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SANITARY SCIENCE AND ARCHITECTS RESPONSIBILITIES IN RELATION THERETO.

WE are again led to write on this most important subject, on the solicitation of the *Sanitary Engineer* and other scientific journals, urging all those connected with scientific publications to use their best endeavours to bring about, in the public mind, a change from that apathy which has so long pervaded it in relation to Sanitation. Until within the last few years, superintendence over the plumbing of a house was never considered of such vital importance as it is to-day, but happily the public is awakening up to a knowledge of the poisonous nature of sewer gases, and few architects now, will entrust entirely to the plumber the carrying out of his plans and specification, without seeing that the work and the materials are of the best quality. It is a matter of such great importance to those who repose trust in the architect that the plumbing of a house should be done in the most perfect manner, that even when the services of the best plumbers are engaged, he has no right to relax his vigilence, when the lives of human beings are at stake. It may be a strong expression to use, but we hesitate not to assert that the architect, builder or plumber, who overlooks a defect in a work in connection with the drains or closets of a building, is, if death in a family results from such wilfulness or carelessness on his part, morally guilty of manslaughter. If every man whose sign announces to the public that he is a plumber by trade, was an educated sanitarian as well, then the supervision of his employees might be, to a great extent, entrusted to him, and even consultation with such a man would be productive of good; but when we have so few of that class, and so many carrying on the trade who are no more competent to perform the sanitary part of it, than an apothecary is to practice as an educated physician and surgeon, then no architect is justified in leaving the arrangement of the supply pipes, water pipes, water closets and ventilation, to an incompetent mechanic to construct.

In a matter of such vital importance to the community, the educated professional man, should direct every detail of his plans, and unless he exercises a thorough supervision of the execution of the work, he cannot be certain that safety will be insured at *everypoint*. The architect, in relation to his client, should be in his entire confidence, and if so, in him is entrusted the health, usefulness, and long life of the family that he shelters in a greater degree than the physician can ever have, and having this confidence reposed in him, he is answerable, to a great extent, for many of the ailments, weaknesses and early death which, in that family, may be the result of his remissness. But if, on the other hand, the client insists upon a contract being accepted, from an inferior workman, because it is the lowest, then it should be the duty of the architect to protest the work, if improperly performed, and there should be a public official, empowered with full authority, to have the work made perfect. One great difficulty architects have to contend against is, that few of their clients understand sanitary matters; if the work is cheap and outwardly appears good, they too frequently ignore the architect. It is unfortunately a common error among persons building, to consider that because a man is a mason, a carpenter, painter or plumber, that he should naturally know more of his own trade than an architect who never worked at any of these trades in his life-time; but in fact many of these men know little more than the mere use of the tools they employ.

Certain conditions of soil and surroundings may produce fever and ague, neuralgia and consumption, or exposure to the emanations of decomposing filth may expose one to the danger of typhoid fever, diptheria, cerebo-spinal-meningites and other diseases of a like class, but whole populations are frequently subjected to these dangers without an outbreak of any one of these disorders, because they are frequently counteracted by other conditions which tend to mitigate the evil; but there is hardly a house that is furnished with the usual plumbing appliances which is not more or less pervaded day and night—but more particularly at night, increasing in density towards morn—with gaseous emanations from drains. A very slight imperfection in a closet or a drain pipe, when covered up from view, becomes an insiduous enemy ever after, breathing out, through imperfect joints, the poisonous gases of the drains; therefore, the more urgent is it that plumber's work should receive the strictest surveillance of the architect, so that such imperfections should be discovered in time.

It is almost incomprehensible the apathy that is shown by the public to sanitary matters. We believe that not one man in a thousand ever cares or thinks about the matter, it is only when death enters the house and carries off one or more of its inmates, that he awakens from his apathy, and seeks to stay the cause when too late. In giving out a contract for plumber's work, seldom is the best work looked for, but the cheapest. For a short time the proprietor flatters himself that he has got as good work done, to all appearance, as his neighbour, and at a much cheaper rate—but soon taps and valves get out of order—pipes burst—ceilings and paper get ruined—and slip joints, hidden from view, give out the noxious vapours of the drain. The first of these evils affect him mentally far more than the rest, because his pocket suffers; broken taps and burst pipes must be mended; but as regards the foul gases, his nostrils soon become accustomed to them, and he ceases to detect them although those coming from the country find the very entrance hall tainted with gases from the drains; nor can you get his uneducated mind to comprehend that at times the most serious danger is often unattended by any marked warning to the senses.

We read a great deal about "sewer-gas," "malaria" and "zymotic diseases." Yet when we come to ask ourselves how much of all our theories is based on clearly ascertained fact, and on demonstrable conclusions, we are forced to acknowledge the really primitive condition of our study. We hear new theories advanced by some writers which are only practical under certain conditions, and would be most injurious under others. Some of them totally impracticable from the lack of mechanical application. Some put forth merely as advertisements, others totally devoid of common sense. We see health committees formed with one half of their members perfectly incompetent to deal with the question; committees in fact formed without a single practical sanitary engineer as a member, and what has been the result? they meet, each to discuss some pet scheme of his own. When will the public see the advisability of appointing two or three really practical men to deal vigorously with the sanitary question, unhampered by any influence whatever?

The finer the house and the more complete its modern sanitary appliances, the more certain it is to be more subject to the inroads of zymotic diseases, than a smaller house with equally perfect plumbing, and if sewer gas were universally poisonous, very few of our first class houses would be habitable at all; but fortunately, like physicians who are daily in the midst of contagious and infectious diseases, many persons live in these houses in tolerable health, under conditions which, while they do not always produce, yet almost invariably accompany attacks of zymotic diseases. This may appear paradoxical at first, and why it is so, it is difficult sometimes to account, but while we have yet to learn why bad air inside the house, or outside of it, sometimes produces zymotic disease, but does not always produce its possibly because some constitutions are less subject to take such diseases than others; this we know, that in its entire absence these diseases do not arise, unless brought to us in our food.

Of what service is a beautiful building laid out with all that taste, skill and constructive ability could do, if its sanitary arrangements are such as to render it a pest-house? We have seldom examined a building in which radical defects were not to be found from garret to cellar. There may be some excuse for a house built ten or twelve years ago when healthful drainage was in its infancy, but there can be no excuse in the present day when sanitation has become a science. Of course many houses are not built by architects, but by so called "practical builders," who do much of the bad house building in our cities and towns. These houses are generally built for speculative purposes, to be sold as quickly as possible, and are constructed of the cheapest materials; for such buildings the visit of an inspector of plumber's work and drains, is absolutely necessary before the work is closed in. Why should an architect or builder be held responsible for a leaky roof, or a defective wall, and not be held responsible for defective plumbing? What shields the architect, builder, or plumber, or on whomsoever the responsibility rests, but the utter indifference of the public to sanitary matters and almost universal disregard of simple aud well known methods of wholesome drainage. If a new roof leaked so badly as to destroy the walls, carpets and furniture of a dwelling, would not the proprietor at once take an action of damages against the builder? but for the imperfect condition of the house drainage and plumber's work which lay a whole household open to an ever threatening danger, in nine cases out of ten the proprietor is utterly indifferent, as far as the danger from foul gases is concerned. However we trust the day is approaching when education will achieve more perfect sanitary arrangements in every public building and private residence. A healthy change has already set in the United States, and the Sanitary Engineer and other able scientific papers are strongly advocating sanitary reform, and we hope the day is not far distant when the public will see the necessity of paying more attention to this all important subject than it has done hitherto. Many theories and suggestions for sanitary improvements have been brought before the public, many of them excellent if only carried out by practical and careful workmen, and many of them mere theoretical ideas; in fact the public is bewildered with essays and pamphlets that have been published for and against sanitary improvement, but no matter how efficient a plan is adopted, it will be of no avail if the details of that plan, are not carried out to the letter. The arrangement of plumbers' work, materials and construction, should never be entrusted to mechanics ignorant of those natural laws and conditions which are essential to good sanitary success.

There are, however, certain general principles for our guidance, which may thus be briefly sketched.

1. Effete organic matter cannot enter a house from an unventilated drain without endangering the inmates to zymotic diseases.

2. That a copious admixture of common air acts both

as an oxidizer and a diluter, and renders the unwholesome gases from drains less dangerous.

3. Water in a trap has only a limited effect in retarding passage of gases from one side of the trap to the other. Water has also the power of absorbing the foul air of the soil-pipe sewer which are given off by it with great freedom. Water has also the power of absorbing the germs of disease from air with which it is in contact, or of absorbing other infection the air may contain, and of retaining it for a considerable time.

4. Although the water-seal will not prevent the transmission of gases, it does form a barrier to *currents* of foul air, unless subjected to a pressure sufficient to overcome its hydrostatic force.

5. Air, in the condition which is the very worst in its effect on health, is very often far off from stinking gases.

6. That a proper system of ventilation to all house drains, and a supply of fresh air will carry off foul gas which would otherwise pass through the traps.

Most of waste matter is retained in the water-trap of the soil pipe or drain until sufficiently decomposed to generate gas, and as the decomposition takes place without the presence of sufficient air to carry it quickly to completion, then becomes established a condition most favorable to disease to which an ineffective water-seal is no barrier at all. In many cases also, the cistern of the water-closet absorbs the gases which ascend to it and add another hidden danger to the house.

Happily all these difficulties may be easily overcome by a proper superintendence over every detail of construction in connection with the plumbing, ventilation and other sanitary appliances of a house, particularly in the doing away with the use of water-traps when so situated that they can retain decomposing organic matter where it will do harm. We must secure not only a free circulation of air through all the soil pipes and house drains by the introduction of fresh air constantly flowing through them, but we must also secure baths and wash-basins from gases passing through them by the absolute closing of their waste through over flow pipes, except when absolutely in use; the pernicious system of discharging the waste water directiy into a foul closet-trap particularly when so many closet pipes have no ventilating shaft connected with them, has made the bath pipe the ventilator of the foul closet-trap, and has doubtless been the cause of more deaths from zymotic diseases than the public or physicians have any idea of; it is a most dangerous system, and cannot be too strongly condemned and exposed.

In closing these remarks we have to express our obligation to a valuable paper read by G. E. Waring, jr., at the annual convention of the American Institute of Architects, and to the Sanitary Engineer, for many suggestions herein appropriated for the benefit of all interested in sanitary reform.

DRAWING AS THE LANGUAGE OF MECHANICS.

Few persons, if any, who can hold pen or pencil are totally devoid of the power of drawing. The delineations may be rule as the "picture letters" of a red Indian, but they will convey, more or less perfectly, the meaning of the draughtsman.

Our purpose is to speak of those who can draw with tolerable accuracy so far as making the hand obey the eye, but who, for want of training, often fail utterly to make such drawings subserve their aims. We are not now speaking of drawing as an artistic accomplishment, but in the sense indicated by the title of this article. A mechanical drawing is the most efficient, often the only efficient, mode of describing the construction of a piece of mechanism. To do this effectually the drawing must follow certain fixed rules. Just as a collection of words strung together in defiance of syntax are but jargon, not language, so any attempt at a mechanical drawing which does not observe the conventional rules of the art is more or less meaningless. Now a man may make a drawing faultless in every line and curve, nay, even beautifully shaded and coloured, and yet convey scarcely any meaning, while another will, by a few lines, show all that a good workman needs to enable him to make the article intended to be described. In mechanical drawings correct sections are of all things the most important, and of all things the least often met with, except from the hands of trained experts. It may be said, "How can any but trained experts be expected to make correct mechanical drawings?" The answer is, that time back, when a man wanted any writing done he had to apply to a public scribe; but that man who now-a-days could not write an ordinary letter would be thought little of. How often do tradesmen, when writing to a merchant or manufacturer, need to describe their wants by something more than words? And in how many cases are they able to sketch correctly what they require? No knowledge that a man could possess would be found of greater utility than a power of making a good sketch of anything which words failed to fully describe.

We are not advocating that everyone should expect to become an adept in the more difficult branches of mechanical drawing; but we do consider that more attention should be paid in educating young men in the rudiments of this useful art. Everyone might be taught how to show a section of any ordinary article of simple construction. And, further, the exact meaning and value of sections to the artificer might be profitably pointed out. If, also, a general appreciation of the value and convenience of what are known as "section papers" was brought about, great benefit would ensue. The publication of a simple series of examples of mechanical drawing, having strictly in view what we have pointed out, would do much good. All the existing handbooks go too far, and are fit rather for the engineering pupil than the general man of business.

WATER GAS AS FUEL.

A propos of the interesting discussion that has been going on recently as to the economic possibilities held out by the new water gas, (hydrogen and carbonic oxid), the *Engineering and Mining Journal* expresses the conviction that the time is near at hand when this new gas will come into general use, replacing coal for domestic purposes, in cities at least, and in many metallurgical operations. That journal now maintains that recent experiments have fully proven that enriched water gas is a cheaper and much better illuminant than coal-gas, but for purposes of illumination both methods will probably be superseded by the electric light.

As for the industrial application of the new process, the Swedish iron masters have been the first to thoroughly investigate the subject. They recently invited Mr. George S. Dwight, a well-known American metallurgist, to erect experimental works for the manufacture of water-gas by the "Strong process." These works afforded opportunity for making the most careful tests of the relative value of water gas, Siemens gas, and illuminating coal-gas, and of the adaptability of water-gas in many of the operations of iron manufacture. These experiments have induced eminent Swedish metallurgists to predict a revolution in the Swedish iron industry, from the advantage which the new system brings them. Large permanent works are now being erected in Sweden, and preparations are making for the adoption of a method in Russia and Germany.

The tendency towards the adoption of the new system in this country for illuminating purposes is quite marked. Already the gas companies in the cities of Scranton, Toronto, Yonkers, Baltimore, Phœnixville, Harrisburg, and several other places have adopted the new process.

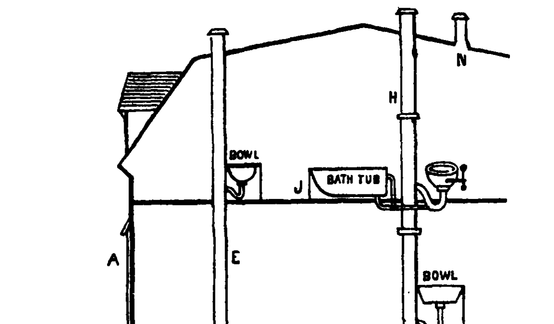
We may add to this that one of the lately established gas companies in New York city, has from the first adopted this method, and has for some time been in very successful operation. It is the Municipal Gas Company, foot of 44th street, North River, where the works for the manufacture of water gas are constructed in the utmost perfection. In Brooklyn another water gas company has been established, which is now laying down its pipes.

In the August number of the *Sanitary Engineer* we find the following remarks under the head of

"A MONTREAL PLUMBER'S VIEWS."

We find in a late issue of the *Montreal Witness* a long letter by J. W. Hughes, of that city, on drainage, together with the accompanying sketch, which we reproduce with the following extract referring to it. Mr. Hughes writes :

"My experience is that carrying the soil and branch waste pipes full size above the roofs of our houses with traps under the different apparatus is the best plan so far. Some of the self-sealing traps are excellent and reliable in their working, and prevent effectually the inlet of sewer gas, but any mechanical device is apt to get deranged and out of order, so it is not safe to place entire dependence on them. A trap on the private sewer just before it enters the house is a good thing in itself, but the great objection to their general adoption is that after a few years they become filled and stopped, and according to the present plan of running the private sewers under the floors where they are not accessible, are liable to become deranged without the fact being known. The choking of the trap is a very serious matter, as the sewage might be filtering out through a defective joint, under the floors, for months before it was known that anything was wrong. The practice of running long lines of sewer pipes under the basement floor is bad, and in any rules or laws laid down in the matter by our sanitary department an effort should be made to correct this evil.



"The accompanying sketch shows one plan of trapping and ventilation that is about as effective as it is possible to get such things; but trapping alone will not do. I know of one case in point, where one of our citizens, a builder, went on trapping in his efforts to keep the sewer gas out of his house, until he had no less than four traps in the sewer between his house and the main sewer besides the traps under the different plumbing apparatus, and in spite of all this his house was at times filled with sewer gas, but on his putting in a ventilator the trouble ceased."

If Mr. Hughes will read the files of this journal, or any of the sanitary literature of the past two years, he will see more effective plans than the above, which does not show the best practice.

Branching a waste from a bath into dip of pan water closet trap is quite common, but nevertheless reprehensible. This trap generally has more or less filth in it, and whenever the closet is used, a puff of foul air is driven through the bath waste into the apartments. The bath should be trapped separately and drained directly into the soil pipe. The bowl and sink traps arranged as shown will be siphoned out when a pail of water is thrown into the water closet tray.

Mr. Hughes' objection to using a trap on the main drain to disconnect from sewer is based on an assumption of badly constructed work. *No drain should be under cellar bottom*, but should run along cellar wall with a good descent. There would then be little risk of stoppage at main trap. We consider the plan shown on page 36 of January issue of this journal as more safe and effectual than the above.

We had much pleasure in favorably noticing, in a previous issue, a pamphlet published by Mr. Hughes, because it contained many suggestions which for years past have received the approval of sanitary engineers, and if any city in Canada requires light more than another on sanitary matters, certainly it is Montreal—particularly as many of those suggestions have been totally ignored by self-styled plumbers with which this city abounds—but when Mr. Hughes publicly approved, by illustration, in a city paper which has a wide circulation, the pernicious practice of inserting the waste pipe of a bath into a water-closet trap, the public health is in danger. In a recent issue of this magazine we protested against this objectionable method of carrying off the waste water of the bath into a trap that is *always foul*, in fact, unhappily, we have experienced its bad effect upon the health of a family. We again most strongly condemn this most reprehensible habit of plumbing, and the only excuse foreman of plumbers could give for it when questioned on the subject was, "that it was the custom and every plumber did it." We are now pleased to find that our ideas are endorsed by so able an authority as the *Sanitary Engineer*.—Ed. S. C.

A WONDERFUL CLOCK.

We present our readers an engraving of a curious piece of mechanism, which is said to eclipse all former achievements in this direction, without excepting even the Strasbourg, which for so many years has been regarded as the great clock of the world.

Mr. Meier, of Detroit, Mich., is the maker, and his clock is the result of nearly ten years of patient labor and the expenditure of $7,000 in cash. The clock is eighteen feet in height, eight feet wide, by five feet deep, and weighs 4,000 lbs. It is of handsome proportions ; the framework is entirely of black walnut, elegantly carved. Above the main body of the clock is a marble dome, upon which Washington sits in his chair of state, protected by a canopy, which is surmounted by a gilded statue of Columbia ; on either side of Washington is a colored servant in livery guarding the doors, which open between the pillars that support the canopy ; on the four corners of the main body of the clock are black walnut niches containing human figures, emblematic of the march of life ; the two lower ones are supported by two female figures with flaming torches ; one of them contains the figure of an infant, the second the figure of a youth, the third of a man in middle life, the fourth of an aged graybeard, and still another, directly over the centre, contains a grinning skeleton representing Father Time. All of these figures have bells and hammers in their hands. The infant's bell is small and sweet toned ; the youth's bell larger and harsher ; the bell of manhood strong and resonant ; that of old age diminishing in strength, and the bell of the skeleton deep and mournful.

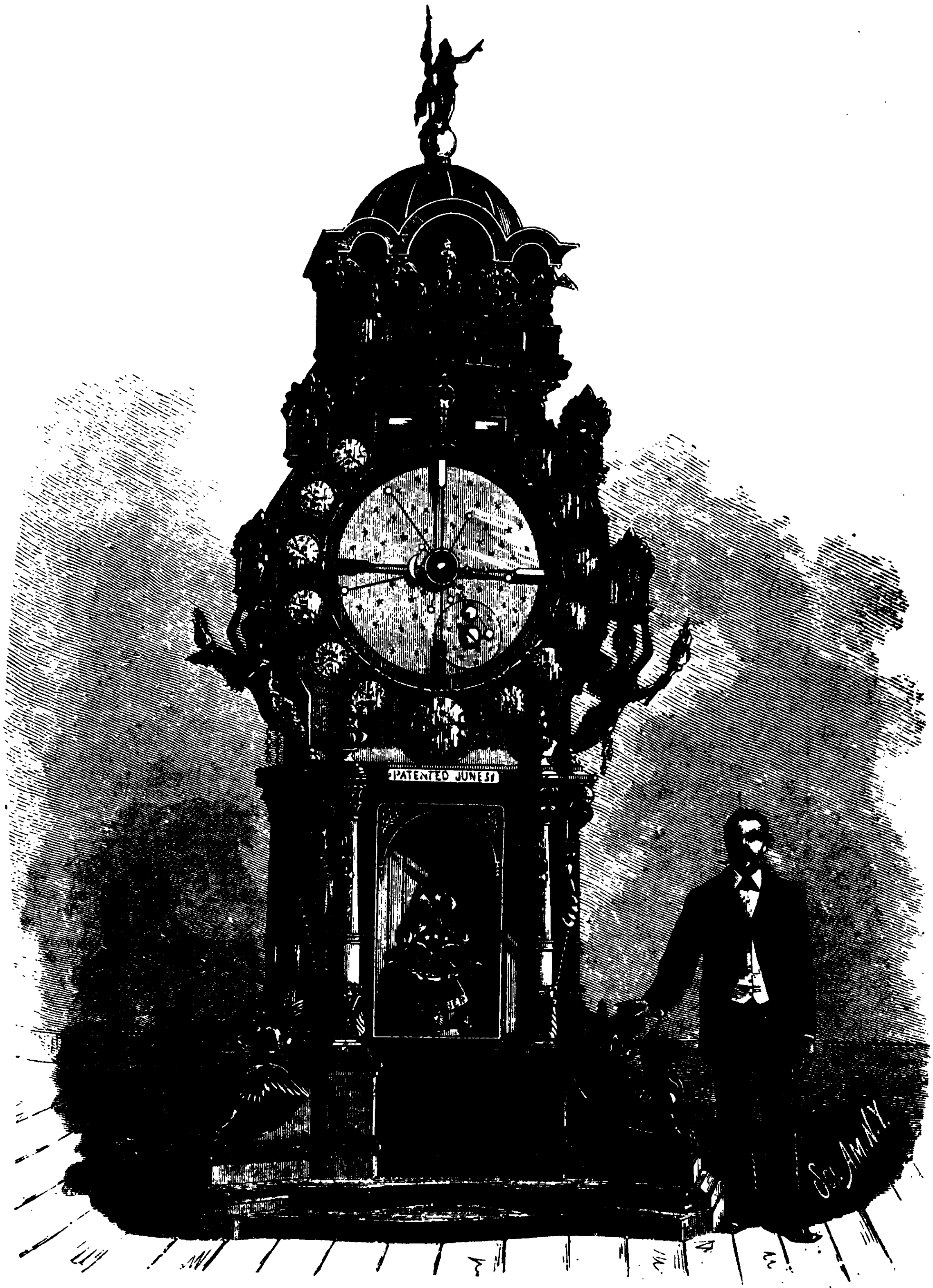
The astronomical and mathematical calculation, if kept up, would show the correct movement of the planets for 200 years, leap years included.

The clock shows the time at Detroit in hours, minutes, and seconds ; the difference in time at New York, Washington, San Francisco, Melbourne, Pekin, Cairo, Constantinople, St. Petersburg, Vienna, London, Berlin, and Paris. The day of the week, calendar day of the month, month of the year, and seasons of the year. The signs of the zodiac, the revolutions of the earth on its own axis and also around the sun. The revolutions of the moon around the earth, and with it around the sun ; also the moon's changes from the quarter to the half, three-quarters and full. It also shows the correct movement of the planets around the sun.

