected a fantastic image of myself on the fog, the shadow being about twelve feet high, and of an oddly distorted character, just as the spectre of the Brocken is said to be. May not the gigantic spirits of the Ossianic heroes, whose form is composed of mist, through which the stars can be seen, be derived from the fantastic images thrown upon the mountain fogs from the camp-fires of the ancient Greeks? In a land where mists abound, superstitious people might very readily come to consider a mocking cloud-spectre to be supernatural, though it was really their own images magnified." The spectre of the Brocken alluded to here is the appearance produced, when ascending the mountain by the shadows of travellers projected under certain circumstances upon the mist below them, giving rise to the legends of gigantic spectres.

THE NORWEGIAN PEASANT'S HOME.

BY W. MATTIEU WILLIAMS, F.R.A.S., F.C.S.

The readers of the *Building Times* have doubtless heard of the importation of Norwegian wooden houses in pieces, and the putting them together and setting them up in England. This has been done by enthusiastic English tourists, who were so much smitten by the home-life of the Norwegian peasant, that they determined to emulate it in their own country. King William IV. of Prussia did even more than this. In 1844 he purchased the old Norwegian wooden church that formerly stood at Wang, near Trondhjem, took it to pieces, carried it to the Riesengebirge district of his own dominions, and re-erected it at Brüchenburg, where it now stands. The word "peasant" is one which few Englishmen are able to understand. We have no peasantry in England, excepting the few survivors of the nearly extinct British yeomen that are to be found in some remote valleys of Cumberland and Westmoreland. We have agricultural factories, where beef and mutton and wheat are "turned out," and where "hands" are employed in ploughing, stalling, wagoning, reaping, threshing, etc., but no great class of agricultural labourers who are attached to the soil by the combined ties of proprietorship and industry; who live in the homes of their fathers, who till with their own hands the land they have inherited from their fathers, and who are both agricultural capitalists and agricultural labourers.

The continental peasant is a man who gives a formal dowry with his daughter on her marriage, a specfication of which, with the inventory of her stock of clothes, house linen, etc., usually sufficient for her life-time, is appended formally to the marriage contract. To him the working on another man's land for mere daily wages is a form of serfdom that is only endurable as a temporary probation by young single men who are preparing for the serious business of life, which begins with the sole or part proprietorship of a farm with its stock and implements. Without this his fellow-peasants will not allow him to marry one of their daughters.

This sort of peasant life attains its fullest development in Norway, a country that has never passed through the feudal state, and consequently has no aristocracy, living merely upon rentals. The "bonder," or peasant farmer, tills the soil of a farm which commonly bears his own name, and in many cases has been held by his family in unbroken succession for more than a thousand years. They are working peasants nevertheless, nor have any notion of being otherwise, although very proud of their ancient lineage. All have more or less of family plate, some of it of great antiquity. Their coat and waistcoat buttons are usually of silver. There are no pawnbrokers in Norway.

Their houses are very characteristic and interesting structures. As I travelled on foot and alone through Norway twenty-five years ago, when English tourists were scarce, and had no other lodging in the country than at the houses of the peasant farmers, my opportunities of the studying them were ample. At first I was puzzled on arriving late in the evening at what appeared to be a village, and on knocking at a door, to be answered by a low hollow moaning. On opening the door I found that the only inhabitants were cows. Then I tried the biggest house, and found this to filled from floor to roof with hay only; then another inhabited by goets; then another by horses. At last I found the human habitation smaller than the hay-house, and less ornamental, but about equal in dimensions and architecture to those occupied by the cattle. It was not a village, only a single farm.

The severity of the climate demands the careful housing of all the stock, and all the harvest produce. All the houses are built of wood, and are detached and far apart in case of fire. They are usually single-storied, excepting the *storhaus* (*i.e.* the "big house" *stor* being the Norsk for large.) Here the hay is kept, and my theory is that our word store-house is derived from this, and we get thus a secondary meaning for the noun *store* and verb *to store*, which originally came from the Norsk adjective for large.

The double story of the storehouse is, however, an outside illusion; there is merely an upper door of sufficient capacity to admit the tilting of a cart, or the pitching of a very large manload of hay, which is carried there up an inclined plane, when the house is filled above the top of the lower door. Some of the storehouses, especially in the wildest and most primitive region of Norway, the Tellemark, are elaborately and very handsomely carved on the outside of the massive doorposts and corner timbers.

After a little experience the traveller learns how to pick out the house allotted to the bipeds by its chimney and its window or windows. The chimney is the only part not of wood. It is a massive stone structure attached to the wooden house, but standing independently on its own fireproof foundation. Otherwise, all the houses are similarly built as follows :

Four large blocks of stone, usually natural boulders left by an ancient glancier, are laid at the angles of the ground plan of the building which is commonly square. These, standing on the rocky ground, form the foundation. Rudely squared trunks of large pine or fir trees are laid with their ends resting upon these. Two of such are first laid opposite and parallel. Then the other sides are started by crossing them with two other logs. Both these and the first have broad notches cut in them at about one foot from their ends. The notches fall into each other, and leave the ends overlapping at each corner, and projecting outwardly. Other logs are laid upon these all similarly notched, so that on falling into each other's notches as they cross near the ends, the lower squared face of each log rests fairly on the that of one below it, and thus together they form a wooden wall as thick as the whole breadth of the logs.

The joints between the logs are afterwards completed by a caulking of moss which is firmly rammed into every crevice. The flooring rests on the first course of logs, and is therefore fairly raised above the ground by the thickness added to that of the corner boulders. The houses, excepting the chimney, thus stand upon four stone feet, something after the manner of our well-constructed corn-ricks.

The roof is made in the usual manner, but of very substantial timbers, more comparable to those of our cathedrals than of our houses. They are closely laid with a complete covering of boards nearly as strong as our floors. In a few places very thick slates are used. This simply depends upon geological accident. The usual roof covering is very characteristic and peculiar. Instead of slate, the bark of the birch tree is used. This bark, as may be seen by examining our English birch trees, is thin, close, uniform, and very tough. By skilful management it is stripped off in large sheets, which are laid with moss upon the flooring boards. The bark is resinous and retains its waterproof qualities for a very long time, and does not rot. Over this is commonly laid more moss and turf; so thick that a good crop of grass grows upon it. I have seen goats grazing on such roofs. They ascend by ladders placed on purpose. I have also seen the thrifty peasant mowing his own roof with a scythe. An old Norwegian story tells of the tender converse of two lovers that was disturbed by a cow falling through the roof on which it was grazing. This must have been a very old roof, for those I have seen in course of construction were strong enough to bear a herd of oxen.

At the fishing stations of Arctic Norway, where all around is barren rock, with snow lying in the hollows of the purple hills, and with blue glaciers in the distance, these verdant roofs dotted with the white star-flowers of the meadow-sweet, the blossoms of the scurvy-grass and saxifrage, rise in the midst of the salt-cod drying grounds, like oases in a fishy desert.

Some of the houses have planed boards nailed to the logs, forming a smooth or paneled inner wall, which is in many cases decorated with carving or rude scroll painting. This depends upon the artistic proclivities of the family as "the building trade" as a trade has no existence in *rural* Norway. Every man is a sort of Robinson Crusoe; builds his own house, makes his own furniture and utensils. Their cooperage is excellent. In the towns the outside of the logs is boarded and usually painted.