There is a movement in this clock which cannot regularly be repeated more than once in eighty-four years.

The inventor has a crank attached to the clock, by means of which he can hasten the working of the machinery in order to show its movements to the public ; by turning continuously twelve hours a day for sixteen days and eight hours, a perfect revolution of the planet Uranus around the sun would be made.

At the end of every quarter hour the infant in his carved niche strikes with a tiny hammer upon the bell which he holds in his hand. At the end of each half hour the youth strikes, at



MEIER'S NATIONAL AND ASTRONOMICAL CLOCK.

the end of three-quarters of an hour the man, and at the end of each hour the graybeard. Death then follows with a measured stroke to tell the hour, and at the same moment a carved cupid projects from either side, with wings to indicate that time flies. At the same time a large music box, manufactured at Geneva expressly for this clock, begins to play, and a surprising scene is enacted upon the platform beneath the canopy: Washington slowly rises from the chair to his feet, extending his right hand, presenting the Declaration of Independence. The door on the left is opened by the servant, admitting all the Presidents from Washington's time, including President Hayes. Each President is dressed in the costume of his time. The likenesses are very good. Passing in file before Washington, they face, and raise their hands as they approach him, and, walking naturally across the platform, disappear through the opposite door, which is promptly closed behind them by the second servant. Washington retires into his chair, and all is quiet save the measured tick of the huge pendulum and the ringing of the quarter hours, until another hour has passed.—*Scientific American.*

THE FLOODING OF THE DESERT OF SAHARAH.

We have on former occasions discussed the plan of flooding the Desert of Saharah, of which a large portion is lower than the surface of the ocean. The execution of this plan would open the African continent to European commerce, by admitting the waters of the Atlantic through an artificial channel into a vast depressed area of arid desert, which has for ages been the impossible barrier that has isolated the dwellers of the rich and fertile countries lying to the south from contact with civilization, and the subject has just received fresh impulse by its presentation in popular form in the pages of *Scribner's Monthly.*

The project of Mr. Mackenzie is older than that of M. Roudaire for creating an African inland sea, though by no means so well known as the latter; and if the engineering features of the scheme have been correctly stated and observed, the Mackenzie project could be made to accomplish vastly more important results, at a cost not greater, and probably considerably less, than that of Roudaire. What is known as the Basin of El Joof is a great depression, 200 feet below the ocean level, in the western portion of the Desert of Saharah, covering an area of 60,000 square miles, and was at one time an arm of the Atlantic ocean, *the channel of which was placed not far from Cape Juby, opposite* the Canary Islands. The mouth of this ancient channel, which is still discernible, is 2½ miles wide, and is blocked by a sand bar about 300 yards across, and elevated from 10 to 13 feet above sea level. Assuming these statements of the topography of the region to be accurate, as Mr. Mackenzie, after several explorations, affirms unequivocally, all that would be required to convert the arid basin of El Joof into a vast inland sea of 60,000 square miles in area, would be to pierce this ancient channel with a canal, 300 yards in length and a little over 30 feet deep. A small ditch only would be required for this purpose, Mr. Mackenzie claims, since, when communication was once established, the waters of the ocean would pour into the depressed basin and scour out the channel for itself.

The feasibility of this project on the score of engineering difficulties, says the *Engineering and Mining Journal*, does not appear ever to have been called into serious question; and of the two projects—Mackenzie's and that of Roudaire—for flooding the Algerian *chottes*, the former is not only vastly the greater in the possible geographical and climatic changes it would bring about, but in its commercial aspects also, since it would bring Timbuctoo, the great negro metropolis, within 2,000 miles of England, making it practically a seaport, and the whole of North Central Africa would be brought within easy reach of the harbors of Europe. Mr. Mackenzie has championed this scheme zealously and indefatigably for a number of years, and though he has suffered many checks and disappointments, his faith in its ultimate success appears to be unshaken.

We cannot forego repeating our former objection, that in that arid and excessively dry climate, where the evaporation must always largely exceed the rainfall, the evaporation of the water in the large inland sea would lower its level, and as there are no fresh rivers to supply the deficiency, it is to be supplied exclusively through the artificial channel with sea water, and this being salt, while the evaporation, carrying off only fresh water, the water must become more and more salt, and finally saturated. But it will not stop here the salt will crystallize, and more salt water will enter, so that in the course of years the whole basin must necessarily become a gigantic salt deposit, as bad, and perhaps worse, than the present sand desert. In fact, it cannot well be otherwise, as the execution of the plan would be equivalent to the formation of huge salt works, operated by solar heat.

Our Salt Lake and the Dead Sea are two nearly saturated inland lakes, which have a constant supply of fresh water; it is the same with the ocean. But this inland sea of Saharah would have a salt water supply, and the results mentioned we believe would be unavoidable.

It is an interesting geological question, whether some of the large salt deposits, such as are found in England, Poland, and other countries, have not been formed in a similar way, by the existence of basins which were continually supplied with salt water, and heated by the solar radiation, or perhaps by the interior high temperature of the earth, or by both agencies, producing an evaporation more rapid than the rain-fall, and ending, of course, in a total elimination of the water, and the formation of a bed of rock salt.—*Manufacturer and Builder.*

A NEW THEORY OF SEA SICKNESS

The singular benefit derived by the use of amyl nitrite in sea sickness has suggested a new theory of the cause of that distressing malady, namely, that it is due to cerebral anæmia. The proposer. Henry Naylor, L.R.C.P., L.R.C.S., Edinburgh, says:

"The rapid swinging of the vessel and the body with it irritates the eyes and vision, and this by reflex action produces a spasm of the cerebral capillaries; this explains the feeling of faintness and giddiness that comes on suddenly, just as the vessel gives a big swing. The sudden emptying of the cerebral vessels causes the stomach to sympathize, resulting in efforts of vomiting, whether the stomach be full or empty. These symptoms are most distressing when the subject is in a standing or sitting position, with the eyes open. If he lies down the change of position relieves the anæmia. the faintness and giddiness pass off, and the sickness ceases. But occasionally even the recumbent position does not give relief if the eyes are kept open. When they are shut the symptoms are not felt in the least. I have known this to be the case with several ladies who were never comfortable while at sea unless they were lying down with their eyes closed. They were able to eat meals and retain them if they lay down and closed their eyes immediately afterwards. In fact, I have been obliged to keep some constantly in bed to prevent their dying of starvation. A fact that helps to show the feasibility of the aæmic theory is that brandy and other stimulants give considerable relief for a time, which would not be the case if cerebral congestion had to do with sea sickness. The explanation of how sea sickness continues so persistently in some, is that the sickness weakens the heart's action, and this keeps up the cerebral aæmia, and that in turn again produces the sickness; so that prolonged sea sickness is due to a circuit of causes, the one producing the other—the visional irritation, cerebral anæmia, sickness, weak heart's action."

Mr. Naylor adds that amyl nitrite usually does good in sea sickness, if used at once, because, being an anti-spasmodic, it relieves the spasm of the cerebral vessels, and thus the brain is refilled with blood. But if it fails, then the persistent sickness, by its effect on the contractions of the heart, prevents the brain from getting a sufficient supply of blood, and thus the brain becomes anæmic, not from a spasm of the capillaries, but from an insufficient power of the heart. It is at this stage that alcoholic stimulants in small doses, frequently repeated, give great relief.

THE ROYAL COMMISSION ON AGRICULTURE.

At length the names of the noblemen and gentlemen who form the Royal Commission on Agriculture are communicated to the public. It is, apparently, the intention to make the inquiry a thorough one, and to extend it laterally as well as directly into all that concerns the occupation and cultivation of land. Tenure of land, rents and profits, the suitability of soils in relation to crops, the mode of tillage, live stock and produce, machinery and manures, transportation and markets—all these will be within the scope of the Commission, and as in all probability every part of the country will be visited, there will be opportunity to collect an exact knowledge of our agricultural position, very valuable for our future guidance, and not inconsequential as a factor in dealing with any alteration of the land laws. But the farmer and the landlord are also to have the benefit of some reliable knowledge of the exact conditions of foreign competition. As this is one of the proximate causes of the inquiry, considerable interest will centre in the result. It is the intention of the

Commission to send Sub-Commissioners to the United States and Canada, Belgium, Holland, France, Russia, Australia, and other lands from which our grain markets are stored in overflowing abundance. This will obviously lead to an investigation of the methods of farming in those countries, and the facilities of transportation, and from the facts thus accumulated on the spot some crumbs of advice may be deduced for the benefit of our own agriculturists. As Mr. Gladstone lately pointed out, they pay much less attention in America to beauty than to utility and rapidity of result, and he might have added that this is true in general of all new countries. But in the matter of food there is something for our land-owners and farmers to ponder over in the fact that grain can be transported 4,000 miles from Chicago to Liverpool—one thousand of these being by rail—at the rate of 35 cents per 100 lbs. Yet all is dearer in a new country than in an old, except land and food.

POISONING BY STRYCHINE.

A recent case of poisoning by strychnine in San Francisco where the patient was well and rational for a long time after the reception of the deadly drug, and conversed pleasantly with his physician, recalls a remedy which is said to be so well known and successful that where life remains the effect of the strychine may be entirely obliterated and its deadly action destroyed. We allude to chloroform. The effect of strychnine on the system is to produce a contraction of the great nerve centers, or ganglia, and bring about paralysis. Aiming directly for these points, it reaches the brain and destroys its vitality by its enormous contractile power upon the system. In case of poisoning by so doing, the contraction is made manifest by the "twitching" of the muscles, the mouth is drawn in diffirent shapes, and the patient then has generally been said to be so effectually under the influence of the drug that he cannot be saved. It is agreed, however, that there need never be a fatal case of poisoning by this death-producing element, and that as long as any signs af life remain a cure can be effected.

Chloroform is administered in sufficient quantities to keep the patient under its influence. This ænesthetic attacks the nerve centers with the same vim as strychnine, but produces a contrary effect, in that it causes a relaxation, and fights the strychnine on its own ground. By allowing the patient to recover from the effects of the chloroform, the "twitchings" of the muscles will be resumed if the strychnine has not been effectually counteracted. In this case, chloroform must be applied again without delay, and kept up as long as the nervous or spasmodic contractions appear. The remarkable effect of the chloroform is apparent as soon as administered. The contractions and twitchings of the month, etc., immediately cease, and do not return as long as the patient is under its influence.

THE DECLINE IN PRICES.

As indicative of the remarkable general falling off in prices during the past decade, the following incident may be cited: A prominent drug and paint firm of this city, says the Boston *Commercial Bulletin*, were recently called upon to duplicate an order for white lead and linseed oil, filled in 1868, and upon examination of their old accounts, found that the charge for the former article was $14.25 per hundred, and for the latter $1.20 per gallon. To-day they are selling at $9.50 and 65 cents respectively. At the time above referred to, alcohol sold at $3 per gallon; to-day it is quoted at $2.02. Spirits of turpentine brought 75 cents per gallon; to-day it sells at 27½ cents. Naptha was held at 43 cents; to-day it is 7 cents. Other articles sold as follows: Salt soda at $3, oxalic acid at 35 cents, camphor at $1.10, brimstone at 4 cents, sulphur at 5¼ cents, and Venetian red at 3 cents.

SOUNDING NIAGARA RIVER.

The United States Corps of Engineers has recently had the Niagara river sounded, a task never before accomplished, owing to the bungling and unscientific means employed by those who attempted it. Bars of railroad iron, pails of stones, and all unreasonable bulky and awkward instruments had been attached to long lines, and cast off the railway bridge and elsewhere, but positively refused to sink. The very bulk of the instruments was sufficient, no matter what their weight, to give the powerful under-current a way to buoy them up upon the surface, or near it. By means of a small lead weighing twelve pounds, however, and a slender cord, the depths from the falls to the lower bridge were easily obtained. One of the sounding party says that the approach to the falls in a small boat was made with great difficulty. Great jets of water were thrown out from the falls far into the stream, and the roar was so terrible that no other sound could be heard. The leadsman cast the line, which passed rapidly down and told off 83 feet. This was quite near the shore. Passing out of the friendly eddy which had aided them in approaching the falls, they shot rapidly down stream. The next cast of the lead told off 100 feet, deepening to 192 feet at the inclined railway. The average depth to the Swift Drift, where the river suddenly becomes narrow, with a velocity too great to be measured, was 153 feet. Just under the lower bridge the whirlpool rapids set in, and so violently are the waters moved that they rise like ocean waves to the height of twenty feet. Here the depth was computed to be 210 feet.

THE END OF THE WORLD.—Camille Flammarion, the well-known French scientist, thus beautifully expresses himself in *La Correspondance Scientifique*, regarding the ultimate fate of our globe:

"We all of us admire to-day the beauties of terrestrial nature, the verdant hills, the perfumed meadows, the purling brooks, the mysterious shades, the groves animate with singing birds, the mountains crowned with glaciers, the immensity of the seas, the warm settings of the sun in clouds edged with scarlet and gold, and the sublime glimmering of the sun on the mountain tops when the first rays of the morning shiver in the gray mists of the plain. We admire the human works which to-day crown those of nature; the bold viaducts thrown from one mountain to another, and over which speeds steam; the ships, marvelous structures traversing the ocean; the brilliant and animated cities; the palaces and temples; the libraries, museums of the mind; the arts of sculpture and painting, which idealize the real; the musical inspirations which make us forget the vulgarity of things; the works of the intellectual genius who explores the mysteries of the world and transports us into infinity; and we live in happiness in the midst of this life so radiant, making ourselves an integral part of it. But all this beauty, all these flowers and these fruits will pass away. The earth was born; she will die. She will die either of old age, when her vital elements shall have been used up, or through the extinction of the sun, to whose rays her life is suspended. She might also die by accident, through collision with some celestial body meeting her on her route; but this end of the world is the most improbable of all.

"She may, we repeat, die a natural death through the slow absorption of her vital elements. In fact, it is probable that the air and water are diminishing. The ocean, like the atmosphere, appears to have been formerly much more considerable than it is in our day. The terrestrial crust is penetrated by waters which combine chemically with the rocks. It is almost certain that the temperature of the interior of the globe reaches that of boiling water at a depth of about six miles, and prevents the water from descending any lower; but the absorption will continue with the cooling of the globe. The oxygen, nitrogen, and carbonic acid which compose our atmosphere, also appear to undergo absorption, but slower. The thinker may foresee, through the mist of ages to come, the epoch, yet afar off, in which the earth, deprived of the atmospheric aqueous vapor which protects her from the glacial cold of space by preserving the solar rays around her, will become chilled in the sleep of death. As Henri Vivarez says: 'From the summit of the mountains a winding sheet of snow will descend upon the high plateaus and the valleys, driving before it life and civilization, and masking for ever the cities and nations that it meets on its passage.' Life and human activity will press insensibly toward the intertropical zone. St. Petersburg, Berlin, London, Paris, Vienna, Constantinople, and Rome will fall asleep in succession under their eternal shroud. During very many ages equatorial humanity will in vain undertake arctic expeditions to find again under the ice the place of Paris, Lyons, Bordeaux, and Marseilles. The sea coasts will have changed, and the geographical map of the earth will have been transformed. No one will live and breathe any more except in the equatorial zone up to the day when the last family, nearly dead with cold and hunger, will sit on the shore of the last sea, in the rays of the sun which will thereafter shine here below on an ambulent tomb revolving aimlessly around a useless light and a barren heat."

USEFUL AND SCIENTIFIC NOTES.

HOW TO SUN A BATH.—The following method is far better than the old way of sunning in a clear glass bottle as it saves much time. Having neutralized the bath with carbonate of soda, or otherwise, place it in a large, flat, white porcelain dish. After a few hours a black scum will appear on the surfase; this is removed by means of strips of blotting-paper, and the light is once more free to act on the solution in an unobstructed manner. The bath should be skimmed every few hours unt l it is found to remain permanently clear, or nearly so, when it is ready to be filtered and to have its strength diluted by the addition of water, for, as will readily be perceived, an exposure in a flat dish, such as that to which the bath has been subjected, necessarily causes a considerable quantity of the water to evaporate, carrying with it much of the ether and alcohol. After being diluted to the proper degree of strength the bath is filtered, and acidified, if necessary, when it will be found to work as well as ever it did, free from streaks, stains and pinholes.—*Photographic News.*

—The extraordinay plague of moths which has visited Central Europe shows littie sign of abatement. From Saxony and the provinces of Eastern Germany the Plusia gamma has made its way westward, and has now been noticed in large numbers in Westphalia and Rhineland. It has made its appearance in gardens in the suburbs of Cologue and in Mulheim and other places on the Rhine. In the neighbourhood of Iserlohn. Westphalia, moths have abounded since the middle of August, especially in the clover-fields, and have very largely diminished the quantity of honey the bees usualty bring home from the heather, which is in flower and very plentiful in the vicinity. In Antwerp, too, and, indeed, it is believed throughout Belgium, the gamma has shown itself in large numbers since the end of May. In the Belgian port just mentioned it is so numerous that, according to a correspondent of a Cologne paper, it is a great nuisance to people sitting in the public gardens or open air, especially after the gas is lit. There it has never before been known to show itself in such numbers as during the present summer.

CAST-STEEL.—A London metallurgist claims to have produced a high quality of cast-steel at a considerably reduced cost by recarbonizing fused metal. The Siemens of Bessemer process furnishes the required kind of metal, which, after being forged, rolled, and brought to the desired size and form, is submitted to a re-carbonizing process in closed vessels of any adequate heat-resisting material, and the carbonizing substances may be such as are employed in the usual cementing process. Wrought-iron vessels about five-eighths of an inch thick, and of such a form as will best suit the purpose for which the steel is intended, are preferred. The covers project beyond the sides of the box, in order to admit of their being firmly fixed with keys or wedges, and the interstices are then tightly filled with clay. An ordinary gas or reverberatory furnace may answer for the process.

BELT LACING, ETC.—Among the recent practical inventions is one patented by Mr. A. C. Krueger—a process for tanning rawhides for belting, lacing, etc. Mr. Krueger's process for preparing the hides for unhairing is by steam. After being unhaired, thoroughly flesh and passed through the fresh water soak, they are removed to a bath containing a chemical solution which readily unites with the component parts of the hides. In due times the hides are taken out of the bath, thoroughly dried, and then placed in the stuffing wheel, where they are made to receive a due proportion of grease, and become very mellow. They are then placed on the stretcher and thoroughly stretched, and from there to the grease coursing table for the last finishing touch. Goods made from this material are said to give great satisfaction everywhere.

A PERFECT MARKING INK.—Mr. Albert Smith, of Essex-road, has sent us a specimen of markigg ink which can be used with any pen, does not require heating, and will not injure the most delicate fabric. The new ink writes with a green tinge, and turns an intense black on the first washing. Mr. Smith infoms us that the ink cannot be removed by any known chemical means—chloride of lime, cyanide of potassium. caustic soda, and potash having no effect upon it. We can testify that it flows easily from a steel pen, and turns an intense black when submitted to the washer-woman's soapsuds, but we have not yet tested its durability. We have, however, no reason to doubt Mr. Smith's statement.

—The increasing use of arsenic in the manufacture of paper collars and cuffs will assuredly bring those articles into disrepute. The medical officers of Coblenz recently analysed a number of these articles, which are largely used by the middle and lower classes in Germany, and the result of the investigation shows that a strong admixture of arsenic is present in the paper collars, &c., as now made at Leipsic. The doctors declare that under cerain conditions the use of such articles is highly dangerous to the wearers.

NUT-SAWING MACHINE.—A new machine for sawing iron nuts has been invented in Springfield, Massachusetts. The saws—two are used—are of soft steel and make 3,000 revolutions a minute, the periphery travelling nearly four miles a minute. The machine will slot a ton of nuts averaging 4,000 in number, in a day.

TO PREVENT THE CRACKING OF GLUE.—Glue frequently cracks because of the dryness of the air in rooms warmed by stoves. An Austrian paper recommends the addition of a little chloride of calcium to glue to prevent this.

TUBULAR PILES.

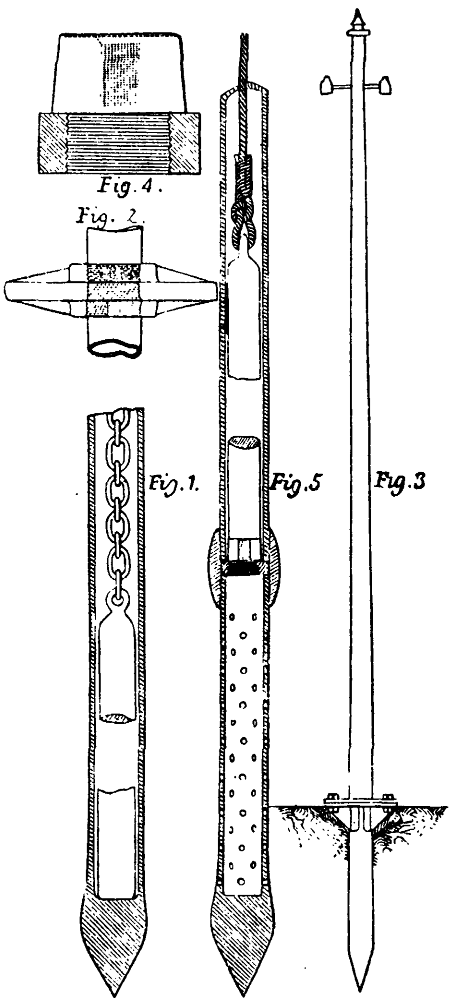
A novel and ingenious system of constructing and driving piles has of late been introduced into practice by Messrs. Le Grand & Sutcliff, of London, artesian well engineers. It involves a considerable departure from ordinary practice, inasmuch as the piles are driven internally and at the bottom, instead of externally and at the top. The invention originated with the senior member of the firm, whilst the credit of some of the applications of the principle is due to the junior member. The piles, says *Engineering*, are tubular, and can be made of either wrought or cast iron, and the thickness of the metal can be proportioned to suit the varying circumstances of construction. The lower end of the pile, as shown in Figs. 1 and 6 of our engravings, is made solid and pointed, and is generally of wrought iron and steel tipped. The piles are made in sections, which are screwed together by strong steel sockets or joint covers, which are barrel shaped on the outside in order to diminish friction when being driven.

The method of driving these piles is as simple as it is novel. Instead of the blows being delivered on the head of the pile, the driving force is expended just where it is wanted, namely, at the point. This result is attained by using an elongated cylindrical driving weight, which travels easily inside the tube. The weight is raised by means of rope or rods, and is allowed to fall on the flat head of the solid point, the pile thus forming its own guide for the driving weight. The effect of each blow is to drag rather than to drive the pile down. It will be seen that the point is swelled, and is of sufficient diameter to effect a clearance for the joint covers which have to follow it down. The form of the joint cover is seen in Fig. 5. A considerable experience in driving tubes into the ground has shown the inventors that, thus made, the point does all the real work, and that a very slight strain is brought on the joints above. An increase of stability is given to these piles in cases where the depth to which they have to be driven is previously known by the use of a flange which is proportioned to suit the nature of the soil into which the pile has to be driven. This flange is shown at Fig. 2, and is so placed that at the final driving it just embeds itself on the river or sea bottom. The tubes forming the pile are screwed into the flange, which in this case takes the place of the usual steel socket, and unites the two lengths of the pile together. It thus in no way diminishes the strength of the pile as it would if screwed on to the tube below an ordinary socket.

With this system of piles it is not necessary to test the ground previously to driving them, inasmuch as lengths can always be added until a firm foundation is reached, failing which the pile can be withdrawn. In prospecting for a site small tubes can very rapidly be driven to ascertain the nature of the soil. Another advantage the system possesses is that piles can be driven in deep water with great facility, and they can be of extreme length. Their strength, moreover, can be increased by filling them in with concrete after they have been driven, if desired. When meeting with obstructions, screw piles have a tendency to become diverted from their position, and are liable to loosen the ground around them. The tubular pile, on the other hand, is not open to this objection, as it will fracture and pass through minor obstructions until it reaches a solid foundation, and being forcibly driven into the ground, the earth firmly surrounds it. These piles are applicable to all classes of engineering work, and they are now being tried by the Royal Engineer Committee, under instructions from the Under Secretary of State for War.

The principle of internal driving has been applied by Messrs. Le Grand & Sutcliff to the sinking of tube wells, driving the foundations for telegraph posts (as shown in Figs. 3, 7, and 8), flagstaffs, and the like. When used in connection with the wells

TUBULAR PILES.



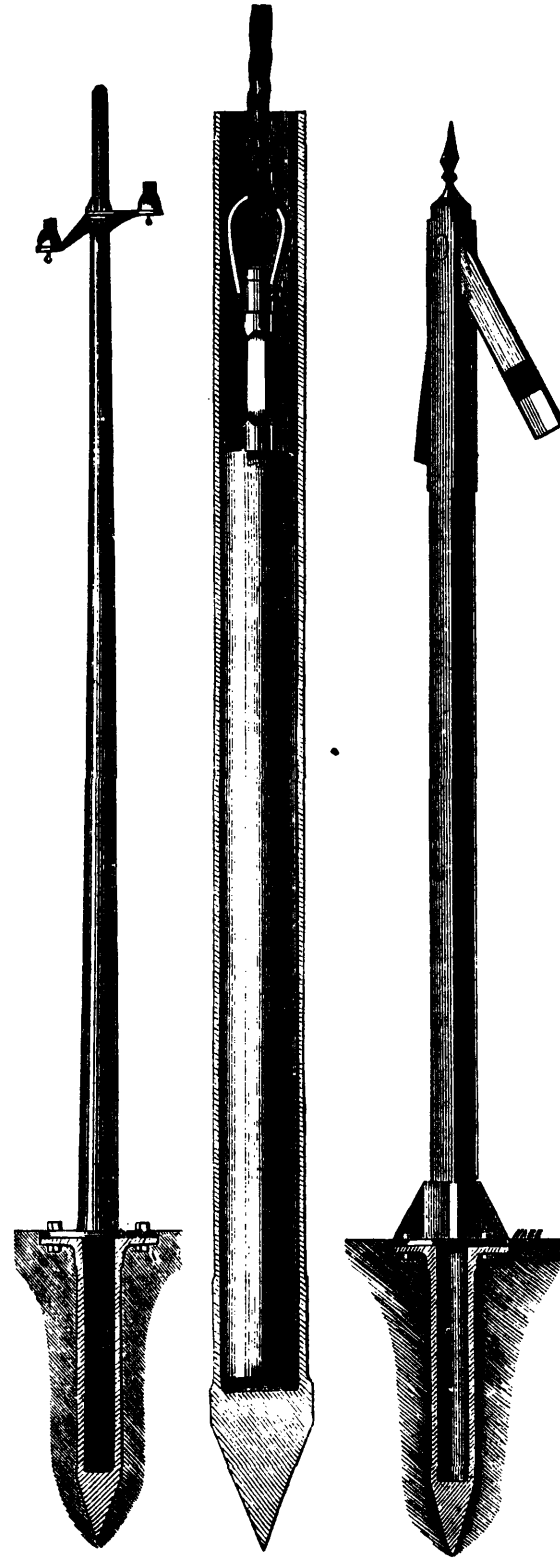


Fig. 7. Fig. 6. Fig. 8.

a slightly modified arrangement has to be employed in consequence of the necessity which then arises for keeping out of the tube the water, which in the ordinary way flows in through the perforations. In this case the first socket above the perforated end is made sufficiently long to admit of a stout iron ring or washer being placed in the center of it in such a way that the two lengths of tube when screwed tightly together butt against it, one on the under and one on the upper surface. The interior of this ring is of sufficient size to allow the water to pass freely through it, but it has a screw thread cut throughout its whole length. During the operation of driving, the opening in this ring is closed by a steel plug, which is screwed down into it until the upper part butts on the ring, as seen at Fig. 4, where the ring is shown in section. The upper part of the plug forms an anvil, upon which the driving weight falls, the blow being thus delivered a short distance above the point of the tube instead of directly upon it, as in the case of the piles. In the center of a plug a hole is bored and tapped, into which a rod can be screwed for removing the plug when the driving has been completed. The male thread on the exterior of the plug is cut left handed, so that ordinary boring rods can bo used in removing the plug without incurring the risk of unscrewing them.

The general arrangement of this system of driving tube wells is shown at Fig. 5. It will be seen that the water cannot rise in the tube above the underside of the steel plug, and in practice no difficulty has been experienced in any other respect. Altogether the system is one which commends itself for its simplicity, and for the facility it offers for carrying out that class of works to which the invention addresses itself.

Painter's Work.

PRINCIPLES OF GLASS STAINING.

This beautiful branch of art is quite too much neglected. The gorgeous display that may be made, and that has been so successfully done by some artists, is sufficient to excite the desire to bring it into more general use. One can conceive of no more beautiful method of ornamenting the windows of churches and public buildings, or, in fact, anything in the way of ornamenting on glass. The following method is the one now in general use. Before engaging in this, it would be better if the artist could get some little previous instruction. We will endeavor to give the correct principles in regard to the oven, the baking, the colors, and the manner of making and using them.

THE OVEN is made of fire brick, and arched over like a common bake oven. This is to admit of an iron chest, or muffle, as it is called, so close on the outside that neither fire nor smoke can penetrate, and about three or four inches less than the oven, so that there may be an equal space at the top, bottom, and sides, with legs to keep it from the bottom.

The sheet of glass to be worked upon (the softer the glass the better) should be spread over with gum water, and let dry, in order to prevent the colors from running together, it being also much better than the slippery glass to work on. After it is dry, lay it down evenly upon the design, which has been previously sketched upon paper, and trace, with a fine hair pencil, all the outlines and shades of the picture or ornament with black. [See the mode of the preparation of colors at the end of this article.]

THE LIGHTS AND SHADES are produced by dots, lines, and hatches, very much after the manner of the engraver. When this is finished and dry, it is ready for the

FLOATING. Take the prepared colors and float them on by dipping the pencil in the color, and taking it, as full as it will hold, to the glass, and just near enough so that the mixture will flow out upon the glass, care being taken that the pencil does not touch the glass, as it leaves a spot. This refers only to transparent colors.

TAKING OUT THE LIGHTS. The methods of doing this, after the color is on, are various. Perhaps the best way is to take a goose-quill, made in the shape of a pen, without the slit. With this the artist may take out the lights by dots, lines, &c., to suit his taste. It is then ready for the kiln or oven.

Over the bottom of the oven, or muffle, must be spread, about a half inch thick, a bed of slacked lime, perfectly dry, and sifted through a sieve. Upon this lay a sheet of glass, then another layer of lime, and so on, if desired, for half a dozen sheets, though for very fine work, and where uniformity of coloring is required, it is better to have a less number. There may be quite a number of iron slides in the muffle, so that a number of glasses may be burned at one heat, without having more than one or two upon each slide. Close the muffle and raise the fire; but gradually, or the heat will break the glass.

After it is got up to a red heat, it may remain so for two, three, or four hours, according to the tests, which are strips of glass, painted with the same colors as the sheets, and drawn out occasionally. When the colors are properly burned in, the fire may die away gradually, as it was raised. When cold, the glass is taken out and well cleaned.

The chemicals mentioned in the following preparation of colors, may be had at most of the first-class drug stores. These preparations should be combined, so that each shall require about the same amount of heating to bring out the color.

COLORS FOR STAINING GLASS.

FLESH.

Red Lead,	1 ounce.
Red Enamel,	2 ounces.

Grind to a fine powder; work it up with alcohol, on a flag stone. Requires slight baking.

BLACK.

Iron scales,	14½ ounces.
White Crystal Glass,	2 ounces.
Antimony,	1 ounce.
Manganese,	½ ounce.

Pound fine, and grind in strong vinegar.

BRILLIANT BLACK.

Made to any degree of depth by the mixture of cobalt with the oxides of iron and manganese.

BROWN.

White Glass,	1 ounce.
Manganese,	½ ounce.

RICH BROWN.

Oxide of Platinum.

RED.

Red Chalk,	1 ounce.
White, hard Enamel,	2 ounces.
Peroxide of Copper,	1 drachm.

FINE RED.

Rust of Iron,	2 ounces.
Glass of Antimony,	2 ounces.
Litharge,	2 ounces.
Sulphuret of Silver,	½ drachm.

GREEN.

Brass Dust,	2 ounces.
Red Lead,	2 ounces.
White Sand,	8 ounces.

Calcine the brass to an oxide, and make all into a fine powder. Heat in a crucible one hour, in a hot oven. When cold, grind in a brass mortar.

GREEN. Oxide of Chrome.

GREEN. Blue on one side, yellow on the other.

YELLOW. Fine silver, dissolved in nitric acid. Dilute with plenty of water. Pour in a strong solution of salt, and the silver, in the form of chloride of silver, will fall to the bottom in a yellow powder. When settled, pour off again, and so on for five or six times. When dry, mix the powder with three times its weight in pipe clay, well burned and pounded. Paint on the back of the glass.

YELLOW. Sulphuret of silver, glass of antimony, and burnt yellow ocher.

YELLOW. Chloride of silver, oxide of zinc, white clay, and rust of iron.

It is by far the best method to buy the colors, if possible, ready prepared. Some, however, *must* be manufactured by the artist. Among them are,—

BLUE. Oxide of cobalt, which is cobalt ore, after being well roasted, is dissolved in diluted nitric acid. Add considerable water, and put into it a strong solution of carbonate of soda. A carbonate of cobalt is thrown to the bottom in a powder. Wash well, as for chloride of silver, and let dry. Mix this with three times its weight of saltpeter. Burn this mixture in a crucible, by putting a red hot coal to it. Heat, wash and dry it. Three pints of this to one of a flux made of white sand, borax, saltpeter, and a very little chalk, melted together for an hour, and then ground into an enamel powder for use. Any shade may be had by more or less flux.

VIOLET.

Black Oxide of Manganese,	1 ounce.
Zaffer,	1 ounce.
Pounded White Glass,	10 ounces.
Red Lead,	1 ounce.

Mix, fuse, and grind.

Remarks.—The fluxes are made of flint glass, borax, pipe clay, white sand, &c.

The principles of glass staining, and making the colors, therefore, will be found of great service to beginners; yet it must be understood that the practice will be very difficult, without some practical instructions; yet, one who has a taste, and some scientific ability, may be enabled, by studying these rules closely, and by a few trials in experimenting, to succeed in producing the work properly.

ANTIDOTE TO POISON IVY.—Dr. J. M. Ward, in the *Medical Record*, makes another addition to the already extensive list of remedies for poisoning by *Rhus radicans*, or "poison ivy." He recommends the profession to use, in all cases of poisoning by this plant, Labarraque's solution of chloride of soda. "The acid poison," he remarks, "requires an alkaline antidote, and this solution meets the indication fully. When the skin is unbroken, it may be used clear three or four times a day; or, in other cases, diluted with from three to six parts of water. After giving this remedy a trial, no one will be disposed to try anything else. It is one of the most valuable external agents known to the profession, and yet seldom appreciated and but rarely employed. It will sustain its reputation as a local application in erysipelas, burns and scalds."

THE BRITANNIA COMPANY'S LATHES AND SLIDE-RESTS.

We have received from the Britannia Company at Colchester, England, the well-known sewing-machine makers, an illustration of their small slide-rests intended for a three-inch centre lathe. It is but recently that lathes have issued from this Colchester workshop; but the firm is already doing a large amount of work of a highly creditable character, and this little rest is simply excellent. In one respect it deserves special commendation,—the quadrant plate allowing of angular adjustme t being without the usual slots for the clamping screws, which always form receptacles for dirt and chips. This part is in fact a miniature turn-

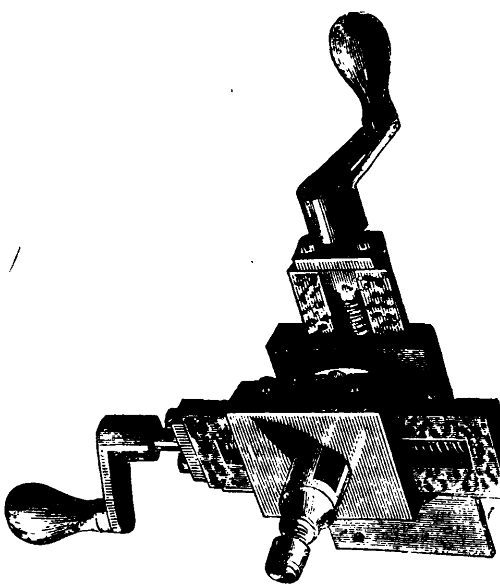


table of improved construction and is neatly graduated and figured to 50° each side of zero. The handles are of horn, which is pleasant to use and prevents rust, besides adding finish to the appearance of the rest. The upper plate is so fitted as to give ample support in the direction of the strain caused by the work upon the tool. The traverse of the upper slide is three inches, which suffices for so small a lathe. Altogether this is a compact, strong, and acurate rest, and if it is a fair specimen of the class of work as now done by the Britannia Company, they will become a conspicuous for good lathes as they have long been for sewing-machines.

TECHNICAL EDUCATION IN RUSSIA.

One of the principal establishments for technical education in Russia is the industrial school of the Czarevitch Nicolas, at St. Petersburg. This school, which bears the name of the late heir to the throne of the Russias, the Grand Duke Nicolas Alexandrovitch, is an establishment of a character which has not found much favor in our own country, combining general education with instruction in everything connected with scientific and manual industries. It originated in the benevolence of private individuals, who founded first an asylum for poor children destined to become artisans. The society obtained royal authority to open other similar establishments, and it has founded an industrial school for girls on the same principles as the preceding. The society and its foundations are placed under the patronage of the present heir to the throne of the Czar, the Grand Duke Alexander Alexandrovitch, who subscribes three thousand roubles annually towards its funds. The idea of the establishment of such a school in the capital of the kingdom was taken up very warmly; the members of the society already referred to gave 200,000 roubles for the construction of the building, and the merchants of St. Petersburg and others supplied more than 30,000 roubles. During the construction of the school, which occupied three years, *the Municipal Council of the capital made an annual* grant of 25,000 roubles, and the Government gave the site for its erection and a sum of 75,000 roubles. The value of the whole, as it stands, is set down at 175,000 roubles. The liberality in the supply of money enabled the architects and organizers of the school to pay special attention to the arrangements, not only for the instruction, but for the health of the pupils; and the lighting, heating, and ventilation of the building are considered *eminently satisfactory*.

The school was opened in 1875, with the three lower classes only, but the number was soon afterwards raised to five, according to the original scheme. Last year the number of pupils was 240, and that of professors and teachers 24. Twelve of the pupils are maintained at the cost of the Grand Duke, and one at that of the Grand Duchess. The authorities of the city maintain 100 pupils at the cost of 25,000 roubles per annum (£3,400, nearly); and the original society suppor s 38 other pupils. A few of the others are maintained by the establishment itself or some of its individuals, others by governmental departments, and the rest by their parents and friends, who pay 250 roubles per annum (about £32).

This establishment is capable of receiving 300 pupils, all resident; there are no day scholars. The total expenses of the school, with the full number of scholars, would be 95,000 roubles.

The boys are admitted to the lowest class at the age of 11, those who are older are examined, and may be admitted to either of the three lower classes.

The instruction includes :—

1. Catechism and sacred history, the Russian language, arithmetic, geometry, history, natural history, geography, physics, mechanics, and the technology of woods and metals.
2. Freehand and mechanical drawing, writing, singing, and gymnastics.
3. Trades.

The programme of studies is arranged by a committee composed of the heads of the establishment, and secular representatives of the arts, sciences, and education.

The amount of time devoted to the various studies is fixed as follows :—

The five classes of instruction occupy 69 hours per week, 21 being devoted to the Russian lan uage, 14 to arithmetic, 9 to catechism and sacred history, 8 to geometry, 5 to history, 4 to geography, 5 to writing, and 3 to natural history. In addition to the above, 9 hours are devoted to special instruction in physics and mechanics, 4 hours to the technology of woods and metals, 5 hours to singing, and 6 to gymnastics; making up a total of 89 hours per week.

Besides the above subjects and exercises, drawing, of course, fills a prominent place; to it are devoted 41 hours in each week, by the five classes. After an elementary course, the pupils draw from geometrical solids and plaster casts, and execute special designs for furniture and wood carving. The course of mechanical drawing includes a section specially adapted to iron-workers and mechanicians. The instruction in drawing terminates with working drawings belonging to the various trades taught in the school.

The industrial instruction is confined to the three upper classes of the school, and ordinarily occupies 20 hours per week, but the two weeks preceding the holidays are exclusively devoted to work in the varions ateliers of the school, which include shops for cabinet-making, modelling, turning, wood-carving, fine iron-work, metal turning, soldering, forging, and fitting.

The instruction in the workshop is on a very methodical plan, including the teaching of the elementary data, as well as the special processes of each craft. Correct and precise work, and the proper employment of tools, are the objects in view. Orders are executed in the workshops and ateliers, but no pupil is permitted to execute such work until he shall have passed satisfactorily through all the prescribed courses of study and instruction.

When the pupils have completed their studies, they may remain one or two years longer in the school, to perfect themselves in any one of the crafts, and obtain the title of apprentice-workman; this extra time is devoted exclusively to work.

On quitting the school, each pupil receives a certificate, and those who have passed with great credit through their examinations earn the titles of foremen and assistant-foremen, and obtain assistance to enable them to establish themselves in business, or to complete their industrial education and practice.

The industrial institutes, schools, and museums of St. Petersburg and Moscow made a very remarkable show in the machinery court at the Paris Exhibition last year. The extent of the collection of diagrams, models, and other educational material, and the admirable *execution of a large number of tools, machines*, and models made by the pupils in these establishments, attracted much attention, the unavoidable inference being that the Russian Government and people are intent on raising the industrial and artistic level of the population as much and as rapidly as science and organization can effect.—*Journal of the Society of Arts.*

IMPORTANCE OF TESTING WATER PIPES AND PIPE JOINTS.

Testing pipes and pipe joints in the open trenches in which they are laid, form the subject of a "selected paper" in Vol. 56 of the "Proceedings of the Institution of Civil Engineers," by Mr. M. M. Paterson. The importance and difficulty of securing good pipe conduits has frequently been referred to by hydraulic engineers in discussions upon water works, and it is admitted that a large amount of silent and invisible leakage from the mains accompanies most systems of water supply. Among instances of the evil effects of leaky mains may be cited Liverpool, where the consumption of 117,425 persons was reduced from 32.12 gallons to 15.97 gallons per head per day by the repair of leaks, discovered by the waste water meter system adopted by Mr. Deacon; Vienna, where a special commission was appointed to report upon the failures in the main line of conduit to that city; and Lewes, in Sussex, where an outbreak of fever has been traced to this cause amongst others. In laying the pipes for the Ossett water works, the whole of the pipes was tested in lengths of from 60 to 500 yards, after jointing in the trench. From the record of these tests an analytical table was drawn up, whence is obtained the following summary, showing the percentage of failures of the aggregate of all sizes: Total joints tested, 7,763; number of failures, 244; percentage, 3.14. Total straight pipes tested, 7,249; number of failures, 104; percentage, 1.43. Total special pipes tested, 514; number of failures, 50; percentage, 9.72. These results are, so far as the pipes are concerned, solely attributable to concealed defects in the castings, discoverable only after calking and while under pressure. The author's conclusions are: 1. That the usual mode of laying cast-iron socketed pipes without testing after jointing, and in the open trenches, does not give sufficient security against leakage. 2. That by such testing the desired security may, in most cases, if not in all, be obtained at no great inconvenience or cost. 3. That all pipes, special pipes included, should, if possible, be tested before leaving the foundry. 4. That the value of the principle of casting pipes with the socket downward is confirmed, although it affords no absolute security against defective sockets. 5. That systematic testing after jointing will tend to improve the quality of both casting and joints, the cost of each failure being thus largely increased, and falling upon the contractor at fault. 6. That the public will be further secured against accidents to pipe conduits, with their attendant evils, viz., the cost of repairs, the loss of water, the interruption of supply, and the indraft of gas or other foul air at leaky points when the pipes are empty.—*Sanitary Engineer.*

THE ORIGIN OF MACHINE-MADE PENS

Joseph Gillott, the first to employ machinery in the manufacture of steel pens, was originally a maker of buckles and other "steel toys," working alone in a garret in a Birmingham "slum." At this time he was engaged to a young woman in his own rank in life, whose two brothers were working, in about the same style as himself, on hand-made pens. Gillott thought he could better the processes employed, and worked secretly in his garret until he had made a press and other appliances, by which he could make twenty times as many pens in a day, and better pens, than was possible under the old methods. He found ready sale for them, and soon the demand outgrew his power of production. At this juncture his sweetheart agreed to his proposal that they should marry and work together, little dreaming of the ultimate issue of their enterprise. In after years Mr. Gillott used to tell how, on the very morning of his marriage, he began and finished a gross of pens, and sold them for £7 4s., before going to church.

DISCOVERY OF A REMARKABLE CAVE.

The *Courrier de Tlemcen* (near Algiers) states that some miners occupied in blasting rocks in the vicinity of the picturesque cascades, discovered the entrance to a cave, the floor of which was covered with water, They ventured upon the subterranean river on a raft, and followed it for some 60 meters' distance, when it disappeared in a vast lake. Here the vault of the cave was very high and covered with stalactites. In many parts the miners had to steer their raft between colossal stalactites which reached down to the surface of the water; eventually they reached the end of the lake, where they noticed a canal extending toward the south, and into which the waters of the lake flowed. The workmen estimate the length of the lake to be 2 miles, and the breadth 1 1-3 miles. They brought out a quantity of fish, which they say, surrounded the raft, and which were found to be blind.

THE CARPENTER'S STEEL SQUARE AND ITS USES.

By F. T. Hodgson.

Editor "American Builder."

THIRD PAPER.

It has been said, and wisely, "That the square is to the carpenter and joiner what the helm is to a versel, or the mariner's compass to the navigator thereof," an instrument of direction, which, by proper manipulation, will convey the operator to success.

On Fig. 1, Plate 36, we find a plan of a roof, having twenty-six feet of a span. But, as you are an apprentice, you may not know what the word span means, when used in this sense; therefore, I will take this opportunity to explain, so that in future, when you meet with this word in architectural, or other works (which you must read and study, if you are desirous of becoming a master workman), you will know what it is intended to convey. The span of a roof is the distance over the wall plates, measuring from A to A, as shown in Fig. 1. It is also the extent of an arch between its abutments.

There are two rafters shown in position on Fig. 1. The one on the left is at an inclination of quarter pitch, and marked B', and the one on the right, marked c, has an inclination of one-third pitch. These angles, or inclinations rather, are called quarter and third pitch respectively, because the height from level of wall plates to ridge of roof is one-quarter or one-third the width of building, as the case may be.