The internal arrangements are very simple. In the larger houses there is a sort of vestibule between the outer and inner door. This has shelves holding milk-pails and sundry farming utensils and serves to retain the warmth in winter. The big room serves as kitchen, dining-room, and sleeping-room for the bonder and his wife ; the boys and girls having separate smaller rooms partitioned off. The beds are oblong wooden boxes with a layer of straw on the bottom and blankets and sheets above. The latter are not used every where. I have slept in beds without either sheets or blankets, the functions of both being performed by sheep skins. These are very pleasant when clean and not too fresh. The wool is of course inwards.

She furniture is very primitive, but substantial. A long deal table, at which all the family, take their meals, is the largest piece. There are various kinds of sideboards with shelves and drawers, some of them very handsomely carved and gaily painted, all of deal and home-made. The primitive Norwegian chair, best seen in the wild Tellemark, is very curious. It is a block of tree trunk like a butcher's block, sawed off in the first place to about 3 ft. in length. This is stood on end, and the front upper part scooped out to form the back, the lower part remaining solid as the seat. It is of course very heavy, too heavy to lift, and can only be rolled on its lower edge. Other framed chairs are used, but long stools prevail.

The bridal chest is another characteristic piece of furniture. Where there is a special best bedroom it stands there. It is a capacious affair 6 or 8 ft. long, and proportionately wide and deep. On the outside is gaily painted the name of the lady and something of her pedigree. This inscription is generally surrounded with floral scroll work. It contains the stock of clothing that came with the bride and her jewellery. The broaches, chain, watch, etc., usually hang on the inside of the lid. They can have no experience of robbery, or they would not so often have lodged such a weather-splashed vagabond-looking fellow as I was in a room alone with such a box lying open, and containing all the portable family treasures.

The stove is the most costly article of furniture, its money cost is nearly as great as all the rest of the house, being an article purchased with hard cash. It is so important, and so much better than what we are accustomed to use, either in the cottage or the mansion, that I must reserve a description of it in connection with the general subject of house warming at home and abroad.

The general woodenness of everything is very striking to the stranger at first. Wooden bowls and troughs, and platters and spoons, and forks are used in eating. The troughs and bowls for porridge and gröd, a compost of meal which looks like Roman cement and is a staple article of food. The dairy utensils, butter-pots, etc., are also of wood. The Norwegian peasant does wonders with a single tool, the knife that he carries in a sheath. With this he makes elaborate carvings, some of them most artistic and original in design. He cuts hedge stakes and shaves himself with the same, and does the work of a dozen ordinary joiners' tools. Since my first visit, considerable changes have taken place in what is seen by the tourist on the main highways. The old farmhouse stations that twenty-five years ago were in primitive Norwegian condition, now have buildings specially erected for tourists, and furnished with exotic mahogany, with mirrors, and crockery ware, such as were formerly unknown. To fare as I did then, the tourist must turn aside from the beaten tracks, where he may still board and lodge in old Scandinavian fashion, and there see household arrangements nearly the same as Alfred saw when he burned the cakes in the Neatherd's cottage.

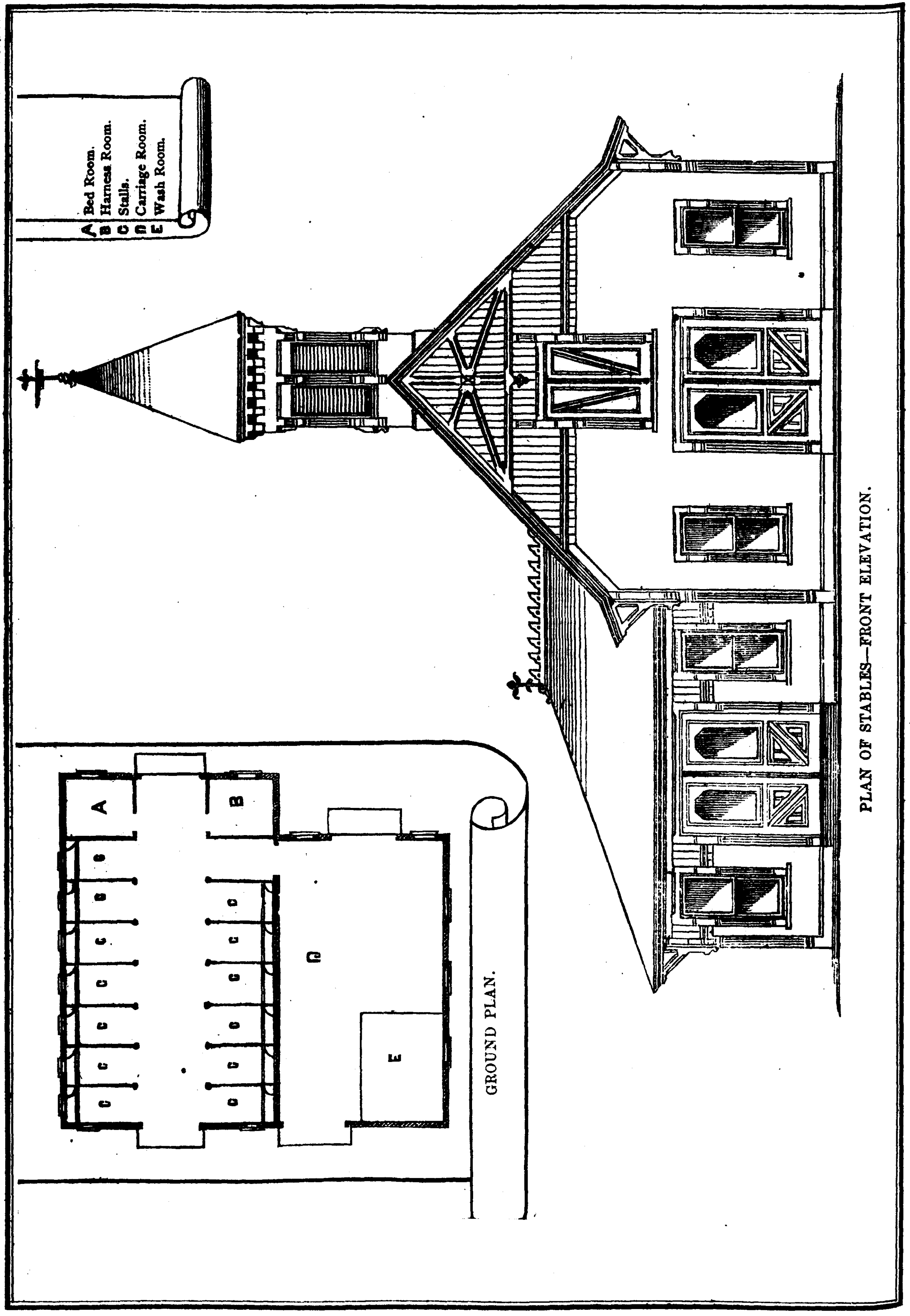
I have said that there is no building trade in rural Norway. There is, however, a very important and growing trade in certain localities in the southern part of the country, where timber is worked up into flooring boards, door, window sashes, etc., etc., for exportation, and much come to this country.

HUDSON'S BAY AS A POSSIBLE OUTLET FOR THE NORTHWEST.

During the past summer the engineers of the Nelson River Railway Company have surveyed a railway route between Norway House at the outlet of Lake Winnipeg and Fort Churchill on the Hudson's Bay. The distance between these places is about three hundred and fifty miles. The surveyed route first follows the course of the Nelson River for a distance of nearly one hundred miles over a level country. The next part of the road is over a broken rocky country, where the Nelson River has a descent of nearly seven hundred feet to the lower plateau, where the country again becomes level, and continues so to Hudson's Bay. Upon entering this rocky range the surveyed route leaves the Nelson River, taking a more northerly course toward the valley of the Churchill River, which is reached at its entrance on the lower Plateau, and continues to follow the course of the river to its outlet in Hudson's Bay. The estimated cost for building the road-bed is ten thousand dollars a mile on the plateau and seventeen thousand dollars per mile along the whole route.