At Fig. 2, the rafter B is shown drawn to a large scale; you will notice that this rafter is for quarter pitch, and for convenience, we will say that it consists of a piece of stuff 2" + 6" + 17'. That portion of the rafter that projects over the wall of the building, and forms the eve, is three or more inches in width, just as we please. The length of the projecting piece in this case is one foot—it may be more or less to suit the eve, but we must continue the line from end to end of the rafter, as shown on the plan, and we will call this line our working line.

We are now ready to lay out this rafter, and will proceed as follows: We adjust the fence on the square the same as for braces, press the fence firmly against the top edge of rafter, and place the figure 12" on the left-hand side, and the figure 6" on the right-hand side, directly over the working line, as shown on the plan. Be very exact about getting the figures on the line, for the quality of the work depends much on this; when you are satisfied that you are right, screw your fence tight to the square. Commence at No. 1 on the left, and mark off on the working line; then slide your square to No. 2, repeat the marking, and continue the process until you have measured off thirteen spaces, the same as shown by the dotted lines in the drawing. The last line on the right-hand side will be the plumb cut of the rafter, and the exact length required. You have noticed that we have applied the square to this rafter thirteen times. Our reason for so doing is, that the building is twenty-six feet wide, the half of which is thirteen feet, the distance that one rafter is expected to cover, so that you see if the building was thirty feet wide, we should be obliged to apply the square fifteen times instead of thirteen. We may take it for granted, then, that in all cases where this method is employed to obtain the lengths and bevels, or cuts of rafters, we must apply the square half as many times as there are feet in the width of the building we are covering.* If we want the roof to be one-third pitch, all we have to do is to take 12" on one side of the square and 8" on the other, and operate as for quarter pitch.

We shall frequently meet with roofs much more acute than the one shown, but the student will easily see how they can be managed. For instance, where the rafters are at right-angles to each other, he will apply the square the same as for braces of equal run, that is to say, keeping 12" and 12", on both sides of the square, on the working line. When a roof is more acute, or "steeper" than a right-angle, we must take a greater figure than twelve on one side of the square, and twelve on the other.

Whenever a drawing of a roof is to be followed, we can soon find out how to employ the square, by laying on the drawing, as shown in Fig. 3. Of course, something depends on the scale to which the drawing is made. If any of the ordinary fractions of an inch are used, the intelligent student will have no difficulty in discovering what figures to make use of to get the "cuts" and length desired.

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* Sometimes there may be a fraction of a foot in this division; when such is the case, it can be dealt with by the same rule, as will be shown in a subsequent paper.—F. T. H.

FIG. 1.

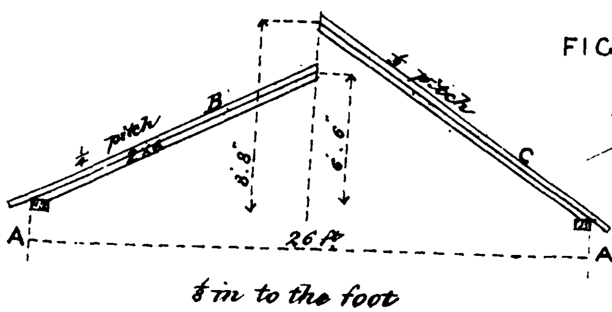


FIG. 5.

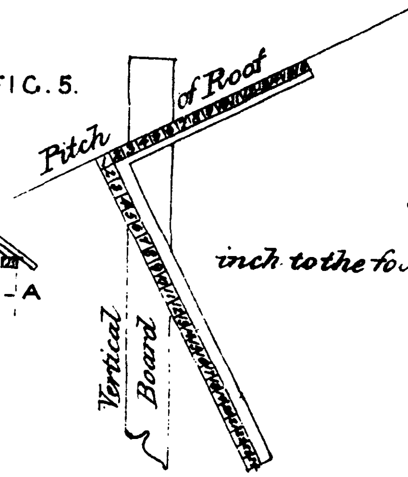


FIG. 2

¼ inch to the Foot

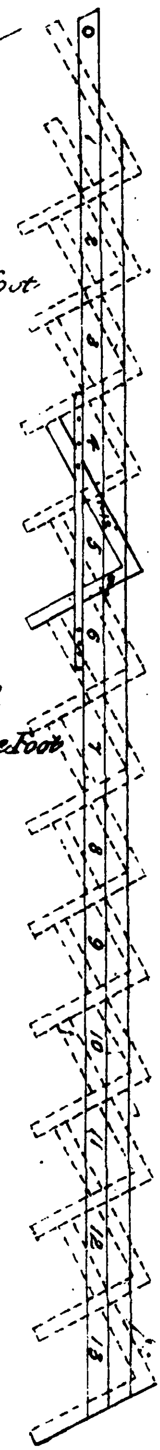


FIG. 6.

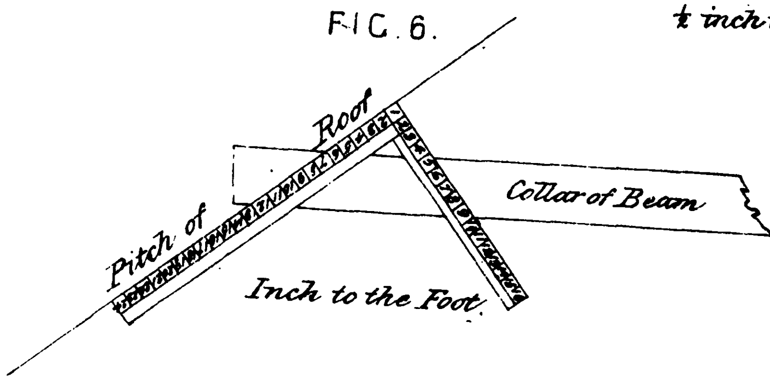
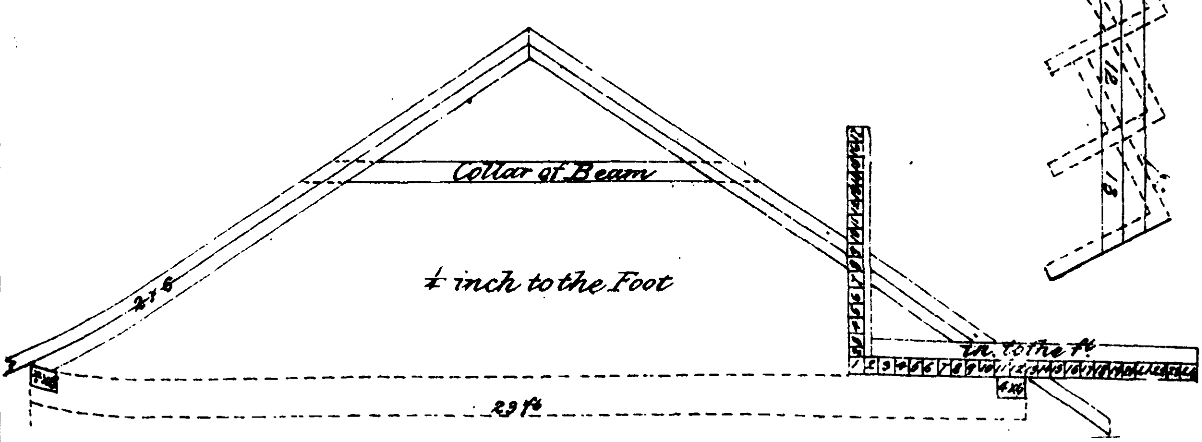


FIG. 3



THE CARPENTER'S STEEL SQUARE AND ITS USES.—By F. T. Hodson, Archt.

Fig. 5 shows how to get the bevels on the top end of vertical-boarding, at the gable ends, suitable for the quarter pitch at Fig. 1.

At Fig. 6 is shown a method for finding the bevel for horizontal boarding, or collar ties, etc.

Sufficient has been shown to enable the student, if he has mastered it, to find the lengths and bevels of any common rafter; therefore, for the present, we will leave saddle roofs, and try what can be done with the square in determining the lengths and bevels of "hips," valleys, and cripples.

(To be continued.)

THE MANUFACTURE OF STEEL.

Just as the ages of stone and bronze gave way, so the later age of iron seems now giving place to steel. On railways the change is almost complete; in marine construction it is commenced; and in the construction of bridges it has already made very great progress; whilst in the subsidiary iron industries the term is becoming a misnomer, and steel is taking the place of the less enduring metal. It is true that the "steel" which is so largely used might be more fittingly called in many instances ingot iron, but over malleable iron it possesses many advantages, whilst it is yearly growing less in price, and as the price descends so the area of the use of the more enduring metal widens at the cost of that which is less durable. It is remarkable to observe the growth of the steel manufacture in recent years, not only in Great Britain but in most of the manufacturing countries of the world; and in most instances, so far as can be learned, it is at the expense of the malleable iron trade. It is only a few years ago since the production of steel was limited to a few thousand tons yearly, which was chiefly produced at Sheffield, but since the introduction of the Bessemer process, the steel trade has been revolutionised, and the growth of the production has been startlingly large. It is tolerably certain that at the present day the production of Bessemer steel in Great Britain alone is about 850,000 tons yearly; in the United States it has rapidly risen to about 700,000 tons yearly; and France, Belgium, and Germany are the chief of the other contributors to the world's production of Bessemer steel. Whilst that trade has been growing up, there has also grown up the production of steel by the Siemens-Martin open-hearth system, by which only six years ago barely 81,000 tons were produced in the two great centres of Great Britain and the United States, whilst at the present time the output of these two nations alone is over 200,000 tons. In the two great manufacturing countries of Great Britain and the United States we have a production of steel by these two processes alone of over 1,750,000 tons annually, whilst beyond this, there is the enlarged production by the older crucible methods of manufacture, and the production in the remaining centres of the trade. Concurrently with this growth, the malleable iron trade has fallen off, and the prospects of the two seem widely diverse. Nor has the growth of the steel trade yet reached its maximum, whilst the iron trade, as we have known it, must wane as its rival waxes greater. It is evident that there is a growth in the demand for steel rails, whilst the substitution of steel plates for iron plates in ship-building is only just commencing. In the railway world the use of steels for rails, for instance, has been proved to have been beneficial, and to be cheaper than the use of iron; but this needs to be demonstrated in the construction of vessels, for though it is believed that steel plate in merchant vessels are cheaper than those of iron, carrying capacity being borne in mind in the comparison, yet this needs to be demonstrated, as also does the belief that they are no more liable to corrosion. In bridge work the use of steel is growing with tolerable rapidity, and in miscellaneous uses it is also advancing. As the production becomes greater there is a cheapening of the cost, and hence the area of the use is able to be enlarged by the material being put to service in places where its higher price acted as a prohibition. Moreover, attempts are being made to use in the steel manufacture those cheaper ores in which the presence of phosphorus has hitherto acted as a preventive of their use for the steel manufacture. It is believed that a means of cheaply and expeditiously evolving that vitiating element has now been discovered, and with full proof of this there will be a very great reduction in the cost of manufacture, and with that reduction a further enlargement of the area in which steel is used, and a further contraction of the area for the use of iron. The introduction of the Bessemer process brought down the price of steel very remarkably, as is tolerably well known; but it is not so well known that during the last few years there has been as remarkably a fall in the price of the metal. Taking Bessemer steel rails as an instance, it may be said that in 1873 they were quoted at £15 10s. per ton, and that in 1875, after the intensity of the demand had passed away, they were still quoted at £9 10s. per ton. At the present time the rate may be said to be on an average £5 per ton; and it is well known that a contract was recently entered into by one of the chief railway companies for a supply at 10s. per ton less than the rate named. In part only is this very material reduction in the cost due the enlarged output. In a very considerable degree it is due to the economies that have been effected in the process of manufacture, more especially by the adoption of the direct process. With these economies, and with the larger demand and larger facilities of production, a very remarkable reduction in the price has been brought about, and the form of the demand for metals has been changed to a very large extent. This reduction is more of a national benefit that at first sight appears. There is an immense saving in coal in the steel trade when contrasted with the iron trade,—that is to say, that the production of a given quantity of steel is effected with a much less expenditure of fuel than the production of a like quantity of iron, and hence the gain is double, for the steel is the more enduring metal. We produce, therefore, steel with a less expenditure of that power which our fuel supplies contain, and we in the use of that steel obtain a fuller measure of benefit or service than we could from a like quantity of iron. At the same time, there is always, in changes such as are taking place in the metallurgical world, suffering to some section of the community, and in this instance it is the puddlers and the iron makers who suffer, and the change appears to be slowly driving them out of the field of metallurgical labour. It is evident that at the present time the change will continue, for we have seen that the area of the use of steel is being enlarged slowly. With that use in shipbuilding there would be as marked an advance as there was when the utility and cheapness of steel rails on railways was proved, and with it there would, of course, be a use, not only of steel plates, but of steel angles, bolts, and other subsidiary, it important, branches. It is evident, therefore, that, both by the Siemens-Martin and by the Bessemer processes, there is at the present ample room for the extension which is now rapidly going on: and though for some uses there appears no probability of the banishment of iron, yet there is no doubt that its use will be much more limited than it has been, and thus it may be said that the substitution of steel for iron is in progress, and that the age of iron is following in the track of those of stone and bronze.—*Hardware Trade Journal.*

A FEW WORDS TO YOUNG STEAM FITTERS.

BY A STEAM FITTER.

Feed Pipes.—The feed valve should be a globe or angle valve placed near the boiler, with the fewest possible joints in the feed pipe between it and the boiler. If it is a loose or swivel disk valve, it should be secured with solder (sweated in) in the threads of the double part of the disk, so as to make it almost impossible to loose the disk from the stem; a mark with a center punch or chisel is not enough. The valve should be so turned toward the boiler that the inflowing water will be under and against the disk, so that in the case of the loss of the disk it will not act as a check valve against the influx of the feed water. This arrangement will bring the pressure of the water in the boiler always against the stuffing box of the valve; but all things considered it is best.

The check valve should be close to and outside the feed valve, with only a nipple between them. Always use horizontal check valves, as they admit of easy cleaning. With the ordinary vertical check it makes it necessary to take down some part of the feed pipe to clean it.

When two or more boilers are fed from the same pump, or when the pump is used for pumping water for some other purpose, it is well to have a stop valve on each side of the check valve, as it will enable the engineer to get at his check without stopping the water to the other boilers or elsewhere.

In passing through boiler walls or cast iron fronts, care should be taken that the feed pipe does not nest, or the settling of the boiler will break it off.

Use a flange union on the feed pipe instead of the common swivel union; the engineer can take it apart with a monkey wrench, and it makes a more permanent job and it will not leak.

Never put a T in the feed pipe inside the feed valve for the purpose of a blow-off; make a separate connection to the boiler.

Blow-off Cocks.—Never use anything but a plug cock of the best steam metal throughout. The reasons for using a cock are that the engineer is always sure when he looks at it whether it is shut or open. It gives a straight opening; if chips, packing, or dirt gets into the cock it will shear them off when closing, or if it does not, the engineer knqwns it is not shut. Do not use an iron body cock with brass plug, for when the cock is opened to blow down a little the hot water expands the plug of the cock more than the body, and it is most impossible to close it. Do not use a globe or angle valve, as you cannot always tell when it is shut; a chip or dirt getting between the disk and seat will prevent its closing. I have seen two fine boilers destroyed from this cause. Gate or straight-way valves are subject to the same objections as globe or angle.

When it is practicable there should be a T with a plug in it in the blow-off pipe outside the blow-off cock, the plug to be removed when the cock is closed. By this means the engineer can always tell if he is losing water from his boiler.

The blow-off pipe should be large, with few bends in it, and fire bends are better than elbows. It should be attached to the bottom of the shell of a horizontal boiler, and not tapped into the head a few inches up. When there is a mud pipe, attach it to it at the opposite end from the feed pipe.

Safety Valves.—They are the main stay of the engineer, acting both as a relief and a warning signal. They should be attached to the steam dome high up. At the side is better than the top, as they are not so liable to draw water when blowing off in that position. They should be large and have a large pipe connection all to themselves. The ordinary cross body safety valve is very much to be condemned, and I think in some countries there are regulations against their use; they are constructed to save making an extra connection for the main steam pipe, thereby drawing the largest amount of steam directly from under the disk of the safety valve. A weighted safety valve is better than a spring valve when it can be used, as the lifting of the valve makes practically no difference in the leverage; not so with a spring valve, for the higher it is lifted the more power it takes to compress the spring.

Gauge of Try Cocks.—Gauge cocks are various in style, the wood handle compression gauge cock being a very good kind for all purposes. When setting gauge cocks care should be taken that they are not too low, and that the drip will not flow over the person who tries them. They should be tapped directly into the boiler if possible; but when it is necessary to use a piece of pipe to bring them through a boiler front or brickwork, give the pipe an inclination backward, that the condensation may run back and into the boiler. When the pipe inclines outward and down, the condensation remains in it and the cock, and will deceive the unwary, giving the appearance of plenty of water with a short blow.

Glass Water Gauges.—Water gauges are best set when attached to a vertical cylinder at the front of the boiler. The cylinder should be connected to the boiler with not less than one inch pipe, top and bottom; the top or steam connection should be taken from the boiler shell near the front head, and not from the dome or steam pipe, as the draught of steam in either will cause the glass to show more water than the boiler contains. The bottom or water connection should be taken from the front head at a point where about two thirds of the water in the boiler will be above it and one third below; this will lessen the chances of the pipe stopping up with mud, etc., and it should also be provided with a half inch pipe at the lowest point for a blow-out. When gauge glasses are set this way the condensation in the cylinder is downward, and the flow of water being toward the boiler through the bottom pipe, the tendency is to cleanse the glass and cylinder and keep them so.

Steam Gauges should never be set much above or below the boilers to which they are attached, as each two feet of fall or elevation from the direct connection is nearly equal to a difference of one pound on the steam gauge; always when the gauge is below, for the condensation in the gauge pipe fills it with water, which leaves a pressure on the steam gauge equal to the hydrostatic head, which is a little over two feet perpendicularly to the pound per steam gauge, giving the gauge the appearance of being weak. When the gauge is above it is not always so, though generally, the pipes being long and of small diameter or trapped, which prevents a circulation of steam in them, they fill with water, which acts against the pressure from the boiler and gives a gauge the appearance of being strong. A good way is to connect the gauge pipe to a boiler below the water line, say 12 or 18 inches, and have the gauge on the boiler about 12 inches above the water line, using no water trap or siphon, that the water may run back from the gauge when there is no pressure in the boiler, thereby preventing the possibility of freezing or of getting steam to the spring of the gauge.

Sometimes a steam fitter has to run a gauge pipe a long distance to an office or engine room. When such a gauge is far above the boiler he should run a large pipe direct from the steam dome and give it sufficient pitch to clear itself of water; it should be covered with some non-conducting material, and be of such size that the flow of steam through the pipe to supply the loss by condensation will be so slow as not to interfere with the flow of water along the bottom of the pipe in a contrary direction, and it should have a siphon immediately under the gauge.

When it is necessary to have a gauge very much lower than a boiler, fill the pipe with water. but before doing so remove the glass and lift the hand or index over the stop-pin and mark where it remains stationary; now fill the pipe to its highest point with water, then with two knives draw the index from its spindle and set it back to the mark where it remained stationary before the pipe was filled, and press it on; then bring it to its normal position on the stop pin and adjust the glass.

The Main Steam Pipe for Heating Apparatus should be high up on a boiler, and any pipe larger than 2 inch should not be tapped in, but connected with a flange bolted or riveted to the boiler Two and a half inch pipe and larger sizes have eight threads to the inch, and will not make a good job otherwise.

Automatic water feeders, combination water gauges, or steam gauges, should not be tapped into the steam heating or engine pipe, as the draught of the steam through the pipe interferes with their proper working.

Engine or pump pipes should not be taken from the steam heating pipe, as the draught they cause relieves the pressure in the heating apparatus and spoils the circulation, especially if it is a direct return gravity circulation.

With an automatic return steam trap applied to an old job, if the steam heating pipe is large enough, it will not be necessary to move the engine pipe, but should the circulation be still defective, remove the engine pipe to shell of boiler remote from heating pipe.

W. J. B.

A Year's Railway Accidents.—It appears from a report to the Board of Trade just published, that the number of persons returned as having been killed in the working of the railways of the United Kingdom during the year 1878 was 1,053, and the number of injured 4,007. Of these, 125 persons killed and 1,752 persons injured were passengers; of the remainder, 544 killed and 2.003 injured were officers or servants of the companies or of contractors; and 384 killed and 252 injured were trespassers and suicides, and other persons who met with accidents at level crossings or from miscellaneous causes. Of the passengers, 24 were killed and 1,172 were injured from accidents which occurred to trains. In addition the companies have returned 59 persons killed, and 2,050 injured from accidents on their premises, but in which the movement of vehicles was not concerned. The proportion of passengers returned as killed and injured from causes beyond their own control was, in 1878, one in 23,540,000 killed, and one in 481,600 injured. In 1877, the proportion was one in 50,144.876 killed, and one in 429,924 injured. The total number of passenger journeys, exclusive of journeys by season ticket-holders, was 565,024,455, or about 14,430,000 more than in the previous year. Calculated on these figures the proportion of passengers killed and injured in 1878, from all causes, were, in round numbers, one in 4,520,000 killed, and one in 320,000 injured. In 1877, the proportions were one in 4,377,727 killed, and one in 429,924 injured.

Diverting the Oxus River from its Present Course.—One of the numerous engineering problems which it has been left to this generation to solve, is the turning back, by Russian engineers, of the Oxus into its Caspian Sea channel, from which it was diverted into Lake Aral by Octai Khan, when besieging Khiva in 1235. Immediately after the Khiva expedition of 1873, a scientific survey was made of the Lower Oxus, and most of the experts were of the opinion that the progressive diminution of the river by artificial irrigation, and the evaporation consequent upon the destruction of the forests which shielded it from the sun, had made its volume insufficient to traverse an extra distance of nearly 5,000 miles incombered with deep sand. It is now stated, however, that the experiment is actually being made; and the Lower Syr-Daria being only 12 inches deep in summer, the Russians may well do their utmost for the Oxus, as their only possible water-way into the heart of Central Asia.

HOISTING BY HOT AIR.

The idea of applying the modern improved caloric engine for hoisting purposes is an excellent one, and has recently been put into execution by the Sherrill Roper Air Engine Co., of 91 Washington street, New York. There are hundreds of localities where hoist-ways worked by hand are in use, but where the amount of material to be hoisted daily is rather too great for hand power, and where the owners are reluctant to go to the expense and trouble of supplying steam power, with its unavoidable drawbacks of boilers and an engineer to take care of them and of the steam engine. Fortunately there exists an engine equivalent to the steam engine, dispensing with boilers as well as with steam engineers, also fully capable of doing this duty, and ready for work much sooner than a steam engine, which requires the raising of steam of a certain pressure before it can be started. This is the Roper hot-air engine, already favorably known for some years, and introduced among manufacturers for various other kinds of work. This engine is now found to be admirably adapted to meet the wants of all who have more materials to hoist to upper lofts, or from cellars and vaults, than can conveniently be done by hand labor.