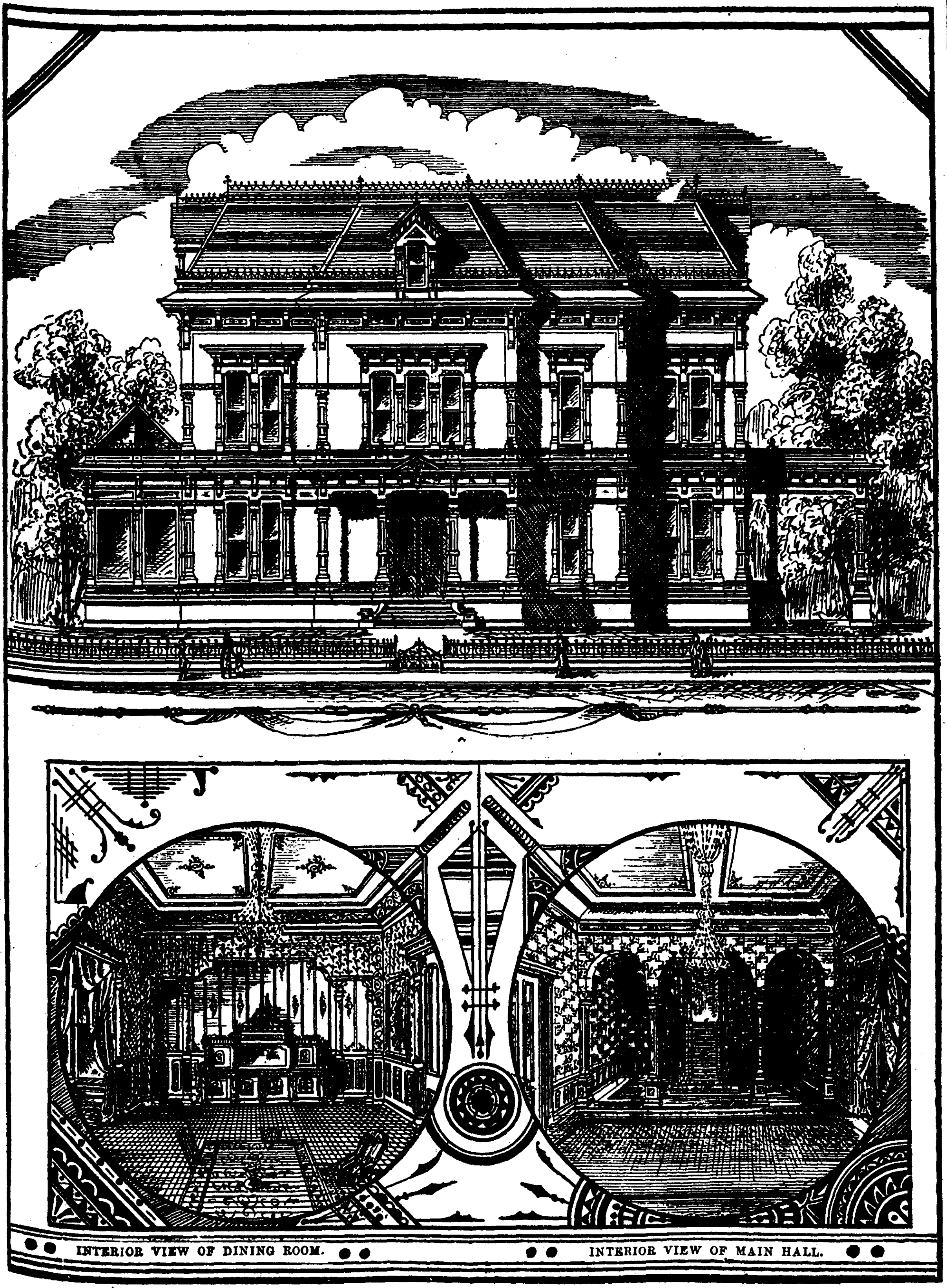
It is claimed that by this route it will be possible to transport grain from the Saskatchewan Valley to Liverpool for less than it will cost to carry it to Montreal by the proposed railway north of Lake Superior.

Professor Bell, of the Canadian Geological Survey, who sailed from Fort York, Hudson's Bay, and passed through Hudson's Straits in the latter part of last September, says that sailing vessels have sometimes considerable difficulty and delay in getting through, but steamships car make the voyage at any time between the first of May and November, as the straits are nearly one hundred miles wide in the narrowest part, and the channel is not obstructed by ice.—*Scientific American.*



PLAN OF STABLES—FRONT ELEVATION.

GROUND PLAN.



ELEVATION FOR A SUBURBAN RESIDENCE.

PLAN FOR STABLE.

The plans for a stable furnish stalls for thirteen horses, harness-room, office, carriage apartment, etc. One similar to this was built some years ago at Piedmont Springs, Alameda County, at a cost not recollected at present. But, like all other constructions, the matter of cost can be varied from 10 per cent. to 500 per cent., according to the material used, character of workmanship, finishes, etc.

SUBURBAN RESIDENCE.

The Elevation for a Suburban Residence appears without the floor plans, but is accompanied with two sketches of interior finishes. It is a class of house in which large conveniences may be effected. Its extensive verandahs suggest its suitability for localities where the summer months are "hot." Properly located, with suitable surroundings, it will make a neat and not costly country or suburban residence, size, etc., considered.

COPYING DRAWINGS.—By a method patented by M. Joltrain, of Paris, it is claimed that copies of drawings having nearly black strokes on a white ground can be made by the following sensitising mixture: Gum, 25 grammes; chloride of sodium, three grammes; perchloride of iron at 55° B., 10 cubic centimeters; sulphate of peroxide of iron, five grammes; tartaric acid, four grammes; water to fill up to 100 cubic contimeters. The developing bath may be a solution of ferrocyanide of potassium, red or yellow, acid or alkaline. The printing is done in the ordinary way, and the developing in a bath of red or yellow prussiate of potash. After washing the proof is put into an acidulated bath, which darkens the lines ta an indigo tint, and is then again washed and dried.

Painter's Work.

UTILITY IN DCORATIONS.

It appears to us that, apart from the abstract opinions of this or that person as to the desirability of using imitations of woods and marble, or what are called shams, we are bound to take into consideration the usefulness and lasting properties of certain imitations, and their suitableness to the purposes they are used for, and for which they are best adapted. For instance, there is an imitation of stone or wood which is so good that no one can discover that it is not stone except by sounding or striking it, and we have known it to stand good when exposed to the weather fully 20 years, and at the end of that time be almost as good as at first. This effect is brought about by throwing common sand or the sand from any particular stone upon the paint when it is wet, in this wise:—The woodwork is well painted with four or five coats of oil paint. The finishing coat is mixed with white lead, boiled oil, and a little copal varnish, to give it "tack" or stickiness, it must be, of course, stained to the particular shade or color of the stone you wish it to resemble. The color is now laid on the work in the ordinary manner, and the sand is thrown on it while it is wet. Care must be taken that the work is well covered, or else there will be more on one part than another, which will cause it to look shady; it is always best to throw as much sand on the work as it will hold, to make sure it is well covered. The work should now stand for a few days until the paint gets hard, the loose sand may then be brushed off. Now, if this is well and carefully done, it will have all the appearance of stone, and will last for a long period without being re-done, but of course may be re-done at any time at a light expense. It is sometimes painted after being sanded, but if properly done it is much the best to leavo the sand unpainted.