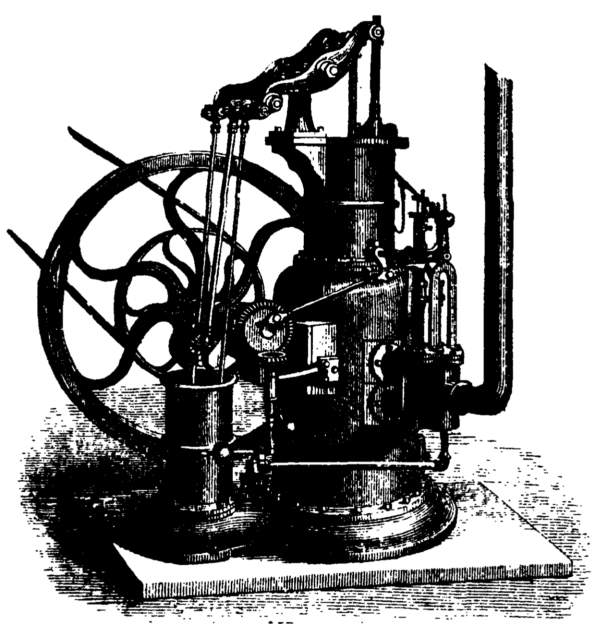


Fig 1.—The Roper Caloric Engine.

The engine is represented in Fig. 1, while the large engraving (Fig. 2) represents its mode of application to an elevator, which may be made to move upward as well as downward from the floor on which the engine stands, so that the latter can as well be placed on the top floor of a building as in the cellar below or the vault under the street.

It is scarcely necessary to enumerate all the advantages gained by this application, and we will only mention such points as are comparatively unknown. In the improved Roper engine (Fig. 1) the fuel and air are employed in a way that insures the most perfect economy of the former and greatest expansion of the latter. The air at the temperature of the surrounding atmosphere is drawn into the air pump and then forced directly into the fire, which burns in an air-tight furnace ; combustion and expansion ensue, and as a result of the expansion of the air and gases produced by combustion, a pressure is obtained in the fire box, which is admitted to the cylinder and exhausted through valves, as a steam pressure would operate. The furnace is lined with heavy fire brick, and as the air is brought in contact with the *fire*, and not hot iron plates, there are no heating surfaces to be destroyed by use.

The mechanical construction is as good as the best of material and workmanship can produce, and we are confident that this compact, simple, upright engine will commend itself to any mechanic or other person who will give it attention. During the past few years a number of small steam engines have been put upon the market, and from their low price are attractive to purchasers ; but however small it may be, or however skillfully made, the fact remains that a steam boiler requires the constant attention of an experienced man, and, as shown by frequent explosion, is dangerous under the most favorable circumstances. Any inexperienced person can, with a few instructions, take care of one or these hot-air engines as well as an engineer, and in such a short time that his other duties would scarcely be interfered with. The wages of an engineer is a large item where a small amount of power is used, and is in many cases more than the power is actually worth. When this sum is added to the amount saved in fuel and insurance, the result will show that a Roper engine will pay for itself in a very short time, while the satisfaction of having power which is in any case absolutely safe is a point not to be overlooked. No water being used, either to make steam or condensed air, the trouble and expense of keeping pipes in order is avoided, and there is no moisture about the engine to cause rust when not in use. The exhaust air can be conducted away in pipes, and used to warm rooms, heat japanning ovens, or other industrial uses. For any purpose requiring power within the amounts furnished by these engines, we state, as proven by the experience of many, that they will in almost every instance effect a saving in one or two years sufficient to pay for them.

Fig. 2.—Application of the Caloric Engine for Hoisting.

ANTIDOTE TO POISON.

If a person swallows any poison whatever, or has fallen into convulsions from having overloaded the stomach, an instantaneous remedy, most efficient and applicable in a large number of cases, is a heaping teaspoonful of common salt, and as much ground mustard, stirred rapidly in a teacupful of water, warm or cold, and swallowed instantly. It is scarcely down before it begins to come up, bringing with it the remaining contents of the stomach; and lest there be any remnant of the poison, however small, let the white of an egg or a teaspoonful of strong coffee be swallowed as soon as the stomach is quiet, because these very common articles nullify a large number of virulent poisons.—*Medical Brief.*

TEMPERING MILL PICKS FOR CUTTING FRENCH BUHR.

"A Country Miller's" complaint, I am afraid, is only too common with users of cast-steel tools, and the fault lies with the smith—that is, if he uses good steel. Now all smiths know full well that if cast-steel is made white-hot it is spoilt; yet if a person takes a chisel, mill pick or other pointed tool to be repaired, the smith (I am only speaking as a rule) pushes it into the fire. The point is soon white-hot. They will now push it in and out of the fire a few times, and at last bring it out red-hot and work it. Of course it is already spoilt; and no matter how low it is tempered, it is next to useless. I should advise "Country Miller" to take one to the smith, and see that he puts the body of the tool in the fire, leaving the two thin ends uncovered till the middle is red-hot. As soon as the middle is red-hot pull back, and let the thin end just get a dull red heat. It must now be hammered edgeways first, and flatways last of all. It is best to hammer it on the flat part of the anvil, as drawing steel on the edge of the anvil, although a great deal quicker, makes it short in the grain, and always causes the tool to break in the thinnest place. Serve the other end the same, only repeat as soon as it loses its dull red color. The lighter the blows in working steel, the tougher it is. The point should be quite as thin as a fitter's chipping chisel, only a little longer; then they will not require doing up so often. When the ends are drawn out the middle will have lost its red heat. The ends can now be filed a little.

Now to temper them: Heat them in the flame of the fire, using great care. When a very dull red heat, cool in rain water, with the chill taken off, about ⅜-inch from the end, and let down to a blue; if it should be too brittle, a little lower. Serve the other end the same. Cool all over. Grind the edge rather blunt, and for the first few blows hit as light as possible. A little soap-suds or oil could be poured on the water, but in my opinion the water is the best. The secret is in working it at as low heat as possible, only keep on repeating very often, and to hit it edgeways as little as possible, but flatways as much as you like.—*English Mechanic.*

UTILISATION OF THE WASTE FUEL OF LOCOMOTIVES.*

The engineer of the Eastern Railway of France lately turned his attention to discover some means for utilising the small cinders drawn by the blast through the flue tubes of locomotives, and deposited in the smoke box, which had, until then, only caused trouble and expense to the company. The proportion of these small cinders was found to vary between 1 and 10 per cent. of the fuel originally burnt, increasing with small and poor coal, and also when the engine works nearly up to the limit of its power. Experiments showed that the cinders contained from 1½ to 5½ per cent. of volatile matter; more than 22 per cent. of ash was present, but the large grains contained less than the smaller. The quantity of ash was also greater in winter than in summer; but, even under the most unfavourable circumstances, the proportion might be reduced to 18 per cent. on extracting 60 per cent. of the total amount of refuse by dry sifting.

With the addition of from 8 to 10 per cent. of gas-works pitch, the proportion of ash in the mixture would be reduced to a maximum of 16½ per cent., no greater than the amount usually contained in unscreened coal of inferior quality, as usually employed for firing stationary boilers.

The conditions of the experiment were, that the conglomeration of the waste cinders should be effected with the simplest and most inexpensive apparatus possible; and the products were to be available for use on the fire grates of the running shed and stationary boilers. The grains, freed from dust and ash by screens with holes of two millimetres (0·079 inch) diameter, were, with the addition of 10 per cent. of roughly broken pitch, put into a Carr's disintegrator making 400 revolutions a minute, and, when sufficiently mixed, passed into a pug-mill heated with a jet of steam. The mill, making from 15 to 18 revolutions a minute, converted the mixture into a paste, which was thrown by the shovel into the distributor of a Dupuy brick machine, altered for its new duty under the direction of the engineer. This machine, which is simple, cheap and portable, produced from 14 to 15 *briquettes*, weighing about three kilogrammes (6½ lb.) each, per minute, or 30 tons a day.

The degree of cohesion of the *briquettes* made in the Eastern Railway Company's coal depôt, La Villette, Paris, was found to be from 56 to 57 per cent., which was deemed satisfactory, as the French Marine Department, whose method of testing was adopted, only requires a cohesion of 50 per cent.

* From a report by M. A. Gambaro, superintendent, Fuel Department, Eastern Railway of France, in *La Revue Générale des Chemins de Fer.*

With a four-horse power portable engine, supplemented by an old locomotive boiler—the only motive employed at La Vilette—it was not possible to perform the operation of riddling, grinding, pugging, mixing, and compressing all together; but this circumstance, through the reverse of economical, permitted of ascertaining the amount of power required by each. The compressor absorbed 5 h.-p., the mixer 3 to 4, according to the temperature, and the screen and disintegrator 7 to 8. With a series of machines properly arranged for the manufacture, the cost is estimated by the engineer as follows:—Labour, per day, for producing 25 tons of *briquettes*, 36fr., or 1fr. 44c. per ton. Add to this 85 kilogrammes (187 lb.) of pitch, at 58fr. a ton, 4fr. 93c., and fuel for the engine, grease, and waste, 22fr. a day or 0fr. 88c. per ton, with 50c. per ton for wheeling the cinders up to the machines, and the cost of manufacture is 7fr. 75c. per ton. A margin of 2fr. 25c. for maintenance, interest on capital, and general expenses, brings up the total cost to 10fr. (8s.) per ton, showing a saving of 7fr. (5s. 10d.) on the price of small coal that had until then been used for the same purposes for which *briquettes* made from the waste fuel of locomotives are now employed. Since the above report was published, the same machine has been turning out *briquettes* for a new branch of the French States Railways, at the rate of 4f. 40c. or 85c. a ton, including all expenses.

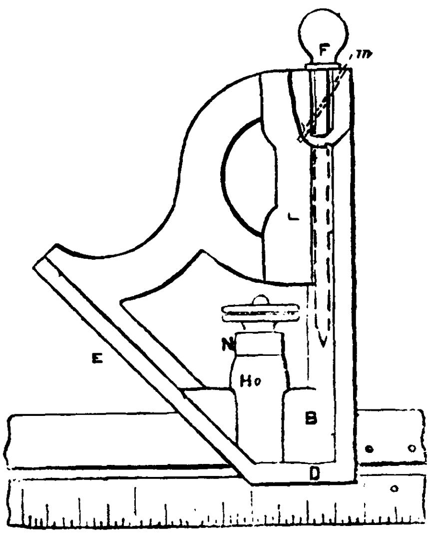
CLEANING AND TINNING METAL PLATES.—For the more speedy and economic coating of metal plates with grease and metal Mr. W. Knight, of Pontypridd, proposes to employ revolving or otherwise moving flat surfaces or rings, made of wood, metal, or other suitable material, which may be uncovered or covered with a hard or soft material, according to the special requirements of the operation. He supplies palm oil or other kind of grease to such surfaces or rings by means of hollow spindles or hoppers; he passes the plates to be treated through such surfaces or rings by any suitable means for the purpose of the greasing process, which being concluded they are conveyed through metal and grease to be coated with tin or other metal contained in a corresponding pot. After leaving the pot, he carries the plates through moving or stationary brushes. After passing through the brushing operation, he then carries the plates through metal, and then through grease into the finishing rolls. He puts the required pressure on the finishing rolls by means of spring balances attached to the end of levers, cranked or otherwise. He also employs machines fitted with the before-mentioned moving flat surfaces and rings, as cleaning machines, and proposes using bran or pollard mixed with powdered fuller's earth, the plates being placed in boxes containing fuller's earth working on axles with side openings or doors, the plates remaining a short time in contact with the material before being passed to the machine.—*Sanitary Engineer.*

HINTS CONCERNING SAWS.—A saw just large enough to cut through a board will require less power than a saw larger, the number of teeth, speed, and thickness being equal in each. The more teeth, the more power, provided the thickness, speed, and feed are equal. There is, however, a limit, or a point where a few teeth will not answer the place of a large number. The thinner the saw, the more teeth will be required to carry an equal amount of feed to each revolution of the saw, but always at the expense of power. When bench-saws are used, and the sawing is done by a gauge, the lumber is often inclined to clatter and to raise up the back of the saw, when pushed hard. The reason is that the back half of the saw, having an upward motion, has a tendency to lift and raise the piece being sawn, especially when it springs and pinches on the saw, or crowds between the saw and the gauge; while the cut at the front of the saw has the opposite tendency of holding that part of the piece down. The hook or pitch of a saw-tooth should be on a line from one-quarter to one-fifth the diameter of the saw; a one-quarter pitch is mostly used for hard, and a one-fifth for softer timber. For very fine-toothed saws designed for heavy work, such as sawing shingles, etc., even from soft wood, one-quarter pitch is best.

CAPTAIN Howgate is determined to lead an expedition to Lady Franklin Bay, if not to the North Pole next year, even if Congress refuses to assist him. That will make two American expeditions started with the view of reaching latitude 90 deg. N. and if Commander Cheyne has his balloons ready soon, the Pole ought to be reaching in 1880. The scheme met with a cold reception at the British Association; but Commander Cheyne believes in it, and is ready to make the attempt when the necessary funds are provided.

IMPROVED TRY SQUARES.

An improved try square for the use of draughtsmen, joiners, and others in line drawing, or in laying out lines at right angles, or at angles of 45°, has just been patented in this country on behalf of Mr. L. S. Starrett, of Massachusetts. In the figure, which is a side elevation, will be seen a graduated steel rule or bar, having extended through it lengthwise on one side of it a long groove, rectangular in its transverse section. This bar enters and slides in a recess formed in the foot or lower part of a stock, B, one edge, C, of which is at a right angle to its lower edge, D, while the other, E, is at an angle of 45° with such lower edge. Within a socket opening into the recess, and made in a boss arranged in the stock, as represented, there is a clamp hook formed to engage with the groove in the steel bar; it is provided with a nut, N, secured on the shank of the clamp, is counterbored, and has within it a helical spring to bear on the top of the base, and to serve when the nut is loosed to draw the clamp upward so as not only to prevent the bar from falling out of place in the stock, but dirt or extraneous matters from working between the bar, and the top of the recess in which such bar is placed. A pin, H, inserted in the base and projected into a hole in the shank of the clamp, prevents the clamp from revolving in the base. The foot of the clamp extends into the recess and takes into the groove in



the steel bar. Furthermore, there is within the stock and parallel to its edge, C, a spirit level, L, which is protected by an arch extending lengthwise over it as shown. The stock is also provided with a socket to receive a stylus or scratch pin, F, which by a friction spring, M, is prevented from accidentally dropping out of the socket. The rule or bar besides having at its opposite edges divisions or lines indicating inches and equal parts thereof, has made through it several holes half an inch or other suitable distances apart from each other, from centre to centre, such being of proper diameter to allow the point of the awl or scratch pin to be extended into and through them far enough to make gauge marks when it may be desirable to use the instrument for laying out work, such as mortises, or tenons. One or more holes near the end of the bar may be countersunk to admit of the point of a lead pencil being introduced through either, and used instead of the scratch pin for making gauge marks. The working edges C, E, of the stock are placed far enough apart for the bottom upper edge of the bar recess to be long enough to afford a suitable bearing for the bar, and also to admit of the boss being made between them, whereby the clamp is not only covered and protected on all sides, and shielded from dust or extraneous matters, but is prevented from accidentally slipping sideways out of the groove in the bar. The instrument made as shown will be readily comprehended by persons skilled in the use of similar instruments.

CHEMICAL TESTS.

We here give a list of the substances used for chemical tests, called "reagents," most commonly used for ordinary purposes, and add to each a few lines in regard to their use.

1. *Distilled Water* (formula, H O).—In most cases pure rain water may be substituted. It is chiefly used for dissolving such solids as are soluble in water, in order to prepare them for the test.

2. *Ether* (formula, $C_4\ H_5\ O$).—Chiefly used for extracting fatty ingredients from a given compound. It is also used to detect and isolate bromine.

3. *Alcohol* (formula, $C_4\ H_6\ O_2$).—Used as a solvent for extracting certain substances not soluble in water. It will also precipitate substances which have been dissolved in water and are not soluble in alcohol.

4. *Sulphuric Acid* (formula, SO_3 HO).—Used as a solvent for many metallic substances, forming with them sulphates. Also a special test for barium, strontium and lead compounds, producing in these solutions a white precipitate.

5. *Nitric Acid* (formula, NO^5 Ho).—A more general solvent for metals, except the noble ones, among which it only dissolves silver. It is also a powerful oxidizing agent.

6. *Hydrochloric Acid* (formula, HCl).—Also a solvent for many metals, and a special test for solutions of silver mercury, and lead, with which it produces a white precipitate. Its vapor forms a white chloride with ammoniacal gas.

7. *Nitro-Hydrochloric Acid* (*Aqua Regia*.)—The only acid that will dissolve gold and platinum, and decompose certain metallic sulphides.

8. *Oxalic Acid* (formula, $C_2\ O_3$ HO). —Its solution a special test for lime. It produces a precipitate or at least milkiness in solutions of lime compounds.

9. *Tartaric Acid* (formula, $C_8\ H_4\ O_{10}$).—A special test for potash. It produces in potash solutions a crystalline formation of cream of tartar, and is used to prevent the precipitation of certain metallic oxides by alkalies.

10. *Baryta, Caustic, Nitrate, Acetic and Chloride.*—Special tests for sulphuric acid or sulphates, producing a white precipitate in their solutions. The caustic baryta produces a white precipitate in magnesia solutions.

11. *Potassa, Caustic* (K O) is used as a solvent of some and as a precipitant of other solutions; separates some oxides from others, and drives free ammonia out of all its salts, so that it can be detected by the smell.

12. *Carbonate of Potash* (KO, CO_2) is used as a precipitant, and for the decomposition of many insoluble salts, especially organic with metallic bases.

13. *Sulphate of Potash* (KO, SO_3) is used to precipitate baryta and strontia, if the use of free sulphuric acid is objectionable.

14. *Cyanide of Potassium* (KCy) is used to separate cobalt from nickel, and to reduce arsenic by heat, but mostly used as a flux for the blow-pipe.

15. *Phosphate of Soda* (2NaO, PO_5) is a test for alkaline earths in general, especially magnesia.

16. *Phosphate of Soda and Ammonia* (NaO, NH O PO_5, HO).—It is the most important blow-pipe reagent, as it fuses almost every chemical compound, hence its name of "microcosmic salt."

FUSIBLE METALS.

Of mixtures of metals which become liquid at temperatures at or below the boiling point of water, there are several known, some of which are placed in convenient order, as follows:

1. D'Arcet's: Bismuth, 8; lead, 5; tin, 3 parts. This melts below 212° Fah.

2. Walker's: Bismuth, 8; tin, 4; lead, 5; antimony, 1 part. These metals should be repeatedly melted and poured into drops, until they can be well mixed, previous to fusing them together.

3. Onion's: Lead, 3; tin, 2; bismuth, 5 parts. Melts at 197° Fah.

4. If, to the latter, after removing it from the fire, one part of warm quicksilver be added, it will remain liquid at 170° Fah., and become a firm solid only at 140° Fah.

5. Another: Bismuth, 2; lead, 5; tin, 3 parts. Melts in boiling water.

Nos. 1, 2, 3 and 5, are used to make toy spoons, to surprise children by their melting in hot liquors. A little mercury (as in 4) may be added to lower their melting points.

Nos. 1 and 2 are specially adapted for making electrotype moulds. French cliche moulds are made with the alloy No. 2. These alloys are also used to form pencils for writing, also as metal baths in the laboratory, or for soft soldering joints.—*Scientific American*.

Medical and Scientific.

Activity, not Energy.—The *Christian Union* thus defines the difference between activity and energy, and suggests wherein a large class of industrious people lack that element which produces success. There are some men whose failure to succeed in life is a problem to others as well as to themselves. They are industrious, prubent, and economical ; yet after a long life of striving, old age finds them still poor. They complain of ill luck. They say that fate is always against them. But the fact is that they miscarry, because they have mistaken mere activity for energy. Confounding two things essentially different, they have supposed that if they were always busy they would be certain to be advancing their fortunes. They have forgotten that misdirected labour is but waste of activity. The person who would succeed is like a marksman firing at a target : if his shots miss the mark they are a waste of powder. So in the great game of life, what a man does must be made to count, or might almost as well have been left undone. Everybody knows some one in his circle of friends, who, though always active, has this want of energy. The distemper, if we may call it such, exhibits itself in various ways. In some cases the man has merely an executive capacity when he should have a directive one—in other language, he makes a capital clerk of himself when he ought to do the thinking of the business. In other cases, what is done is not done either at the right time or in the right way. Energy, correctly understood, is activity proportioned to the end.

—A paient was taken out in Germany last year, by Messrs. Bonbriel and Beck, for iampwick made of glass thread. They have now taken an additional patent for wicks consisting of glass threads sewn in cotton. Such are provided of any form or size for petroleum lamps. The insertion of the glass wick is done in the same way as that of the ordinary wick. The first three days, it is recommended to gently clear away the burnt parts of the tissue with a cloth, before lighting the lamp, so as to leave the glass threads free. When this has been done, the wick burns without any further cleaning, as long as the lamp is in use. If, after long use, there forms at the upper part of the wick a hard crust of fused glass, cotton residue, and oil particles (which does not indeed affect the luminous force, but makes it difficult to turn down the wick), the wick should be pressed down into the burner with some flat surface, *e,g.*, with the palm of the hand ; the crust then breaks off. Such a crust forms, as a rule, only where the lamp has been extinguished by blowing out and not by turning down

A Voltaic Pencil.—*Le Technologiste* gives the following description of an instrument which seems to be an improvement on Edison's electric pen : "It is to M. Bellet, a Parisian, that we owe the invention of the voltaic pencil, which perforates the paper in the same manner that it is pierced by Edison's electric pen, but without the intervention of the needle vibrated by a little electro-motor. Instead of actuating a needle as in the ordinary pricking machines used by those who design laces, embroideries, etc., the electric current itself passes through the paper ; for, as is well known, the lead of a pencil is a good conductor. This arrangement is advantageous in that the artist sees the traces of his work, his method of working being in no way different from the one which he habitually uses. But more than this, by means of this voltaic pencil, so skilfully perfected by its inventor, the artist, by drawing directly upon the lithographic stone or the metal plate, can now dispense with the services of the engraver, who so often denaturalizes the artist's work."

Erysipelas from Sewer-Gas.—It has been proved beyond a doubt by observations in England that erysipelas is often caused by the entrance of sewer-gas into houses and hospitals. The London *Sanitary Record* remarks that "there is now no more doubt that erysipelas is originated by sewer-gas than that typhoid fever is due more often than not to impure water." Several cases at Lincoln and Manchester are cited. At the latter city many cases of erysipelas and pyæmia were traced to the hospital sewer-gas. The *Record* condemns lead soil pipes. and says : "We have known cases of the escape of sewer-gas through a 'rat-eaten' (or gas-corroded, which is far more common), lead pipe in spite of good arrangements for its ventillation. Let the pipes be of *iron*, and well ventilated, and all mischief from this source may really be defied."

New Railroad Tie.—A new iron railroad tie recently exhibited at Philadelphia dispenses with the use of spikes, bolts, nuts, or fish.plates, and with the drilling and punching of rails, and avoids the consequent dangers of weakening or fracture from such causes. The mode of attachment is by means of a recess, with which each tie is provided, along the bottom of which recess wedge-shaped transverse pieces are cast. At the side of the recesses are two creosoted blocks of wood, which form a cushion and a fulcrum for two clamps, which grasp the flange and web of the rail above, bearing upon opposite faces of the wedge below. By this device the weight of the train increases the grip of the clamps. The first cost of this tie is greater than that of the wooden tie, but it is claimed that this is more than offset by its much greater durability.

Borax and Niter for Hoarseness.—*La France Medical* remarks that these two salts have been employed with advantages in cases of hoarseness and aphonia occurring suddenly from the action of cold. The remedy is recommended to singers and orators whose voices suddenly become lost, but which by these means can be recovered almost instantly. A little piece of borax, the size of a pea, is to be slowly dissolved in the mouth ten minutes before singing or speaking. The remedy provokes an abundant secretion of saliva, which moistens the mouth and throat. This local action of the borax should be aided by an equal dose of niter, taken in warm solution before going to bed.

Arsenic in Water Colors.—According to the *Chemiker-Zeitung*, M. Fleck, in searching into the causes of the death of a young engineer, found in the corpse remarkable quantities of arsenic, the origin of which he attributed to the water colors which the deceased had been in the habit of using ; for on an analysis, he found that a specimen of sepia contained 2.08°/o of arsenicus acid, one of terra di Sienna 3.14% and one of red brown 3.15%. The deceased engineer having been in the habit of drawing his brush, charged with the color, through his lips, it is not impossible that the arsenical colors were absorbed by degrees in the saliva.

India-Rubber Tires.—A gentleman read a paper before the recent meeting of the Institution of Mechanical Engineers at Glasgow, in which he claimed that the rubber tires used on the traction engines of India are of great service in reducing the cost of the ordinary engine repairs, and in giving uniformity of adhesion, without damaging the surface of the roads. The cost of the tires did not exceed 1½d. per mile. The manager of the Glasgow tramways stated that the engines used by him were provided with rubber tires, without which they would be unable to secure sufficient adhesion to enable them to do their work.

Pencils for Writing on Metals.—L. von Faber makes pencils for writing upon glass, porcelain, metal, &c., as follows— Black : ten parts of lamp-black, forty parts white wax, ten parts tallow. White : forty parts white lead, twenty parts wax, ten parts tallow. Blue : ten parts Berlin blue, twenty parts wax, ten parts tallow. Dark blue : fifteen parts Berlin blue, five parts gum Arabic, ten parts tallow. Yellow : ten parts chrome yellow, twenty parts wax, ten parts tallow.

To Prevent Boils.—A very simple remedy is made known by Dr. Sieven, in a St. Petersburg journal, for preventing the developement of boils. He states that if the skin be superficially scraped with a small knife, so that a drop or two of blood may be pressed through the epidermis as soon as the peculiar stabbing or pricking sensation and slight induration announce the commencement of the boil, it will not be further developed.

Commander Cameron, of the British navy, says that the Morse system of telegraphy, as far as it depends on the length of sounds, has long been in use in Africa. He has found tribes that, by stationg drummers at intervals, carry intelligence for miles with great rapidity, the beats of the drum being made in accordance with a previous arrangement of signals.

Honey mixed with pure pulverized charcoal is said to be excellent to cleanse the teeth and make them white. Limestone water is very good to be occasionally used by those who have defective teeth or an offensive breath.

For headache, wet with camphor a piece of flannel (red), sprinkle with black pepper and bind it on the head ; and we will assure you before it is on long your headache will be gone, and you will be ready to sing a song.

Common salt, mixed in cold water (tolerably strong), and used as a gargle night and morning, is found to harden the throat and keep off bronchial attacks.

IRON AND STEEL OUTPUT.

An elaborate table of the iron and steel output of the chief producing countries in the world has been drawn up by Mr. Commissioner Morrell, which is especially interesting at the present time as indicating the relative position of the producing countries. The percentage of the production may be thus tabulated:—

	Iron.	Steel.
Great Britain	46·63	39·70
United States	16 67	26·53
Germany (with Luxemburg)	12·16	13 87
France	10·26	10·17
Belgium	4.07	3·61
Austria and Hungary	3·21	4·08
Russia	3·04	·46
Sweden	3·51	·86
Other countries	1·55	·72
	100·00	100·00

The most remarkable feature which is shown by a contrast of these figures for the present time with those of a few years ago is that the position of the great iron-producing district remains substantially the same, and whilst there has been a very material advance in both that and the production of steel, the United States has increased her output of steel in a much more rapid ratio than have other of the chief producing countries. Whilst Great Britain produces nearly three times as much pig-iron as does America, the output of steel is only 50 per cent. more, and the difference seems likely to be very largely reduced. In the present year, whilst the output of iron is falling in Great Britain, the contrary is the case in the United States; and the production of steel is at its full extent there, whilst there it is below the facilities of production.

Facts about Lightning Rods.—In an interesting article in the *Building World*, it is stated that there is in Carinthia a church which was so often struck by lightning that at length it became the custom to close it during the summer months: this continued until in 1778 the church was rebuilt, and provided with a suitable lightning-conductor, since which time the building has been struck but few times and has suffered but little damage. It was at one time held that the best way to protect a building was to repel the lightning from it, and as glass is one of the best non-conductors, a thick glass ball was placed upon the top of the spire of Christ Church, Doncaster, England, but in 1836 lightning struck the church, shattering the ball and seriously damaging the spire. The carrying out of a theory which in this case proved so diastrous has had a happier result in the Houses of Parliament, London, where Sir W. Snow Harris, who was charged with protecting the building, carried the flat copper bands which were used for lightning-conductors behind the plastering of the walls; and Faraday caused a spiral channel, following the course of the stairs from top to bottom, to be cut in the granite of the light-house on Plymouth breakwater, in which was laid the massive copper lightning-rod. One of the best instances of what may be called natural protection is afforded by the London Monument. This column, some two hundred feet high, is crowned by a bronze flame, which typifies the great fire of London, this flame is in contact with the bars of the iron cage in which it was found necessary to enclose the balcony at top, to prevent persons from throwing themselves over, and the bars in their turn connect with the rail of the balcony and the hand-rail of the stair-case which descends to the ground. It is useless to try to insulate the vane spindle or finial upon a tower or spire by using glass rings; it is better to make this rod the upper part of the lightning-conductor. The earth end of a lightning-conductor should be carried to continually damp earth, or running water, but not to a stone-lined well or cistern, because serious damage is known to have been done by return shocks in cases where the dissemination of the fluid was so checked.

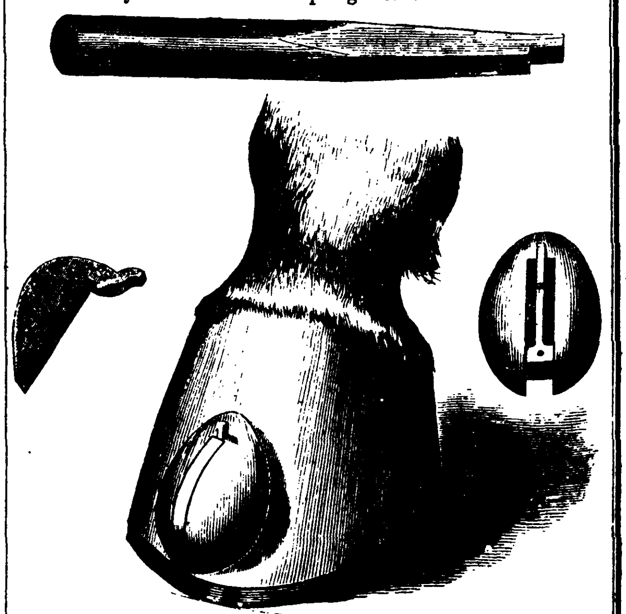
Lever Mainspring.—The cause of the irregularity of the force of mainsprings of watches is caused chiefly by those portions of the stone—the fusee threads—having been cut away too much by the person who cut, *i. e.*, formed the threads," which should be tested by the "examiner" of the watch before it is sent from the manufactory. A fusee cutter—the tradesman who forms the grooves—could alter it by being informed which part produced the stronger "pull." But, it may sometimes be improved by "setting up" the mainspring two or three clicks more, which is very effective when the "pull from the top gradually increases to the last turn." The examples to which the querist refers, in all probality were not tested for adjustment.—Seconds' Practical Watchmaker.

IMPROVEMENTS IN TOE-WEIGHTS FOR HORSES.

The object of this invention is to provide an improved construction of toe-weights (or side weights) such as are used attached to horses' feet for inducing an increased tendency of the horse to throw his feet forward and increase his speed in trotting or otherwise regulating the gait of horses, said construction being made with a view to facilitate the attachment and removal of the weight, and keep it, when attached, firmly to the foot, without tendency to wear loose and clatter.

The invention consists in a grooved weight, wedge shaped, in the cross section taken along the groove, and provided with a spring catch, in combination with a toothed clamping hook having a shoulder and toe on its lower end, by which it is secured in a suitable rabbeted slot in the horseshoe.

The weight proper, lined with leather, and concaved on its inner side to conform to the curvature of the hoof, and is provided on its front side with a groove for the reception of the clamping hook, by which the weights is held to the hoof, and in the bottom of the said groove with another groove to give room for the necessary movement of the spring catch.



A cross section of the weight along the groove has the shape of a wedge, whose front side, being the bottom of the groove, bears against the rear or inner side of the clamping hook when the weight is adjusted to hold it firmly to the hoof.

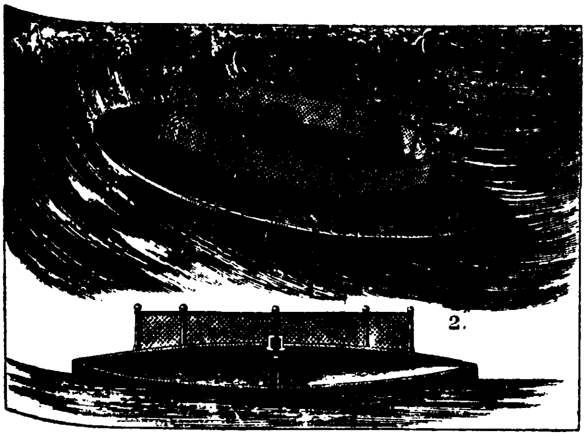
The spring is riveted at its lower end to the weight in the lower end of the slot and has near its upper end a small tooth, which is pressed by the spring into the teeth on the inner side of the upper end of the clamp hook, to prevent the wedge portion of the weight from accidentally slipping up and out of place.

The lower end of the clamping hook has two bends in opposite directions, forming the shoulder, (by which it bears upon the upper surface of the horseshoe) a downward projection (which enters a slot in the horseshoe), and a toe at the lower end of said projection (which toe bears with its upper surface against the shoulder formed by rabbeting one side of the slot underneath).

In releasing the weight of the spring catch is pressed back by the little hook or handle at its upper end, which is bent back to cover the end of the inner groove, to prevent the latter from being filled with dirt.

Messrs. Redmon, Frisbie and Clary, of Cynthiana, Ky., are the proprietors.

Borax Water.—Borax water will instantly remove all soils and stains from the hands, and heal all scratches and chafes. To make it, put some crude borax into a large bottle, and fill with water. When the borax is dissolved, add more to the water, until at last the water can absorb no more and a residuum remains at the bottom of the bottle. To the water in which the hands are to be washed after gardening, pour from this bottle enough to make it very soft. It is very cleansing and very healthy. By its use the hands will be kept in excellent condition—smooth, soft and white.



A NEW SURF BOAT.

The accompanying engraving represents a novel surf boat recently patented by Mr. Richard H. Tucker, of Wiscasset, Me. The boat is circular in form, with convex upper and lower surfaces, and its entire interior forms a reservoir for holding compressed air to be used in the propulsion of the boat. The propelling device is very simple. It consists in air nozzles projecting toward the stern, one being placed in each between the keels, of which there are several. The air nozzles are provided with valves which are operated from the deck. The boat is steered by closing the air valves on one side or the other as may be required.

This boat is not designed for long distances, but it is claimed that it has propelling power sufficient for ordinary requirements. It certainly contains no machinery which can become impaired either by use or rest, and it possesses sufficient buoyancy and is of the proper form to maintain its proper position in the water.

APPARATUS FOR REMOVING TORPEDOS.

Our naval instincts of defence are still energetically devising fresh means against the diabolical methods of attack and destruction that seem to increase steadily around. The torpedo scare has been the last fright for our unfortunate sailors—sneaking, diabolical machines, that will explode and send a good ship to the bottom without the least warning. A harbour defended by sunken torpedoes has been thought practically impregnable. We find, however, that a trial of a new method of clearing harbours of sunken torpedoes has lately been tried with every promise of success. The apparatus was fixed on the gunboat *Bloodhound*, at Portsmouth, and consists in running out a couple of booms 30 feet in length from the bows of the ship. Across the submerged ends is fixed a horizontal beam 38 feet in length, having a zig-zag arrangement of iron rods in the form of a **W**. It is expected that the open space of each **V** as it is pushed through the water, will enclose the torpedo fastenings or connections and lead them to the point at the bottom. The **V's** are here fitted with a scissor contrivance which is worked by levers in connection with the capstan on board. The beam-searcher has a sweep of 50 feet and the mechanism is capable of cutting through the strongest electric cable. A net which is supported from the whiskers of the bowsprit receives the liberated torpedo, and prevents it exploding against the operating craft. We understand that the trial was a great success, and the plan will be largely adopted. The invention is by a Captain Arthur whilst in command of the "Vernon."

A New Steam Boiler.—An english engineer named Whitehead, recently exhibited at Owlestown, near Sheffield, a boiler made on a new plan. In making this boiler a ring of steel is cast and heated. Then it is placed upon a large roller, and by the aid of smaller rollers it is enlarged to the requisite dimensions. The ring is run from one end of the roller to the other, and is returned by reversing the machinery. The other portions necessary for the completion of the boiler are subsequently put on with bolts. The machinery is rather expensive, and it is its cost which is said to be the point upon which the success of the invention hinges. The inventor claims that within six hours he can construct the shell of a boiler of a more durable nature than those now used.

THE MECHANIC OF THE FUTURE.

BY AN ARCHITECT.

Looking back a few years, we cannot but be struck with wonder at the rapid progress made in the efforts to advance the intellectual status of our mechanics through the publication of such journals as *The Plumber and Sanitary Engineer*, and others having a similar aim. The day is fast approaching when the intelligent mechanic will occupy a far higher position among his fellow-men than he ever did. He will combine with the routine of his trade and the mechanical uses of his hands and tools an intellectual mastership ; his mind will become cultivated in and familiar with the principles which necessitate his work and the devices thereof ; he will know better with his head what is required of his hands ; he will hold the situation himself, and sanitary laws and rules will no longer be the reserved study of the professor or the doctor, but will come down into common practice in the workshop, thrusting aside the old hereditary "rule o' thumb" cobwebs and disclosing theories which men have labored all their toilsome lives in vain to understand. The dignity of trade will be heightened, and the truth-seeking mechanic will familiarize himself with every subject which will enlighten his mind and elevate his position. His shop will become a laboratory, and natural philosophy, hydraulics, and chemistry, and the causes and reasons and the theory of his calling, which have been so long and blindly served, the study of his life.

It will not always be the family physician or the doctor who, when "put to their trumps," charge everything to "malaria poison," who will be sought after, or who will dictate and direct in such cases—but the plumber ; in other words, the "sanitary engineer," whose specialty all such matters shall be.

There never was a more common fallacy than to suppose that the mechanic needs but little education. On the contrary, he cannot be too well informed, especially the plumber. He of all controls the most important, useful and necessary internal portions and conveniences of human habitations, which, when imperfect, are the most dangerous and inimical to life.

All topics discussed by the sanitary savans of the day should be familiar to him, and he should select for his workmen and apprentices those whose mental capacities are equal to the scientific as well as the other parts of the business they are to follow.

And here lies the basis upon which the intelligent mechanic of the future must first build his hopes. Until the last war it was said that the ignorant man made the best soldier, but the world has learned that moral courage and cultivation are the greater requisites.

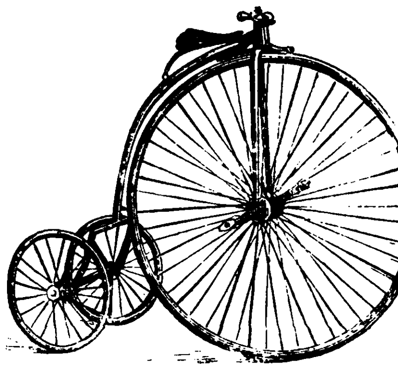
Intelligence "tells" wherever it is. You may hide it in the dingy shop, but it will shine out through the cracks, crevices and knot-holes of the darksome shutters. It will show itself in the simplest "bit of mechanism," and stamp the maker "a clever mechanic ;" more than all, is it visible in the calculation and arrangement of the plumber's work and his knowledge of sanitary rules, through his knowledge of sanitary law.

Fill the shops with bright minds ! Select your apprentices for their brains, and the trades will soon be as dignified as the professions. The sneer, "He's only a mechanic," will lack substance, and the future will wonder why it was ever said ; and while to-day the land is filled with lawyers, doctors, and a vast surplus of professional men who might have done greater good and have been more successful as mechanics, the time will come when such papers as *The Plumber and Sanitary Engineer* and others will have exalted the mechanical branches to the height of their ambition, and the best in the land will put their sons to a trade, and a new order of things prevail. The mechanic will then be of the true nobility of the soil, the truly practical builder of the public good—not too proud to don his "overalls" for his college clothes, but proud in the consciousness of "earning his bread by the sweat of his brow," and by the assistance of education, achieving greater undertakings, greater inventions, and greater perfection in all things pertaining to man's health, happiness and ingenuity than ever.—*Sanitary Engineer.*

Expensiveness of English Patents.—A writer in the London *Builder* complains that an English patent costs, in government duties, $125 within the first six months, then $250 within three years, and $500 within four more—total, $875 levied in seven years for a patent during fourteen years ; while a patent in America costs only $35, in one payment, for seventeen years He finally adds : Thus are the brains of Englishmen handicapped against those of their rivals."

A BI-TRI-CYCLE.

Some of our readers who are debating whether a bicycle or a tricycle will suit them best may be glad to know that one of the most novel velocipedes in the market is known as the Nancy Lee, and is so constructed that it can be converted from a tricycle into a bicycle, or *vice-versa*, in five minutes. We give an illustration of the machine as a tricycle, the alteration to a bicycle being made by unscrewing the backbone and replacing the back fork shown with one containing a single wheel. The back wheels are close together, so that the machine does not require more room than an ordinary bicycle with treadles on, but they are suffi-



ciently separate to enable the rider to stop and rest without dismounting. The machine as a tricycle weighs from 38lbs. to 54lbs., according to size, and is made with different kinds of rims, tires, &c., to suit the taste of purchasers. The manufacturers are the South London Machinists' Company, Suffolk-grove, Southwark, who also make a tricycle with two large wheels and a small one leading, the power being applied by means of treadles and links to the cranks—a machine suitable for the use of ladies. The width of the machine is only 26in. and the weight from 50lbs. to 58lbs. It is stated that it will turn round in its own width, and that anyone can ride it with perfect ease and safety.

RETOUCHING VARNISH.

A good retouching varnish is a boon to all retouchers, and those who are unfortunate enough to be plagued by too thin films will gladly hail a formula which promises this desideratum: In his recent work on retouching, M. Janssen, the *Photo. Correspondent* says, recommends the following varnish:

Alcohol (sp. gr. 0,830)	60	parts.
Sandarac	10	"
Camphor	2	"
Venetian turpentine	4	"
Oil of lavender	3	"

This varnish may also be used for paper pictures. The retoucher should not set to work as soon as the negative has been varnished, as the film will not then be hard enough to bear the touch of a lead pencil. The varnished film is in the best condition for retouching when a day old.

GLOSS FOR PHOTOS.

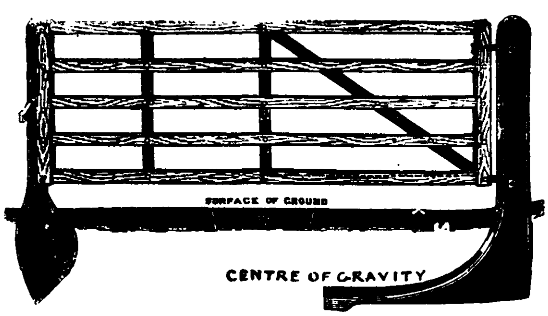
The same gentleman also gives a formula (said to be used by Salomon, of Paris) for a cerate for giving a high gloss to albumenized pictures. The components are:

White wax	800	grammes.
Elemi resin	10	"
Oil of lavender	300	"
Benzoin resin	200	"
Oil of spikenard	15	"

SNOW IMITATIONS FOR PARLOR ORNAMENTS.

A neat parlor ornament, inexpensive and readily constructed, can easily be made by the exercise of a little taste and patience, in snow or frost imitation of fern or trees.

Take a branch of a tree which is thickly studded with small leaves. This should be painted over with white glue, rather thick; then sprinkle on plaster paris, leaving it much thicker on top. The tree, or rather branch, should be upright while doing this. Put it on pretty thick. You will soon see the damp from the glue go all through the plaster paris. Let it remain until the next day when it will be sufficiently hard for the finish. Now for the secret. Get some clean alum, powder it as fine as possible in a mortar, or otherwise, and sift it through a very fine sieve or piece of coarse muslin cloth. Then get some very clear gum arabic; buy it dry, and sort out the whitest and dissolve it. It must be thick. Brush a good coat all over the plaster paris, after which sprinkle on the powdered alum as quickly as possible. When thoroughly whitened, stand it aside in a dust-proof place, and when dry blow off all the loose alum, and you will be proud of your work.



BALANCED FIELD GATE AND POSTS.

Mr. A. L. Bricknell, Chancery Lane, London, exhibited his patent "Balanced Field Gate and Posts," a staple article which is in daily demand in all agricultural districts. The gate consists of rails of wood arranged on each side, and attached to a solid iron framework the entire depth, and half the length of the gate, which forms not only the heel of the gate, but also the slanting and the upright braces. The arrangement is of the simplest, strongest, and most rigid character, and it also admits of the easy removal and renewal of the wooden rails by an ordinary farm carpenter. The head of the gate cannot drop, because the iron hanging post is curved under the ground to a point at or about the centre of gravity of the combined weight and post upon which it is hung, whereby the weight is balanced. It is claimed that the gate never gets out of order, while it is sold at a lower price than any common gate and posts.

Splitting Paper.—It is one of the most remarkable properties of that wonderful product—paper—that it can be split into two or even three parts, however thin the sheet. We have seen a leaf of the *Illustrated News* thus divided into three parts or three thin leaves. One consisted of the surface on which the engravings are printed; another was the side containing the letter-press, and a perfectly blank piece on each side was the paper that lay between. Many people who have not seen this done might think it impossible; yet it is not only possible, but extremely easy, as we shall show.

Get a piece of plate glass and place it on a sheet of paper; then let the latter be thoroughly soaked. With care and a little dexterity, the sheet can be split by the top surface being removed. But the best plan is to paste a piece of cloth or strong paper to each side of the paper to be split. When dry, violently and without hesitation pull the two pieces asunder, when part of the sheet will be found to have adhered to one and part to the other. Soften the paste in water, and the pieces can be easily removed from the cloth.

The process is generally demonstrated as a matter of curiosity, yet it can be utilized in various ways. If we want to paste in a scrap book a newspaper article printed on both sides of the paper, and possess only one copy, it is very convenient to know to detach the one side from the other. The paper, when split as may be imagined is more transparent than it was before being subjected to the operation, and the printing ink is somewhat duller; otherwise, the two pieces present the appearance of the original if again brought together.

Some time ago the information of how to do this splitting was advertised to be sold for a considerable sum. We now impart it to all our readers gratuitously.—*B. and O. Printer and Stationer.*

THE UNIVERSAL BATH.