The sand forming an impervious coating (in fact, it is a coating of stone, having this advantage over stone, that it is non-absorbent of wet or damp) the uses of this process will be evident, especially in districts where stone is not to be had except at great cost of carriage, and also in many country districts, where wood is plentiful and stone is not. It will be said by the realists, "why not leave it as wood? Don't cover it and make it appear like stone, which it is not;" to which we may answer, that wood, especially when exposed to the weather, alternate heat, wet, and frost, soon becomes split up into innumerable cracks, and its surface gets rough and unsightly, its color dirty and black; nail holes, and the rust from the nails become unpleasantly visible, and ultimately rottenness and decay in numerous forms set in, and it becomes unsafe, and has to be taken down and replaced with new wood. Now if the wood is done over as described, all this is prevented, the wood preserved, and always pleasant to look upon. It will perhaps be said, "Why not varnish the wood, and then it will resist the effects of the weather?" It is quite true that if the wood is well varnished it will stand for a time, but how long a time? If it is outside work, varnish will not stand above two or three years, even with the very best varnish. The heat of the sun dries up and exhausts the oil of the varnish, and when that is gone the gum shrivels up, cracks and turns white, peels off, and thus perishes, consequently the wood is left without protection.

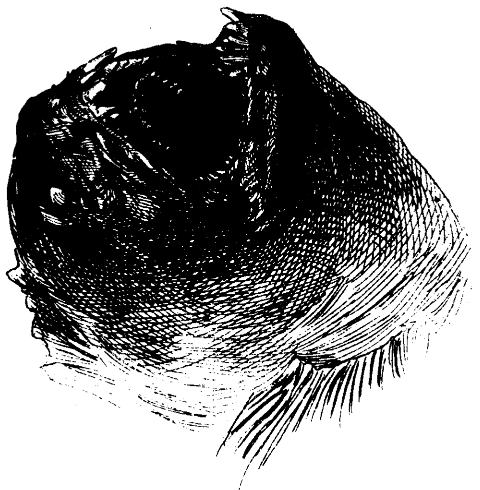
In these cases artistic taste and love of the beautiful may induce us to leave the wood uncovered, but utility and common sense bid us cover it up and thus preserve it. We remember some 30 years ago examining some exquisite carvings in oak and pear tree wood, which were rapidly falling to decay—worm eaten and rough on the surface from the effets of dust, time and neglect. We suggested that some means should be taken to arrest the decay, and thus preserve such beautiful and valuable works. The gentleman to whom they belonged rose up in arms at once at the bare suggestion: it no doubt seemed to him a profanation to touch them with any vile composition. As the artist had left them so they should remain, fresh from the chisel; a very proper feeling in many cases, but in this case, when it was so evident that Father Time was using his destructive chisel with such fatal effects, we ventured to differ, and after much persuasion we induced him to allow us to try what we could do with part of the work. Our first efforts were directed to the cleaning the carving from the accumulated dust of years, which we did as well as we could by first blowing all the loose dust off with a pair of house bellows; we then used small hog-hair brushes, and by supporting the weak parts with the hand we managed to clean it well without injury to the most delicate parts. We then used the bellows again to blow off any remaining particles of dust from the insterstices and undercutting. When it was as clean as we could get it, we placed it in a tub large enough to hold it, and then filled the tub with the purest linseed oil we could procure high enough to cover the whole of the carving; we let it stand in the oil for 24 hours, and when taken out we cleaned off all the superfluous oil with large and small hog hair brushes, wiping the oil out of the brushes as we used them, until there was not left sufficient oil on the surface to form a skin. This is a very important point in the process, and requires great care, otherwise the carving would be spoiled. The oil darkened the wood a little, but not so much as would be supposed, the oil being free from litharge or any other dryer or coloring matter. After 20 years had elapsed we again saw the same carvings, and we found that those which had been treated in the manner described were just in the same state as when we left them 20 years before, but had become so hard that a sharp knife would hardly touch them: but those which had not been submitted to the same process were in some parts irretrievably gone, and the rest were rapidly following. Now we hold it to be unwise, and, in fact, almost a crime, to allow these beautiful creations of man's genius to go to decay and be destroyed for the sake of a prejudice or rather an obstinate persistence in what is evidently a mistake. Look at the exquisite gems of art left us by Grinling Gibbons, and others, which are dropping to pieces and crumbling away simply for the want of some such means being applied to preserve them. Would it not be better a thousand times over to sacrifice some little of their beauty than to see them as they are? Of course we would all rather see them untouched as they were left by the artist; but common sense steps in and points to the fact that however beautiful these things are, and although they may appear, and, in fact, are more beautiful left as they are, yet the material of which they are composed is so perishable that they must of necessity soon decay, and all the labor, and skill, and thought employed in their production be lost for ever except some means be taken to stay the hand of the destroyer. We are surprised that the remedy has been so long delayed. We do not advise varnish or polish to be used; the process we have described does not produce that result, but leaves the wood nearly dead—that is, without gloss; although there is no better polish for wood than linseed oil itself. If a mahogany or oak table be regularly rubbed for years with pure linseed oil, the polish which results is the best and most indestructible that can be produced, and becomes so hard in time that scarcely anything can injure it. We have digressed somewhat with regard to carvings, but we hope not fruitlessly so; and trust that this brief notice may call attention to the subject, and help to a remedy.

Imitations of wood and marbles may be classed amongst the useful arts. There are thousands of homes in the construction of which no other wood is used but the common pine, full of ugly resinous knots, and which, for that reason and many others, has to be painted and puttied to make it passable. And if we could use real oak and mahogany for our doors—that is, if it were cheap and plentiful enough for that purpose—it would not be wise to leave it unpainted, as it would require so much time and trouble to keep them bright and clean, that nine-tenths of the world could not afford the necessary time and cost to keep them in order; consequently it is not only more convenient but economical, but it is really better to have painted woodwork in the majority of our houses—better because woodwork painted, grained and varnished, is the most cleanly-looking and serviceable method of decorating the doors and other woodwork in all those rooms in our houses which are most used, or which require to be done so that they will not easily soil. For we cannot always dwell in a china shop, and must have some rooms where we can move about at our ease, and where we are not continually afraid of spoiling something. Now for this purpose nothing can be more appropriate or better adapted than imitations of wood, well done and well varnished. Its lasting properties are very great, and at any time a wash down and a coat of varnish make all new again. For public buildings where real oak or mahogany is not used, we cannot substitute anything equal to it. If we paint them in dark low-toned colors, and varnish them, they will not last so long, nor look so cheerful, nor so appropriate, for even the objectors to imitations of all kinds will agree with us that wood painted in imitation of wood is much more in accordance with good taste than if painted in any other manner. If we were to paint a door in imitation of marble, we should be committing an offence against good taste and good sense, notwithstanding that there are real marble doors, of which the Russian malachite doors in the Great International Exhibition of 1851 were examples; but if we paint them in imitation of wood, we do not offend our sense of propriety, simply because it is wood, and has the structural character of wood. If we were to paint a column, or a pillar, or pilaster, or a plastered wall in imitation of wood, we should be doing wrong—we should err in judgment, in taste, and against structural propriety. In the interiors of our dwelling houses and public buildings there cannot surely be any impropriety in finishing them in imitation of stone or marble, of which materials they ought and would be built if they were only cheap enough. The utility of the practice is unquestionable; that it is economical is proved by the fact that if once properly done, and ordinary care taken of it afterwards, it will last and wear almost any length of time. Work of this kind which has been done upwards of fifty years, was, with the exception of its color being a little darker than when it was first done, quite as good as when new; this very fact alone is a sufficient proof of the legitimacy of such methods of decoration. What can be better adapted for a public staircase than a good imitation of one of the granites, gray or red? If well done and well varnished it will last for scores of years, and will wash and clean with little trouble, and although thousands of people may pass up and down the staircase, its serviceable qualities are so great that it will suffer no great harm. In this case we, of course, only mean that the granite should be done up to a certain height for purposes of utility. The upper part may be painted or ornamented in any suitable manner, either in distemper or oil color. We shall find there is a suitableness and an unsuitableness in the application to special purposes, and that independently of any abstract views we may have in regard to beauty, or this or that style, we are bound by the circumstauces of any particular case to consider not which would be the most beautiful, but which will best combine beauty, usefulness and durability. For instance, we had occasion a few days ago to go into a first-class shop in one of our principal streets in which the counter was painted in imitation of black walnut wood, and the moldings were part black and part gilt. The gold was in a very dilapidated state, scratched, and rubbed quite bare, and injured by the continual dusting and cleaning necessarily required in such a situation. The gold being upon the round beads (which were the most prominent members of the moldings), was of course much exposed to wear and tear, and soonest spoiled, and there is nothing looks so bad as gilding when it has got into such a state. Now here a great mistake has been made. The principle of utility had been entirely lost sight of—sacrificed to the vulgar desire for glare and glitter. Had the decorator been content with his work without adding the gold to it he would have produced a very successful work, and one which would have been serviceable, quiet and good, instead of which the reverse was the case. As a matter of taste we object to gilding on grained woods; the two do not assimilate, and seem to have no connection with one another. If the work were real wood polished, we should never dream of gilding any part of it. There is really no necessity for it, and it is, therefore superfluous. In the choice of paper hangings, furniture, carpets, and other aids and necessaries for our comfort and happiness, we are bound to take into consideration utility as well as beauty. *American Cabinetmaker.*

METALS AND PAINT.

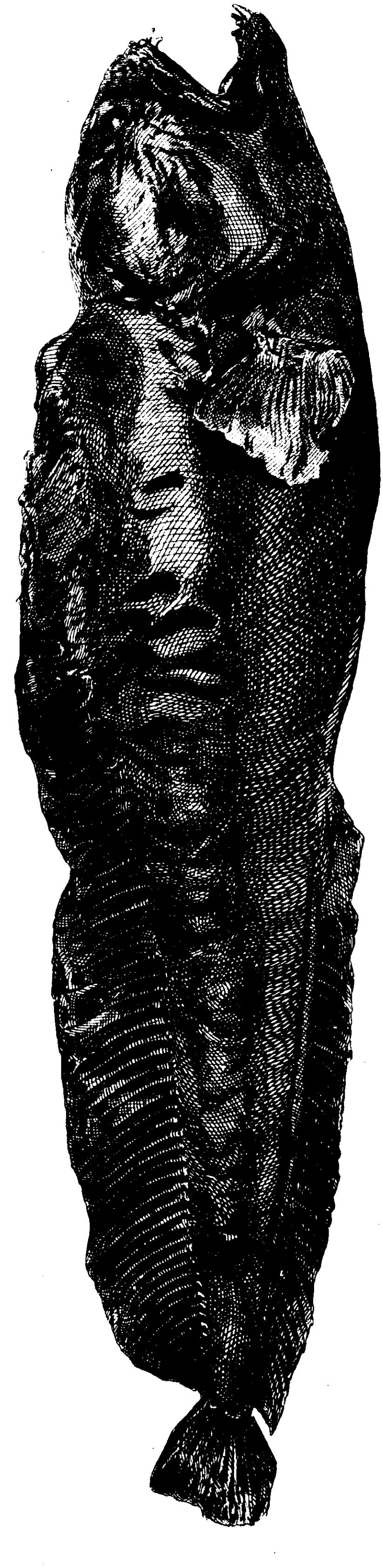
The subject of painting metallic bodies is not generally understood by many painters or architects, and as in this climate there is a great necessity for the proper covering of all metallic surfaces, to shield them from the elements, the subject will bear investigation with profit. Metallic paints, and many other compound chemical mixtures, are heralded as the paint for all work, whether wood or metal. It is true of these and many other kinds, that they are good for *painting*, but not for *preserving* metals from oxidizing. All fine preparations of the carbonates and oxides of lead or copper, are unsuitable for this purpose for the reason that a *pure* oxide, when applied to other metals, will assist in the action of the elements to oxidize the metals they cover. The vehicle of all good paint is boiled or raw linseed oil, and this, when thickened with pigments, covers a less given space; and the material being an oxide, holding more oil than is imparted to the surface to be painted, soon throws off its share and is ready to absorb the air and convey it to the body of the metal, where natural corrosion will take place, and then the two oxides unite chemically. In other words, all paints, in the absence of a solvent, which time soon releases them of, act upon iron or tin as a filter, feeding the porous spots with moisture, like a porous plaster of *rust*; and as like produces its kind, the decomposed metals work like a happy family, and roll in beds of rust. This fact is observable on flat surfaces, or in gutters where inequalities occur. Here the fine dust or powder collects and keeps the water in them until the oil is decomposed; then the work of oxidation commences. There is another fruitful source from which rust on the upper or *under* side of roofing tin comes, and that is, mixing paints in common cheap oils of kerosene, containing sulphuric acid. This oil never dries. It may harden the film of paint so as to allow the acid it contains to corrode the tin, and the best paint in the world on the opposite side cannot prevent the acid-eaten holes from coming through; and judge the effect, where both sides happen to receive the same potent mixture. The best paint for tin or iron is composed of pure linseed oil and earthy ochres, red or yellow. The coarser granulated powders are best as a pigment, as they offer less air-holes and give a firmer hold for the oil on the grits, and thus bind them to the metal. The oil in this manner gets close to the metal, and offers resistance to the air in removing the atoms from its cohesion. Beware of all metallic oxides or *mineral paints*, especially on lofty towers or inaccessible coverings of metal. Roofing tin should, when laid, be kept clean from windfalls of dust, and painted once in every two or three years, by the day—never by contract. Metals applied in the angles of roofs as flashings, where shingles are laid behind parapet walls, should be well painted on both sides, and the exposed crevices between the laps puttied and painted, and thus cut off leaks in corners "which no feller can find out." I have known of a case where leaks in an outer wall from an A No. 1 tin roof were undiscovered for years. Carpenters were called, imperfect boards were removed from the exterior wall side, and the whole repainted. Still, there was the leak unabated for years; and at last, the painter being called upon to find out the source of the trouble, found upon examination that the clap-boards on the inner side extended down to the tin, or nearly so, thus preventing the paint from reaching the angle of the tin back of the boards. There the dust collected, and dampness had eaten through, and a ruinous leak was discovered by simply sliding a putty knife under the edge of the siding. Wood work never should be allowed to close down on the metal, but instead, a space of one or two inches should always be left, so that the paint can be easily applied to all flashings on all sides, and where the dust can be easily swept out. Many troublesome leaks occur from the base of balustrades shutting down so close that dirt is completely imprisoned, and consequently in time decomposition sets in, and the metal coverings are ruined. Bay windows, with balconies, or with other ornaments, if put on with an idea of permanency, should leave ample room for the painter's brushes to reach every angle, nook, or corner, and thus save a thousand leaks.