The Universal bath, represented in the adjoined engraving, is a valuable appliance that can be attached to the common house chair. It weighs but 15 pounds, is simple, strong and durable, yet marvelously adjustable; it is of material similar to the body of a diving-bell, which is well known to be proof against fresh, salt, and all kinds of mineral waters, and being vulcanized by steam, it is applicable to vapor baths also, while from the pliable and peculiar nature of its rubber and cloth texture, a single one is efficient for almost every conceivable form, size and kind of bath—vapor and water, infant, adult, full, sitz, spine, sponge, electric, mineral spring, artificial sea baths, etc. Applications which would corrode and ruin a metallic bath, do not injure this in the least, therefore in a bath-room it is far superior to any metallic bath, and it is stated by those who have used it for

many years, that it requires so little water, is so light, easy to manage and stow away, that it renders a bath-room unnecessary. It is never immovably fastened, but may be set up in any room, hence it may be taken to the bedside of the sick, and used in almost any desirable form or style. When not in use it is collapsed and hung up like a common garment.

This bath was originally designed for ordinary family use only, but the many conveniences and important advantages which it presents have attracted the attention of eminent physicians, who recommend it for convenient use in practice. Its conveniences for bathing are even better than they are in bath-tubs that cost say $160, and are obtained by its simplicity in structure at a cost of about one 10th this sum.

Illustrated circulars, with testimonials can be obtained by addressing E. J Knowlton, Ann Arbor, Mich.

NEW COPYING PROCESSES.

Respecting this new process of copying a correspondent to the *English Mechanic* gives the following information :—

I lately purchased a "chromograph," which is apparently the original form of a new copying process. It was patented and made by a company, but within a few days I came across no less than four other close imitations, which were being freely sold under various names. I inquired about the validity of the patent, and could not get any very decided information. After a few minutes' search at the Patent Museum, I found a patent by J. G. Wilson, 13 November, 1878, No. 4601, which seemed to embody, at all events, the principle of this new process, but partly because imitations were being freely sold, and because the specification made no mention of several points about the article which are decided improvements, I felt no scruples in copying the receipt, from which some dozen or more have been made (for private use) by my friends.

Take 1 part by weight of gelatine (glue does just as well), let it swell in 2 parts of water, melt, and add 4 parts of (common) glycerine with a few drops of carbolic acid, and sufficient whiting or white-lead to make the whole milky. Pour the mixture into a shallow or zinc dish ; it will be ready for use in about 12 hours.

I have not been successful with the ink prescribed in the specification : 1 violet methylated aniline (Hoffman's purple ?), 7 distilled water, and 1 alcohol, so I have bought it at the most extravagant price of 1s. per ½oz. bottle ; but acetic rosaniline, boiled down in alcohol till it does not run in writing, forms a capital red ink. The purple ink is dosed with oil of almonds, I suppose, to mask its real composition.

To use the process, write on any kind of paper with the ink, taking care that the writing is thick enough to show a green lustre on drying. When dry place it face downwards on the jelly, rub it gently to bring it well in contact, and leave for one or two minutes ; then peel it off. It will leave a large portion of the ink neatly transferred to the jelly ; then place the paper to be printed on the writing and pass the hand over, bring it well into contact as before, peel it off, and it will bring away a perfect copy of the original. In this way 60 to 80 copies may be made ; by using a thick pen and plenty of ink 100 good prints may be taken. If the original still shows a green lustre, another transfer may be made. When exhausted wash off the ink from the jelly with a sponge and cold water, the ink need not be entirely removed since it does no harm if too faint to print, and the composition is worn away by washing ; a layer ¼in. thick would give 5,000 copies at least, if not twice that number. If the jelly is injured it may easily be melted down over a spirit-lamp or in an oven. After melting, and in the first instance after making, the surface should be washed with cold water.

I consider this to be one of the most important inventions made for some time, and it is a great pity the inventor, a Bavarian gentleman, did not more carefully protect it, though it is very foolish to sell an article for 12s. 6d. made by anybody with the greatest ease for 2s. 6d.

The use of the whiting or white-lead is to show up the writing on the composition, and to enable the washing off to be observed more easily. Neither this nor the carbolic acid are mentioned in the specification ; but since so many slightly differing articles are being sold, I believe anybody is at liberty to make one. 12in. x 10in. is a convenient size. A pair of tablets this size is sold for 20s.

HOW TO REMOVE NITRATE OF SILVER STAINS FROM CLOTHING

In the manipulation of the nitrate of silver bath solutions in photography the operator frequently receives stains of the salt upon his clothing, which are not very attractive in appearance. The question of their removal has been a puzzle to many. Nitrate of silver, it will be remembered, is the base of most of the so-called indelible inks used for marking linen in almost every household. Stains or marks of any kind made with the above silver solution or bath solution may be promptly removed from clothing by simply wetting the stain or mark with a solution of bichromate of mercury. The chemical result is the change of the black-looking nitrate of silver into chromate of silver, which is white or invisible on the cloth. Bichromate of mercury can be had at the drug stores. It is slightly soluble in water, is a rank poison, and we would not advise anybody to keep it about one's house.

TECHNICAL EDUCATION IN SWEDEN.—Technical education is provided for by the following institutions: Technical or professional primary schools, the school of arts or trades at Stockholm, elementary technical schools, schools of mines, and the Chalmers industrial school at Gothemburg. The first named are intended for the instruction of workman who are engaged during the day, and are open on Sundays and every evening during the week. There are four principal institutions of this class—at Norrköping, Malmo, Orebro, and Böras—all of them being affiliated to the elementary technical schools in the same towns. There is also Eskiltuna school exclusively intended for iron and steel workers. The number of students in this class of schools was 1,318 in 1877. They are in general maintained at the expense of the various communes, but that of Eskiltuna is a Government school, subsidized by an annual grant of 6,600 crowns. The State, moreover, helps these primary schools. 20,000 crowns being annually marked off in the budget for this purpose on condition that each communes contributes an amount equal to the grant. At Böras there is also a textile school for weaving, the course of instruction in which is from 1½ to two years. It has about 40 pupils. The Chalmers Industrial School at Gothenburg, was formed by a bequest in 1811, though it did not commence operations until 1829. It furnishes a much higher class of education in natural science for those who are going into the various professions. Although the Chalmers School was founded by a private person, the State contributes about 40,000 crowns per annum to the expenses. The Polytechnic School at Stockholm was called, until 1876, the Technological Institute, but assumed its present name in that year. The mining school at Falun was absorbed into it in 1869

ALL THOSE WHO HAVE BUSINESS WITH PRINTERS

would do well to preserve the subjoined page of "Proof," as showing at a glance, many of the ordinary mistakes of Printers, and the manner of marking their correction.

HOW TO CORRECT A "PROOF."

We believe we are conferring a favor upon many of our readers by giving them a specimen of the manner of marking the corrections of many of the ordinary mistakes made by printers. We received the copy wrapped around a sample of pens. In the present day when so many write for the press, and the legal and mercantile community issue so many circulars and pamphlets, this example will be found very useful. On one page is shown the corrections to be made and the form of symbols used; on the other, the revise proof with the corrections completed.

CORRECTIONS FOR PRINTER.

"The source of many a writer's woe has been dis/covered." 1/ ₰

PENS! PENS!! PENS!!!

"They come as a boon and a blessing to men,
The Pickwick, the Owl, and the Waverly Pen." 3/ e

"The misery of a bad pen is now a voluntary ~~restriction~~." 3/ *infliction*
Another blessing to men! The Hindoo Pen.

bolder — 1,200 Newspapers recommend them. See *Graphic*, 17th May 1873.
Sold by every respectable Stationer. Post 1s 1d.

Patentees—M/A/C/N/I/V/E/N & C/A/M/E/R/O/N *space wide*

23 to 33 BLAIR STREET, EDINBURGH.

4/ *caps.* "Macniven & Cameron deserve a NATIONAL MEMORIAL for 4/ *l.c.*
3/ e the Bl/ssings they have conferred upon Society. 5/ *run on*
A bad pen is enough, proverbially, 'to make a saint sWear,' but 6/ *w.f.*
the most wicked literary sinner must be very in sensible to real bene- 7/ ⁓
1/ ₰ fits, if he does not cease from the evil and singthe praises of Macniven 8/ #
p.s & Camerons' Pens."—*Leigh Cronicle*, 14th *November* 1874. 2/ h

A |—| THE WAVERLEY PEN. "Those who are much ~~who are much~~ 1/ ₰
engaged in writing would do well to supply themselves with a stock of *lead*
4/ *sm. caps.* the 'Waverley' Pens. They will prove a treasure."—*Standard.*

9/ "The Pens of Macniven & Cameron embody improvements of great value, 10/
ue, the turning of the points secures an ease and fluency in writing which
we daily find most valuable and agreeable."—*Engineer.* 11/ *tr*

THE OWL PEN.—"Those only who write much can adequately
appreciate the service which *Macniven & Cameron* have conferred upon 4/ *rom.*
2/ *the invention of* the world by their really excellent pens."—*Morning Post.* "The 'OWL' 12/ *N.L.*
4/ *ital.* is par excellence the Ladies' Pen."—*Court Journal.*

THE PICKWICK PEN.—"They are the best pens invented, and
13/ *stet.* it is only ~~bare~~ justice to the Patentees to record the fact."—*Shrewsbury*
Journal.

3/ *AE* THE PH/ETON PEN.—"The Phaeton Pen is well adapted for 14/ *br. lr.*
15/ ⦅ bo☰ and rapid writing."—*Queen.*

THE HINDOO PENS.—"We recommend them strongly to their 15/ ⦅
16/ | living namesakes and others."—*Lucknow Times* 2/ ⊙

EXPLANATIONS.

1. Where letters or words are wished deleted, or are printed twice over, a line is drawn through superfluous letter or word, and ₰ (delete) written on margin.

2. Where letters or punctuation have been omitted, or additions are desired—mark correction on margin opposite to place of insertion.

3. Delete wrong letter or word, and write correction on margin.

4. Where letters or words required to be altered from one character to another, a parallel line or lines must be made under the word or letter, thus—

To change to CAPITALS—underline with 3 lines, and write *Caps.*

To change to SM. CAPITALS—underline with 2 lines, and write *Sm. Caps.*

To change to *Italic*, underline with 1 line, and write *Ital.*

If printed in capitals and wished small, underline, and mark on margin *l.c.* (lowercase). If wrongly printed in italic, underline and mark *rom.* (roman) on margin.

GOOD PENS.

To all those engaged in writing, whatever position they may fill in life, a good pen is a real treasure. Having so frequently experienced the difficulty of writing freely, and setting down ones thoughnts with rapidity with a bad scratchy pen, we were induced to apply to a Scotch firm for a sample card of their celebrated pens, which they kindly responded to, and certainly we cannot speak too highly of their merits. Here we have before us on the card, two dozen pens of every variety, and suited for every kind of writing. For book-keeping, letter writing, fancy writing, music and engrossing, law pens, architects pens, draughtsmen's pens, mapping pens and school pens. Pens with every kind of point, and suitable for the requirements of every kind of hand. They have been highly recommended by the English press, and in recommending them ourselves to our readers we feel we are conferring a favour upon all those to whom a good pen is a thing to be desired and obtained. The manufacturers are Messrs. Macniven and Cameron, 23 Blair street, Edinburgh, from whom sampie boxes can be obtained on remitting one shilling sterling. Stationers should keep them always on hand.

CORRECTED FOR PRINTING.

"The source of many a writer's woe has been discovered."

PENS! PENS!! PENS!!!

"They come as a boon and a blessing to men,
The Pickwick, the Owl, and the Waverley Pen."

"The misery of a bad pen is now a voluntary infliction."
Another blessing to men! The Hindoo Pen.

1,200 Newspapers Recommend them. See *Graphic*, 17th May 1873.
Sold by every respectable Stationer. Post, 1s 1d.

Patentees—MACNIVEN & CAMERON,
23 to 33 BLAIR STREET, EDINBURGH.

"MACNIVEN & CAMERON deserve a National Memorial for the Blessings they have conferred upon Society. A bad pen is enough, proverbially, 'to make a saint swear,' but the most wicked literary sinner must be very insensible to real benefits if he does not cease from the evil and sing the praises of Macniven & Cameron's Pens."—*Leigh Chronicle*, 14*th November* 1874.

THE WAVERLEY PEN.—"Those who are much engaged in writing would do well to supply themselves with a stock of the 'WAVERLEY' Pens. They will prove a treasure."—*Standard.*

"The Pens of Macniven & Cameron embody improvements of great value. The turning of the points secures an ease and fluency in writing which we daily find most agreeable and valuable."—*Engineer.*

THE OWL PEN.—"Those only who write much can adequately appreciate the service which Macniven & Cameron have conferred upon the world by the invention of their really excellent pens."—*Morning Post.*

"The 'OWL' is *par excellence* the Ladies' Pen."—*Court Journal.*

THE PICKWICK PEN.—"They are the best pens invented, and it is only bare justice to the Patentees to record the fact."—*Shrewsbury Journal.*

THE PHAETON PEN.—"The Phaeton Pen is well adapted for bold and rapid writing."—*Queen.*

THE HINDOO PENS.—"We recommend them strongly to their living namesakes and others."—*Lucknow Times.*

EXPLANATIONS.

5. Where paragraph improperly made, draw line connecting it with last word, and write *run on* on margin.
6. When the letter is of a different face, mark *w.f.* (wrong fount).
7. Where space should be deleted.
8. Where space has been omitted.
9. Where beginning of paragraph has not been indented.
10. Shows line too closely spaced, and words marked to be taken over to next line.
11. Where words have been transposed.
12. When new paragraph is desired, mark as shown, and write *N.L.* (new line) on margin.
13. Where words have been struck out and are afterwards approved, underline with dots and write *stet* on margin.
14. *Br. lr.* for broken letters.
15. When letters not standing properly.
16. Shows space standing high between two words.

Miscellaneous Items.

Poison for Rats and Mice.—Carbonate of baryta has been found to be a most efficient poison for rats and similar vermin. Indeed, at a special series of trials by the Zootechnical Institute, in connection with the Royal Agricultural College, at Proskaw, this substance was found to be more efficacious than any other. It occurs as a heavy white powder, devoid of taste or smell. In the Proskaw experiments it was mixed with four times its weight of barley meal, and pellets of the paste were introduced into the holes of the rats, house mice, and field mice. A small quantity proves fatal. It appears to cause immediate and complete paralysis of the hind extremities, so that it may be assumed that mice eating of it in their holes will die within them, and so not prove destructive in their turn to domesticated animals that might otherwise devour the carcases. It was found in practice that neither fowls,nor pigeons would touch the paste, either in its soft state or when hardened by the sun ; so that its employment is probably free from danger to the occupants of the poultry yards. Some rabbits, on the other hand, that got access to the paste ate heartily of it and paid the penalty with their lives. Next to the carbonate of baryta paste the ordinary phosphorous paste proved most destructive, and this, it was found by experiment, is more attractive to the mice in a soft form than when hardened into pills. But it is considerably dearer than the baryta preparation, an important factor in the calculations of the farmer who has to wage war against rodents on an extensive scale.

Artesian Wells in Central Australia.—Successful borings for water have been made in Frome County, South Australia, in a district hitherto almost devoid of surface water, and regarded as consequently almost worthless for agricultural or pastoral purposes. One well, sunk in some arid country near Lake Frome, at a distance of 400 miles north of Adelaide as the crow flies, on being bored to the depth of 370 feet, produces a daily supply of 10,000 gallons of excellent water ; and other artesian wells in the same district have proved equally successful. As the result of the enterprise, we are told that, whereas that country would formerly only carry a few thousand head of stock, its capabilities are now practically unlimited. This success will stimulate similar enterprises elsewhere. Much of the so-called desert country forming the boundary between the coast districts and the rich pastoral lands, which have been discovered in the interior of the continent, will be reclaimed by this means. The South Australian Government is sending a scientific expedition to the shores of the Great Australian Bight, with a view to the selection of proper sites for artesian wells to tap the deep springs which are known to exist there ; so that a part of the country which has hitherto been regarded as almost the most inhospitable portion of Australia, will, by this means, says the *Colonies and India*, be thrown open to agricultural enterprise.

Reaping 20 Square Miles of Wheat.—The poetry of the harvest field will have to be rewritten. A correspondent of the Chicago *Tribune*, writing from the Dalrymple farm, furnishes the rough materials for one canto.

"Just think," he says, "of a sea of wheat containing twenty square miles--13,000 acres—rich, ripe, golden ; the winds rippling over it. As far as the eye can see there is the same golden sunset hue. Far away on the horizon you behold an army sweeping along in grand procession. Riding on to meet it you see a major general on horseback—the superintendent ; two brigadiers on horseback- repairers. No swords flash in the sunlight, but their weapons are monkey wrenches and hammers. No brass band, no drum beat or shrill note of the fife, but the army moves on—a solid phalanx of twenty-four self-binding reapers—to the music of its own machinery. At one sweep in a twinkling, a swath of one hundred and ninety-two feet has been cut and bound—the reaper tossing the bundles almost disdainfully into the air—each binder doing the work of six men. In all there are 115 self-binding reapers at work. During the harvest about 400 men are employed, and during thrashing 600—their wages being $2 a day with board."

A patent has been taken out in England for removing one of the chief nuisances of large manufacturing towns, by washing the dense black smoke of tall chimneys and rendering it so white that it will not soil a pocket-handkerchief, and obviating the necessity of chimneys higher than those of ordinary houses. By its means injurious gases and unpleasant odors are prevented. The process is described as follows : "After the dense and gas-laden smoke leaves the furnace, before it enters the chimney, it passes through a flue and over a tank of water holding soda-ash in solution. Paddle-wheels, with fans just touching the water, are suspended over the tank, the number varying with the size of the establishment. Set in rapid motion, these wheels dash the water up in a fine spray, which washes the smoke hastening on its way to the chimney. Successive screens of lath, down which the water trickles as it returns to the tank, afford additional facilities for the detension of the impurities in the smoke. The revolution of the paddle-wheels in the direction in which the smoke is moving increases the draft, and insures more uniform heat in the furnace."

Lithography.--For making lithographic ink, a copper or iron pot with a lid is provided. In this linseed oil of the best quality is boiled until it will ignite readily upon the application of a light. It is then allowed to burn until the required consistency for the varnish is obtained, which is known by taking a small quantity out with a knife, and permitting it to cool. The lid of the pot is then put on, which extinguishes the flames. It is obvious that this is a somewhat dangerous process to conduct under an ordinary chimney. With this varnish, which must not be too thick, as much best calcined Paris black is ground up as possible. The more black that can be ground in, the richer will the color be. The transfer paper is made as follows :—Dissolve in water ½oz. of gum tragacanth, strain, and add 1oz. of glue and ½oz. of gamboge ; then take 4oz. of French chalk, ½oz. of old plaster of Paris, 1oz. of starch ; powder, and sift through a fine sieve ; grind up with the gum, glue, and gamboge ; then add sufficient water to give it the consistence of oil, and apply with a brush to thin sized paper.

A writer in the Boston *Shipping List* comments on Mr. Smith's article and takes issue with him as follows : It is calculated that 2,984,000 square miles of this land belong to Canada, while 2,933,000 square miles of it belong to the United States. This territory, which is being settled with unparalleled rapidity, Mr. Smith thinks, will be the great source whence England will make good her wheat deficiencies at some not remote period in the future. The outlet, he says, will be *via* the Nelson river, which issues from the north-east angle of Lake Winnipeg, and discharges its surplus waters into Hudson's Bay. This route is said to be 80 miles shorter than the distance between New York and Liverpool ; but there is one little drawback to its successful utilization. The river in question happens to be closed by ice two-thirds of the year. There is no doubt about the magnitude and productiveness of the Red River country, but its products will not be likely to find their way to market by way of the North Pole.

Cement Floors for Cellars.—For making floors, the following method is said to produce very desirable results : Four parts coarse gravel, or broken stone and sand, and one part each of lime and cement, are mixed in a shallow box, and well shoveled over from end to end. The sand, gravel and cement are mixed together dry. The lime is slaked separately and mixed with just mortar enough to cement it well together. Six or eight inches of the mixture is then put on the bottom, and when well set another coating is put on, consisting of one part cement and two of sand. This will answer for making the bottom of a cistern that is to be cemented up directly upon the ground without a lining of bricks. This will also form a very good cellar floor. A cement of one part sand, two parts ashes and three parts clay, mixed with oil, makes a very hard and durable substance like stone, and is said to resist the weather almost like marble.

Good Mucilage.—The following mucilage is far superior to any generally to be had in shops :--4 parts (by weight) of fine glue are allowed to soften in 15 parts of cold water, and then moderately heated until the solution becomes quite clear ; 65 parts of boiling water are now added, with constant stirring. In another vessel 30 parts of starch paste are stirred up with 20 parts of cold water, so that a thin milky fluid is obtained without lumps. Into this the boiling glue solution is gradually stirred, and the whole kept at a boiling temperature for a short time. After cooling, a few drops of carbolic acid are added to the paste. This paste is exceedingly adhesive, and may be used for paper as well as for paper and cardboard. It should be preserved in corked bottles to prevent evaporation, and in this way will keep good for years.

Good News for Dyspeptics.—We have seen, says one of large experience, dyspeptics who suffered untold torments with almost every kind of food : no liquid could be taken without suffering ; bread became a burning acid ; meat and milk were s lid liquid fires, and we have seen their torments pass away and their hunger relieved by living on the whites of eggs which had been boiled in bubbling water for 30 minutes. At the end of the week we have given the half yo'k of the egg with the white, and upon this diet alone, without fluid of any kind, we have seen them begin to gain flesh and strength, and quiet, refreshing sleep. After weeks of this treatment they have been able, with care, to begin other food. And all this without taking medicine. Hard-boiled eggs are not half so bad as half-boiled ones, and 10 times as easy to digest as raw eggs, even in eggnog.

IN the very centre of this great Dominion of Canada, equi-distant from the Gulf of Mexico and the Arctic Ocean, and mid-way in the other direction between the Atlantic and Pacific, lies the low depression of Lake Winnipeg, 300 miles long, 50 to 60 miles wide—the future Black Sea ol Canada. Its shape is roughly parallelogram, lying north and south ; at three of its four corners it receives the waters of a large river, the main trunk of a hundred smaller ones. At the remaining north-east angle a fourth and larger river—the Dardanelles of the system—conveys the accumulated waters of nearly a million square miles into Hudson's Bay. This Lake Winnipeg receives the drainage of the future wheat-field of the world.—*Vernon Smith, in the Nineteenth Century.*

STOP-COCK OF EASY CONSTRUCTION.—Take two glass tubes, one of which slides easily into the other, close the end of the smaller tube in the flame or a Bunsen's burner, and make an opening about an inch from the closed end by filing crosswise with a rat-tail file. Connect the two tubes by a piece of rubber tubing, which should fit the smaller tube closely, and the stop-cock is complete. When the smaller tube is pushed into the larger one the cock is open ; when shoved back into the rubber tube the opening in the small tube is covered by the rubber wall, and the passage of liquids or gases prevented.—*Edward Hart.*

NEW PROCESS OF CONSTRUCTING BOILERS.—Last week a number of engineers visited the Park View Steel Works, Owlerton, near Sheffield, for the purpose of seeing Mr. George Whitehead's new process for producing weldless and seamless steel and iron boilers. A ring of steel is cast and heated. Then it is placed upon a large roller, and by the aid of smaller rollers it is enlarged to the requisite demensions. The ring is from one end of the roller to the other, and is returned by a reversing of the machinery. The other portions necessary for the completiou of the boiler are subsequently put on with bolts. Mr. Whitehead states that boilers constructed on this process stand twice the pressure of those made of riveted plates.