J. E. W. C.



2.—Head of Wolf-fish.

3.—Lynx recently Captured near Peterborough.



1.—Wolf-fish in the possession of Mr. Phelps.—(See Editorial.)

SOME INTERESTING NATURAL HISTORY SPECIMENS.

1. FLAG FISH.—2. CORAL FISH.—3. CLIFF FISH.—4. CHARIOTEER.—5. DUKE FISH.—6. EMPEROR FISH.

Natural History.

SCALY-FINNED FISHES.

Our engraving represents members of a large family of fishes called by Dr. Günther *Squamipinnes* or scaly-finned fishes, because "the vertical fins are more or less densely covered with small scales;" but the spinous portions are not always scaly. These fishes are mostly carnivorous, and are inhabitants of the tropical seas and rivers. They are remarkable for their peculiar shape and their strange coloring. Their bodies are thin and very deep in proportion to their length, and their mouths are usually small.

The first group of this family have small mouths furnished with several rows of tiny, slender, and bristle-like teeth, which give them their scientific name *Chætodontina*, a term composed of two Greek words, the former signifying hair, and the latter a tooth. The colors of this group are brilliant and generally arranged in stripes or spots. Black and yellow are the prevailing colors, but blue and green are found in some species.

Fig. 1 in our engraving represents a fish which is found in the Indian Ocean and the western part of the Pacific Ocean, and is called by the Arabian fishermen of the Red Sea the flag fish (*Chætodon setifer*), on account of the considerable lengthening of the fourteenth ray of the dorsal fin. Dark bands run in different directions upon the whitish ground of the body. A black band edged with white extends from the neck through the eye to the throat; it is widened on the under side. Five or six blackish bands run obliquely from the front upward toward the dorsal fin, and from these lines eight or ten bands issue nearly at right angles, take a slight sweep downward, and then converge toward the tail. The region over the eye is also ornamented with four orange-yellow diagonal lines. The back part of the dorsal fin is lemon color, and has a black spot surrounded with an edge of white; above this the fin is a fiery red edged with black. The caudal fin is lemon yellow, ornamented on the back side with a crescent-shaped pale yellow and white-edged girdle, then with a cylindrical dark brown, black-edged girdle. The anal fin is orange color edged with black and seamed with white. The pectoral and abdominal fins are reddish-white. The dorsal fin has thirteen spinous and twenty-five soft rays, the anal fin three spinous and twenty soft rays; the pectoral fin has sixteen, the abdominal fin six, and the caudal fin seventeen rays. The length of the fish is about eight inches.

The coral fish (*Chætodon fasciatus*), Fig. 2, is about six and a half inches long. The main color of the head is white, with a broad black band extending from the crown of the head to the "præ operculum," or front gill cover. The body is a bright yellow, ornamented with from nine to twelve brownish-black bands running obliquely from the front upward and back, reaching to the yellow fins. The lips are rosy red. The soft dorsal and anal fins have a black border. The caudal fin has near the end a lentiform black diagonal marking and a whitish edge. The dorsal fin has twelve hard and twenty-five soft rays, and the anal fin three hard and nineteen soft rays. This fish inhabits the waters extending from the Red Sea to China.

A third species of this group is the cliff fish (*Chætodon villatus*), Fig. 3. It is about four and a quarter inches long. The ground color of the body is lemon yellow, and has about thirteen longitudinal stripes. The head is ornamented with a broad black curved eyeband, with a narrower band behind it running in the same direction. The brow has three or four diagonal lines, which, with the bands and the surroundings of the mouth, are black. The soft part of the yellow dorsal fin has a black edged band and an orange colored border. The anal fin has a bright yellow stripe extending the whole length with an orange colored border, and the black caudal fin has a broad rosy-red border. The dorsal fin has thirteen hard and twenty-one soft rays, and the anal fin has three hard and nineteen soft rays. This beautiful fish is found in the waters between Eastern Africa and the Society Islands.

Fig. 4 represents a remarkable fish which, on account of the peculiarly elongated dorsal spine, has received the name of long-spined chætodon or charioteer. It also exhibits well the scale covered fins. Both of the scientific names *Heniochus monoceros* are of Greek origin, the former signifying a charioteer—the long slender spine representing the whip; and the latter signifies "single horned," in allusion to the same peculiarity. The fourth dorsal spine is enormously elongated and whip-like, its use not being as yet ascertained. The prevailing color is grayish-yellow, which passes upon the breast and throat into a silvery white; the head is partially or wholly black, the side of the snout light. Two very broad black bands are drawn across the body touching the fins. The first extends from the back to the abdomen; the second is almost parallel with the first, and runs from the fifth to the eighth spine of the dorsal fin downward to the extreme end of the anal fin. The fins are lemon color where they are not touched with the bands. This fish inhabits the whole of the Indian Ocean.

Nearly forty species of the genus to which the duke fish (*Holocanthus diacanthus*), Fig. 5, belongs are now known. They all possess some remarkable peculiarity of coloring, and the front gill cover is armed with a strong sharp-pointed thorny spine. The ground color of the body is lemon yellow. There are eight or nine pale blue bands broadly edged with black extending diagonally across the body. The back of the head is black, and beautifully marked with blue longitudinal and diagonal lines. A blue stripe surrounds the eye, another runs down to the edge of the front gill cover. The pectoral, abdominal, and caudal fins are yellow. The soft part of the dark brown dorsal fin is striped with black and blue at the edge; the remainder is spotted with dark blue. The brown anal fin is ornamented with six or seven curved bright brown bands. Fourteen hard and nineteen soft rays support the dorsal fin; three hard and nineteen soft rays, the anal fin.

The emperor fish (*Holocanthus imperator*), Fig. 6, is still more beautiful. The smutty sulphur-yellow head is adorned with a brownish black brow and eye band, which is edged with bright blue. The region over the pectoral fins has a large black spot bordered with yellow which stands out distinctly from the violet blue color of the body. The body is ornamented with a large number of curved yellow stripes extending throughout its entire length. The abdomen and breast are a greenish brown, the fins bluish, their rays brighter or darker orange color merging into black. The brown anal fin is decorated with blue curved longitudinal lines. This fish has also the thorny spine on the front gill cover. It is an inhabitant of the Indian Ocean.—*Brehm's Animal Life.*

Miscellaneous.

THE TEST OF DEATH.

The discussion is still continued in scientific circles as to what constitute the surest indications of death. The rigidity of the remains, say the majority, although that has set in before the extinction of life. The flexibility of the members is a proof of the absence of death; but such can exist along with death. Bichat maintained that in the case of the asphyxated, no stiffness of the body is found; and Hunter asserted such was absent in the case of death from lightning; a foetus does not become rigid after death according to many. However, rigidity is a phenomenon very constant after every form of death, and observed alike with vertebrate and invertebrate animals. Though this stiffness be peculiar to the muscles, other tissues, as the brain, liver, kidneys, present a rigidity analogous, while less marked. The rigidity is presumed to be due to the coagulation of the albuminoid matters which enter into their constitution. What is the difference between congelation and rigidity? A muscle in the latter condition has still a certain degree of elasticity, but a frozen muscle is hard as metal, and when struck, sounds; when pressed, emits the crackling noise peculiar to tin. When does rigidity set in? The moment is very variable; immediately after death in some cases, and later in others. Sardines and white bait become rigid immediately after asphyxiation. There is a close connection between this stiffness and muscular irritability. All muscle separated from the nutritive action of liquid blood, passes through three stages: increase of excitability, decrease of some, rigidity and putrefaction. The stiffness is presumed to commence by the trunk and neck, next the thoracic membranes, and afterwards the abdomen. The muscles of the jaw, according to some authorities, are the first affected. Upwards of 27 per cent. of corpses become rigid within four hours, and 20 per cent. within six hours. The turning of the thumb against the palm of the hand, to be covered by the fingers, is not always a sign of death. There is a rigidity, a kind of catalepsy peculiar to battlefields; thus, a soldier has been found dead and stiff, one hand holding the bridle of his horse, the other his carbine, one foot in the stirrup and the other on the ground; another soldier whose head had been carried off by a shell, held firmly in his hand a goblet full of water that he was in the act of drinking. These phenonema can be reproduced by killing rabbits. A sardine expires instantaneously when removed from the water, but a conger will live for a long time; birds become stiff sooner than rabbits, and the latter more rapidly than dogs.

The influence of heat is an important point. Cold is declared to hasten rigidity; but an animal may be rigid, yet warm, as is illustrated in shooting game. Further, the cooling of a dead body proceeds slowly, often taking 24 hours to equal that of the surrounding air, because chemical changes take place a long time after life? In the case of deceases from cholera, madness and lockjaw, the body actually becomes warmer by two or three degrees pending a space of four hours. There is then no connection between cadaverous frigidity and rigidity. In cold weather a dog will remain eight days stiff after death, while in summer it will hardly become rigid. Instances can be adduced, where in typhus fever cadaverous rigidity set in, though the pulse beat for three minutes later. Hares, when run down, are found with their legs rigid, and life not departed. Butchers always allow stock that have been driven from a distance to repose a few days before being slaughtered, as if instantly killed rigidity would set in at once, but later, due to the chemical action taking place in the muscles, that stiffness would disappear and putrefaction prematurely arrive. This is the reason why in La Plata, when troops of cattle are destined to be killed for the European market, they are ever allowed several days to repose before entering the abattoir.

In the case of animals poisoned by strychnine, their arterial blood is ever found to be black, rich in carbonic acid and poor in oxygen. It is by provoking asphyxia that electricity destroys life; a frog, however, can be charged with electricity for hours and be in no way affected, simply because frogs cannot be suffocated. When a muscle works it becomes acid; perhaps this acidity contributes to cadaverous stiffness, although Claude Bernard has found the muscles of crawfish alkalin after death. Paralyzed muscles become sooner rigid after death than the others, but neither age, sex nor physique modify rigidity. On the whole we know nothing certain of the causes which determine rigidity. Winslow, it is true, doubted that any certain signs existed of death; however, the presence or absence of rigidity, even when all other evidence is wanting, will indicate when death is definite. No confusion must take place between tetanic and cadaverous rigidity; in the former, when the stethoscope is applied to the muscle, the ear recognizes a certain rattling; in the latter, absolute silence. In the case of catalepsy, the muscle when acted upon, by electricity will contract; in the dead muscle no excitability will ensue. For juridical purposes if a body be completely rigid, death may be set down as having taken place within two hours, and not extending beyond 40, or in winter 60. A corpse may be supple—a proof that rigidity has disappeared, and which may occur in periods of great heat or deaths caused by lightning. The death of a muscle then is characterized by rigidity, which till then retained its irritability or life; the disappearance of that rigidity is caused by the forming of acids dissolving the coagulated or stiffening matters of the muscles, thereby producing ammonia—the characteristic of incipient putrefaction. Cadaverous stiffness then belongs to the chemical order of phenomena. *American Inventor*.

THE "IDEAL" CYCLE.

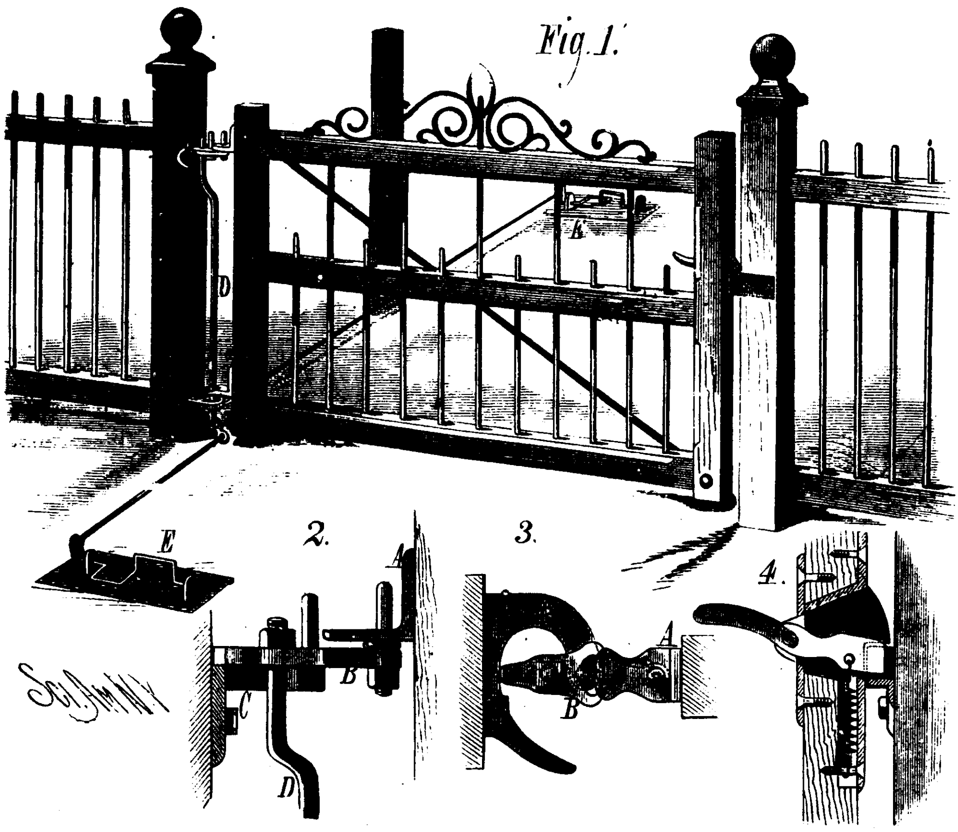
The "Ideal" cycle is a velocipede which runs practically on one wheel, although, as will be seen in the woodcut, it has three. The seat and guiding handle are so placed, that all the weight is carried by the large driving-wheel, which is turned to preserve the balance and to steer by means of an ordinary handle on the head of the fork. The small leading wheel turns more than the driving wheel, and the back wheel is carried in the ordinary way in the back fork. The machine will thus balance and steer as readily as an ordinary bicycle, whether the front or back wheel is on the ground. Both of the small wheels are not on the ground at the same time. In practice it will be understood that a bicycle rider while running would for the greater part of the time be resting his weight on the great wheel alone. For tricycle riders, side wheels are used, carried on extension arms which fold up, the wheels being kept down by light springs having a vertical play of about 2in. The inventor claims for his machine, which we may mention was privately tried last Monday at Lillie Bridge, and was on view at the Stanley Exhibition, the greatest speed attainable, ease in mounting hills, perfect safety from falling over handles, efficient brake-power, absence of jolting from the back-wheel, and capability of carrying luggage, while in the tricycle there is perfect safety with the greatest speed, and the closing of the arms brings the machine into the dimensions of a bicycle.

SORGHUM SUGAR.

A clause in the U. S. Agricultural Appropriation bill provides for an appropriation of $25,000 for the expense of machinery, apparatus, and labour, to continue experiments in the manufacture of sugar from sorghum and other sugar producing plants. This is an increase of $18,000 over the appropriation of last year. This increase is proposed in view of the successful experiments made by the department under the last appropriation. In speaking of this clause, Mr. Gillette, exhibiting samples of sugar produced from corn stocks and sorghum, says that according to these experiments, the cost of producing pure light sugar from sorghum is only three cents per pound, while the duty on the same quality of sugar if imported is 3.44 cents per pound; in other words, the northwest can produce pure sugar for less than the duties upon it to day. One thirty-fourth part of Iowa can produce as much sugar per annum as we now import. In other words, 1,039,082 acres out of 35,228,800 acres of alluvial lands in the state of Iowa can produce an amount of sugar equal to the importation into this country of that article at a cost less than the duties now paid upon sugar. The imports of sugar, syrups, etc., during the last fiscal year amounted to 1,727,121,816 pounds, and cost, including duties, $131,000,000. The experiments at the agricultural department show an average product per acre in sorghum sugar of 1,662 pounds, beside syrup, 800 pounds. This result was produced with experiments upon some very poor varieties of sorghum mixed in with better. This will be discarded in the future. Estimating sugar at 8 cents per pound, Iowa has for sugar per acre $13,206, besides 800 pounds of syrup. The sorghum crop makes a very slight drain upon the soil, much less than corn. The experiments in manufacture of sugar from cornstalks were not so satisfactory, because preparation was not made until too late, but 960 pounds of sugar, or at that rate per acre, have been obtained from cornstalks, after the corn was gathered. The commissioner reports two attempts to manufacture sugar from corn on a large scale by parties who preserve sweet corn,—one in Iowa and one in Illinois,—and both parties report that they are so much encouraged that they will go on and perfect their machinery. The farmers have been led to make an attempt to produce by the success of experiments by the agricultural department. There is no doubt about its practicability. It has been demonstrated and the profits shown. Mr. Gillette believes a much larger appropriation would would be made if this house began to comprehend the vast importance and practicability of producing sugars at home rather than by purchase abroad. Especially to the northwest is this discovery of her sugar producing capabilities a bonanza. The total consumption of sugar in this country last year was 41⅔ pounds per capita.

THE SHAFTESBURY PARK ESTATE.

A writer in the London *Metropolitan* gives a lively description of the town built on the Shaftesbury Estate in the Thames Valley, about twenty miles from London, in the vicinity of the South-western and other lines of railway. It is in the shape of a long triangle, covering about 40 acres belonging to the "Artisans, Laborers and General Dwelling Company," which has totally changed the aspect of what had been formerly waste ground. Four classes of houses (1,200 in number) have been built upon it, the first containing eight rooms, bringing 10 shillings per week, and the last, of five rooms, rented for 7*s*. 6*d*. Thirteen roads or streets intersect this colony, which has two schools and about 1,200 scholars. It has a Labor Loan Society, which realizes for the Shareholders about 20 per cent. on their money; two halls for public meetings; a Liberal Association; a Co-operative Store, and an Equity Permanent Building Society. It has no church, but within a few minutes walk beyond its limits are two—a Methodist Chapel and a Church of the Ascension, affording sufficient accomodation for the booksellers, clerks, coachmen, cooks, compositors, goldsmiths, gas-fitters, jewellers, musicians and a number of other workers—including 17 post-office men, 40 railroad men, 10 school teachers, and 46 widows—the only "dangerous class" in that population. Of course the place has its shops, or stores. The *accoucheur* of the locality is an old woman, after the good old fashion of our fore-mothers, and no other doctor is wanted. There is not a liquor saloon in the town, and no drainage is carried through the houses. The company will not allow them to be sublet or over-crowded with lodgers; and it could easily let double the number of its tenements. The writer of the sketch says it is a quiet, sedate, orderly little place; not very lively, but very clean and comfortable, and a paradise compared with the dwellings in the midst of great cities.



LONG'S SWINGING GATE.

NEW SWINGING GATE.

A simple and very effective automatic gate is represented in the annexed engraving. It presents none of the objectionable features found in the class of gates operated from overhead, and has but few parts, all of which are substantial and durable.

Fig. 1 shows the gate in perspective, the horizontal connecting rods being exposed to show the connection of the various parts. Fig. 2 is a side elevation of the upper gate hinge, and Fig. 3 is a plan view of the same. Fig. 4 shows the latch used in connection with the automatic gate. This gate can be made of wood or iron, or of both materials combined, and it may be of any style to correspond in general design with the fence to which it is applied.

The gate is supported at the top by a bracket, A, attached to the stile, and apertured to receive the pintle of the bar, B, the latter having a heart shaped opening for receiving the pintle of the bracket, C. The bar, B, is rigidly attached to the upper end of vertical rod, D, which is offset to bring its lower portion axially in line with the pintle of the bracket, C. The rod, D, is journaled near its lower end in a bracket secured to the bottom of the post, and carries a horizontal stud upon which rests the portion of the hinge attached to the lower part of the gate. This part of the hinge is forked to embrace the rod, D, and bent down ward forming inclined planes, and when the rod is turned the horizontal pin passes under one or the other of the inclines. This combination assists in opening or closing the gate, as will presently be described. The trip rods E, consist of iron or steel rods bent so as to form two cranks at right angles to each other, and one end of each rod has a lever arm connected by a horizontal rod with a T-lever secured to the bottom of the vertical rod, D. The horizontal connecting rods are made adjustable as to length to compensate for any accidental change in the position of the trip rod.

This gate is readily operated by a light carriage containing one person, and its action is quick and sure. The operation of the gate is as follows: The vehicle wheels operate through the trip rods, E, and the connecting rods to turn the vertical rod, D, in the usual manner of such gates. It is well understood by those familiar with such devices that the vehicle wheel forces the trip rod entirely down almost instantaneously, and retains it there only momentarily, and therefore that there is no active pressure on the gate except for a every limited space of time, in which it is impossible for the gate to swing entirely open or shut. The result has been that such gates would often remain partially open by reason of a reaction of the mechanism after the wheel had left the trip rod. By means of the bar, B, having the heart-shaped orifice and catch formed on the bracket, C, the difficulty is avoided. The mechanism is operated at once to its full extent by the wheel impact upon the trip rods, and the vertical rod, D, is consequently given the one fourth revolution necessary to turn the gate instantaneously and before the gate has acquired any perceptible swinging motion. This moves the bar, B, on its pivot, so that the pivot occupies one of the sides of the heart-shaped orifice instead of its apex, and the bar is thus made to move rearwardly a sufficient distance so that its point will engage with the catch formed on the bracket, C, and is thereby held in position until the gate swings into position, when it draws the bar forward and the pivot resumes its place in the apex of the heart-shaped opening.

The horizontal stud in the rod, D, turns around under the inclined portion of the lower hinge, so that its face, which rests upon the stud, has a tendency to slide upon the stud, and thus accelerate the motion of the gate, or enable the same to be operated when tilted to a less angle than would otherwise be necessary.

The gate latch is lifted out of its notch when the free end of the gate is raised by the tilting mechanism, so that it offers no impediment to the opening of the gate by a passing carriage.

A double gate may be made on this plan by simply adding another arm to the lever at the bottom of the rod, D, and connecting it by a rod to a corresponding arm of a similar mechanism on the second gate.

This gate was recently patented by Mr. Nathan H. Long, of Muncie, Indiana.