NEW RAILWAY BRAKE.—A novel form of railway brake has been invented by Mr. W. Wiseman, of the Indian Government Railway Department. An application for a patent was made, but was not proceeded with. In the specification it is stated that sand is placed in a chamber fitted with valves, which when opened allow the sand to pass into a second chamber, in which revolve blades attached to the axle of the vehicle. The motion of these blades is arrested by the rush of sand impinging and clogging them. We believe that experiments have been made with some stationary machinery, and the brake was found to be practicable. It is intended to be worked by electricity.

SINGLE STORY MILLS.—It is thought that before long the cotton mills of New England will be built with one story, instead of with five or six, as at present. The advantages claimed are increased safety and convenience and a higher speed for machinery. The report of a New England gingham factory on last winter's use of a one-story building was that it covered about an acre, was built of brick with corner towers at a cost of $23,000 and saved in gas alone a sum equal to the interest on the cost of the building. The looms were driven at 12 per cent. higher speed than on the second floor of the old mill, the repairs were fewer, and less imperfect work was turned out.

—According to a parliamentary return, 9,919 coaches, or 25 per cent. of the total number in use on the railway lines of the United Kingdom, have been fitted with continuous brakes, but only 19 per cent. of the locomotives have been so fitted. In the tabular statements the figure relating to the two rival systems of brakes respectively are as follows :—Westinghouse automatic, 226 engines and 1, 433 carriages ; Smith's vacuum, 554 engines and 2,899 carriages. Of the other descriptions of brakes enumerated in the return, two only are largely used, but they are not applied to any engines. Clark and Webb's has been furnished on 2,743 carriages, and Fay's is in operation on 1,334 carriages. Neither of these is self-acting.

SOME HINTS FOR MOLDERS.—Experience has shown certain facts which may be useful to observe by molders, and to be adopted as rules in regard to preparing the running of the metal. Choose, if possible, the thickest part of the casting for the runner. If the casting be deep, run in the metal at the bottom. Where the casting has a flange in the form of a pipe, it is generally preferred to run the metal in at the flange ; but the metal should *not be allowed to fall from any hight upon a weak* part of the mold. When the casting is thin, and has many ranehes, or when it is of great length it is advisable to run in the metal in the center. Care should be taken to choose a place in the mold so that the metal will have no tendency to wash any part away in its first rush.

PAINTING FLOWERS UPON MIRRORS.—An art lately revived in Rome is the old Venetian art of painting upon mirrors. Birds and butterflies are also often added, and the effect of the glass underneath, especially when this is thick and beveled, is to make them appear as if suspended in the air. The design must be traced from natural flowers with a lithographic pencil, and painted in oils with peculiar care ; for nothing can be more unlovely when badly done with muddy ill-assorted colors. These mirrors are usually framed in carved ebony or ebonized frames in the cinque cento style, another fashion recently revived.

ZINC-PLATE FILM.—Husnik's plan for causing a chromated gelatine film to adhere to a zinc plate is to coat the zinc plate with a solution of three grammes of chromic acid in one thousand grammes of water. When the acid has acted upon the zinc, wash off the solution, and first coat the plate with plain gelatine, and then with the chromated gelatine. Treated in this way, the film is said to adhere very firmly to the zinc ; bnt it must be kept dry before being used, otherwise a chemical reaction is apt to set in, by which the printing surface would spotted.

ELECTRO-BRONZED IRON.—A process for covering iron with a durable coating of bronze by electrolysis has been patented by the Philadelphia Smelting Company. The articles to be bronzed are first put into a bath of paraffin, which stops further oxidation. They are then coated with a metallic matter and immersed in the electro-bronzing bath. When taken out they are treated with a protecting varnish before being ready for use. The "deoxidised bronze" employed is an alloy of copper and tin, highly malleable, and capable of a smooth finish.

A CONVENIENT mode of testing dynamite, sufficiently exact for practical purposes, is the following, recommended by the *Chemiker Zeitung* : Dynamite, as our readers are aware, is simply an infusorial earth, which is saturated with nitro-glycerine, and the explosive energy of a sample will depend upon the quantity of nitro-glycerine it carries. For this purpose, a weighed portion is taken and treated with ether, which dissolves out the nitro-glycerine, leaving the inert infusorial earth unaffected. The difference in the two weighings will give the percentage of the explosive present.

TRAVELLERS describe two different ways of shoeing horses in Turkey and Russia, which may seem very awkward compared with the simple methods of American smiths. In Turkey and Servia the horse's head is held by one man, another holds the leg on his arms, while the third operates on the foot. In Russia the horse is placed in a square cage made of rough planks of wood and is strapped around the belly with wide leather straps to cross bars of the framework ; his head is also tied safely ; the foot is fixed to a stake in the ground and held by an assistant while the smith places the shoe on.

THE DEATH-RUN.—An eminent English surgeon states, on no account, except that serious fire was on hand, or to save a life, should any person ever *run* after having reached 50 years of age. The reason alleged was, that a tendency to heart disease, apoplexy, etc., might suddenly be brought to a climax by violent exertion, and especially with corpulent persons. Mr. William Adamson, aged 56 years, residing at Germantown, Pa., lately ran a considerable distance to reach a train of cars and fell dead. A post-mortem examination showed that he died of heart disease.

TO PRESERVE AUTUMN LEAVES.—Spread the fresh leaves and press them in a suitable dish, with alternaete layers of fine sand, which is thoroughly dry, and as hot as the hand can bear. When the sand has cooled they may be removed, smoothed under a hot iron, dipped for a moment in clear French spirit varnish, and allowed to dry in the air.

Machine Construction & Drawing.

(From *Collin's Elementary Science Series.*)

(Continued from page 285.)

specified kinds of lines for specified kinds of material, we could indicate the kind of material of each separate part. However, this is more simply and effectually done by employing colours, each kind of material having a separate colour.

The usual method is to colour, at least, all sectional parts; the kind of colour used is conventional, and in some cases bears little resemblance to the colour of the material; this, however, is not a disadvantage, for if we try to copy the colour of the material, we should not have that uniform system which we have by using a certain standard colour for each kind of material. The following list contains the colours used for some of the chief kinds of material:—

Material.	*Representative Colour.*
Cast-Iron........	1. A neutral tint composed of Indian ink, Prussian Blue, and Crimson Lake. 2. Payne's Grey.
Wrought-Iron....	Prussian Blue.
Steel............	Crimson Lake, with a little Prussian Blue added.
Copper..........	Crimson Lake, with a little Gamboge added.
Brass...........	Gamboge.
Wood...........	The colour varies from Raw Sienna for light coloured woods to Burnt Sienna for dark coloured, mixtures of these being used for intermediate shades.

111. There are several ways of colouring sectional drawings, each of which has its special advantage; for a moderate sized drawing a flat tint is the neatest, as is shown in Fig. 194, Plate XXVII. If the whole drawing is tinted, the sectional parts should be of a darker shade than the other parts; and if two or more sectional parts are in contact, a slight difference in the shade of colour may be employed for the adjacent pieces. For edges which would be fine lines in shade-line drawings, there is left a narrow margin between the colour and the line, but for edges which would be dark lines the colour is laid up to the lines; for sections where two or more pieces are in contact, the colour is laid up to the bottom and left-hand lines of each piece, as in Fig. 194, Plate XXVII.

Another way of colouring is to lay the colour in diagonal lines, with the pencil or brush, sloping the lines in different directions, corresponding to the diagonal section lines in the different figures in this book.

112. Before concluding we may give the student a few general hints respecting this part of our subject, assuming he possesses the necessary colours; a slab, with, say, six compartments, two or three brushes, either of camel hair or sable; the latter are best for general use, and may be obtained from 4d. each, and the former from 1d. each and upwards, according to size.

Each colour should be mixed in a separate compartment of the slab; and in mixing a neutral tint each colour should be mixed separately, and then the necessary colours mixed together; the Indian ink and the other colours also should always be fresh mixed. Before using a colour, especially a neutral tint, stir the mixed colour with the brush; always mix a sufficient quantity of a neutral tint to complete the work in hand, as it is difficult to obtain the same tint at two separate mixings.

If the surface to be coloured is small, the colour may be laid on in darker coats than when the surface is large; the beginner should use very light coats of colour, and go over the surface several times, allowing each coat to get dry before laying on another. The colour must be laid on evenly all over the surface, and no little pools of colour allowed to remain on any part of the surface, as they would destroy that uniform appearance which it is desired to give to the surface coloured. Before mixing any colour the slab should be carefully cleaned by washing; this remark applies also to the brushes; in fact the brushes should never be put away with colour in them. Order and cleanliness are two important points to be observed in colouring, we may say in drawing also, and they should always be in the mind of the beginner.

The representative colours and the methods of colouring given in Arts. 110, 111, apply to flat surfaces only; when a drawing is to be shaded in colours, the shading is generally done by introducing other colours to those given, but this part of the subject is beyond the limits of this book.

[The remainder of the plates to complete this work will be given in supplement form in December number.]

PLATE VI.

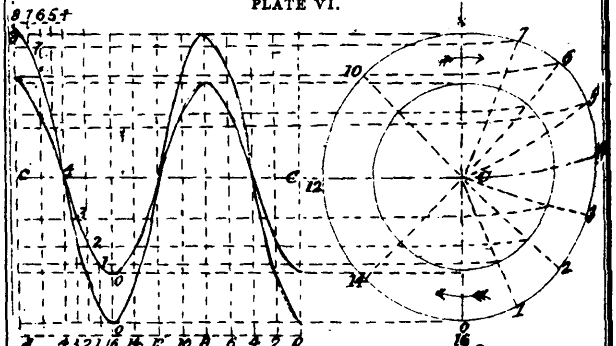


Fig 79 Fig 78

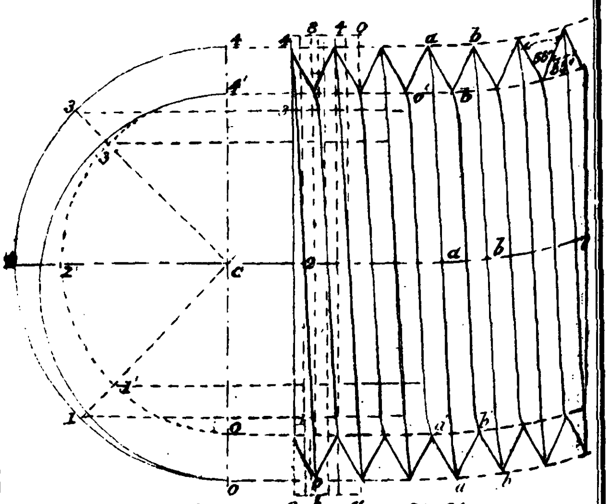


Fig 83 Fig 84

Full Size

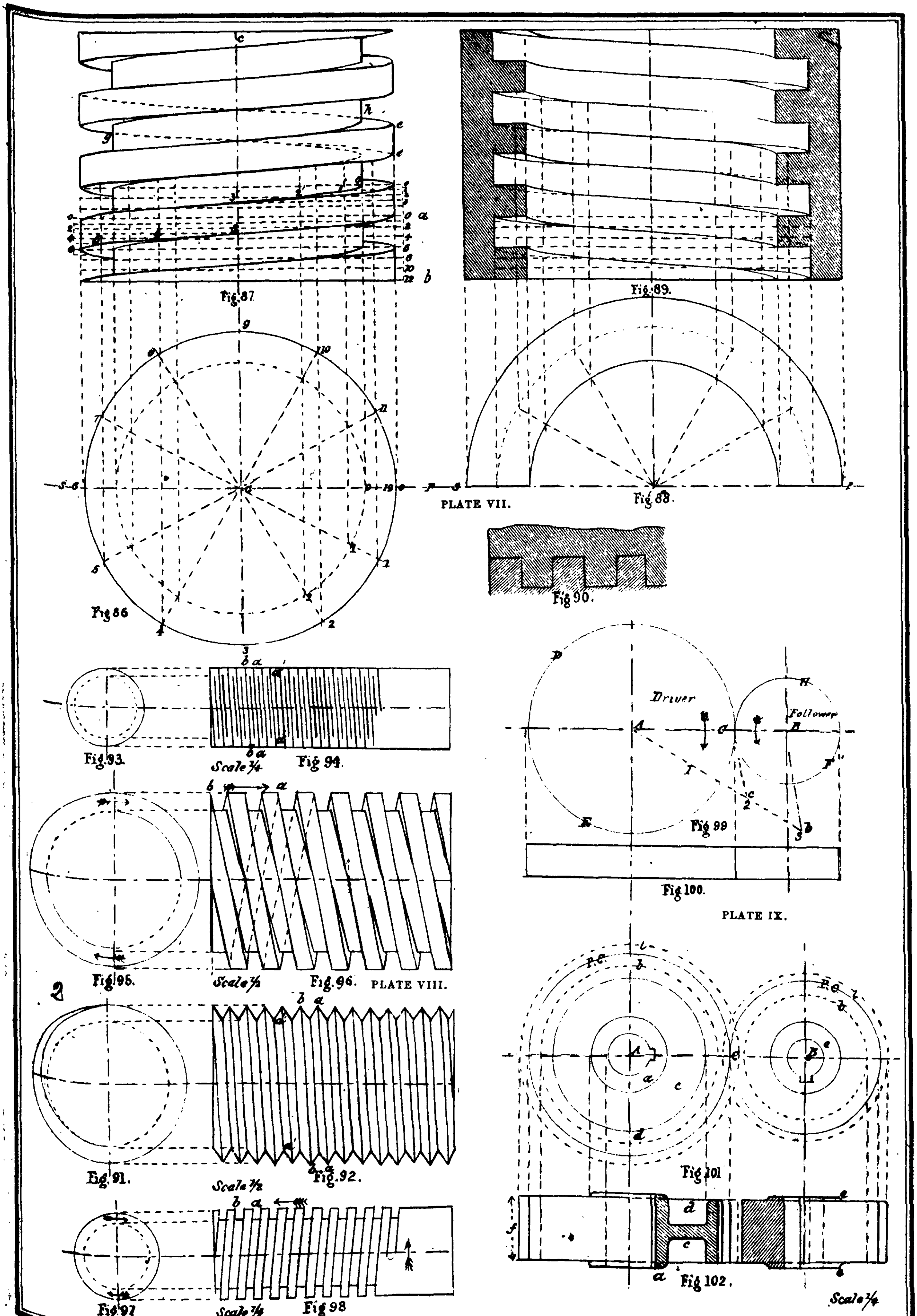


Fig. 87
Fig. 89.
Fig 86
Fig 88.
PLATE VII.
Fig 90.
Fig. 93.
Scale 3/4
Fig 94.
Driver
Follower
Fig 99
Fig 100.
PLATE IX.
Fig. 95.
Scale 1/2
Fig. 96.
PLATE VIII.
Fig. 91.
Scale 1/2
Fig. 92.
Fig 101
Fig 102.
Fig 97
Scale 3/4
Fig 98
Scale 3/4

Correspondence.

To the Editor of the SCIENTIFIC CANADIAN :

SIR,—As you have devoted part of the space of the SCIENTIFIC CANADIAN to architecture, I have taken the liberty of writing a few lines, in the hope that they may be the means of stirring up those who are interested in the art to do something to place it in a higher position than it now holds.

I will not attempt to describe the many evils under which architecture is now struggling, but will be satisfied with drawing attention to what concerns the proprietor as well as the architect, inthe hope that both parties will try to remedy the evil when it is brought to their notice.

If we take a glance at the present state of affairs, we will find that an archictect's special aim seems to be to get work at any cost, both in regard to loss of self-respect and remuneration, but the lower the precentage allowed the less work will be done. The architect nearly always proportioning the amount of work he does to the amount of remuneration he is to receive. The consequences of such a system may be seen in the planning and sanitary arrangement of our houses, and in their design, or, rather want of design.

Proprietors have apparently imagined that there is just so much work for an architect to do, and that there is but one way of doing it, therefore, the man who will do it the cheapest is the best man to employ. But as there is such a thing as "Paying too much for one's whistle," even when it is bought at the lowest rate, I would advise some of them to balance their accounts and see how they stand. Perhaps they will find that it has been very expensive employing an incompetent man, and paying for his mistakes in the increased cost of the building. There is another point from which I would ask them to consider the advisableness of taking such a course, and that is to take into consideration the results in the completed building. If they find that they have a house which is badly planned, wretched in design, and the sanitary apparatus so arranged as to be the cause of sickness, they will surely be forced to acknowledge the short-sightedness of having employed a man simply because he offered to work cheaper than others, without having considered for a moment whether he was competent or not to do the work required of him.

Where the trouble lies is in the fact that the public do not recognize the difference between a competent and an incompetent man, placing both on the same level, if their terms are the same. An architect may have spent many years in study, and much money to fit himself for his professional duties, and after all may find that the services of one, who is comparatively ignorant, are preferred before his, for the reason that what he has to exchange with the public for money, whereby to gain a livelihood, has not form, so that the buyer may be able to judge of the size, even if he should be unable to decide as to its quality, and thus his superior knowledge avails him little. The man who has intelligent professional skill to exchange, which necessarily can have no fixed value, instead of material which always has a value below which it can not be sold without loss, will always be at a disadvantage, because few are able to judge of its value until experience has taught them. However, there is no reason why the architect should remain at so great a disadvantage as he does at present. United effort on the part of a few, who are really interested in their work, to raise the profession, of which they claim to be members, to its proper position in the estimation of the public, would soon bring about a better condition of affairs. For the present a thoroughly competent man must take one of two courses, either not to do any work except at a proper percentage, and conseqnently have little to do, or be content to accept what he can get and do as little as possible for it. If he decides to take the latter course he will not loose so much as those who have been the means of forcing him into this way of proceeding.

It lies with architects to improve this unsatifactory condition of affairs, as it can not be expected that those who are but indirectly interested will be first to take the necessary steps, although assistance and encouragement may be expected of them in any movement which may be made in earnest by those who are directly interested. I would then call on all architects to do their utmost to make matters better for themselves, and thus benefit the public indirectly, by whatever means may be considered to be the most conducive to the best interests of architecture.

The question is how can this be done? It may seem very difficult to do anything in the right direction, but if all will assist something will be accomplished without a doubt. I would, therefore, with your permission, call on those who have any suggestions which they think would help to solve the problem to state them, a discussion would surely result in some good, even if it did not effect a radical change. I am of the opinion that the proper course to pursue is to see that those who will be architects of the future receive a thorough training in all subjects pertaining to the profession they have chosen, for as soon as our architects are properly qualified all the evils to which architects is now subjected will gradually be removed. But how is this education to be given to students in architecture. I would propose that an architectural association be formed and incorporated, this society to take charge of the training of students in the various branches of architecture, with power to hold examinations and to give diplomas to those who are successful in passing them ; and when this society has got into good working order, that powers be obtained whereby it may be able to prevent any but properly trained and qualified men from practising. Those architects who may be practising when such powers are given to be exempt. The details of this scheme can be considered in the future. I would here remind those, who having read this, will say that it is impossible to obtain the powers named, and who will refer to Great Britain and the United States as countries where such powers have not been obtained, that we live in Canada, a country as far advanced in education, if not further than these countries are, and where rings and special interests do not hold sway. I think that I may affirm without fear of contradiction that those who are striving to promote art will receive encouragement and support from those who are, or may be, in authority.

There are many reasons of greater weight than those I have urged, which might be brought forward. For instance, there is the artistic point of view, which in itself is a sufficient reason why something should be done. I hope some person able to handle that part of the question may be induced to do so.

I will now conclude by giving a quotation from a speech made by Sir Alexander Cockbu n, Lord Chief Justice of England, "Architecture was a science and an art which could not be too highly approciated, or too much admired, and the Institute of Architects, standing upon the confines of art and science, combining both, was one to which every man must look with admiration and honour."

Thanking you for the large amount of space I have occupied in your valuable magazine, I am,

Yours, in hope of an improvement,
C. G. S.

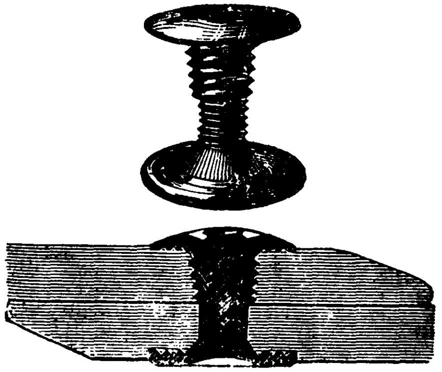
Toronto, Oct. 18th, 1875.

[Our correspondent is in error in stating that this country is as advanced in education as Great Britain or the United States. In the study of fine arts, elegance and taste, we can bear no comparison yet with those countries ; most of our wealthy men in Canada who build fine houses are very deficient in this respect, and that is one reason why architects do not receive that appreciation to which their profession is entitled, and until technical education receives more consideration in our public schools, this will remain so. We fully concur, however, in the main with the views expressed in our correspondent's letter. The difficulty is to get architects, after they sign an agreement, to keep it.—Ed.]

LIME JUICE FOR RHEUMATISM.—In the *Canada Lancet*, Dr. A. H. Chandler calls attention anew to the use of the old remedy, and reports several severe cases in which good results followed its use. Without regard to the condition of the bowels—unless previously mueh constipated—he begins with at least ten ounces of lime juice, increasing rapidly to eighteen or twenty-four per diem—from half an ounce to one ounce or more every hour, with not less than double or treble the quantity of cold water, usually diluted and sweetened to the patient's taste. He finds that even on the second day the amendment is decided, and the disease, in acute cases, more particularly sthenic or asthenic, generally subsides on the fourth or fifth day of treatment. He usually prescribes one grain of opium, with or without lead and tannin, night and morning, in order to restrain the bowels which the juice has a tendency to relax. The effects of this treatment are, he says, rapid diminution of joint swelling, diminished perspiration, steady fall of pulse, which often becomes quite slow, with a slight tendency to syncope, the majority of cases requiring quinine and supporting food about the sixth day. Such vigorous treatment should evidently be undertaken only under the supervision of a competent physician.

PATENT BELT SCREWS.

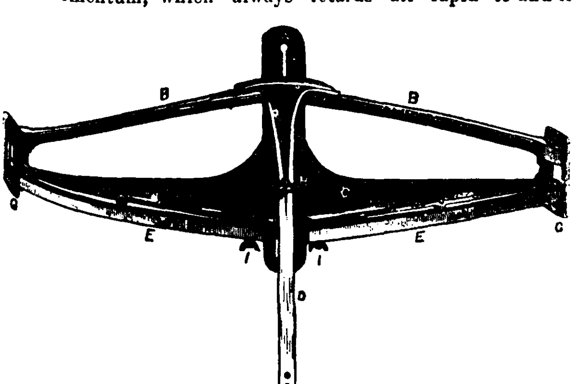
Messrs. Selig, Sonnenthall & Co., of Lambeth Hill, Queen Victoria street, E. C., have just brought out "Sonnenthall's Patent Belt Screws," in which, as will be seen, the nut part is screwed on the outside, instead of being plain. This belt screw consists of two parts, the upper being made of bronze, the lower of steel. The screw is cut with a left-hand thread, so that the tendency of the nut to turn in screwing up only is merely to tighten the screw. Both parts have comparatively large heads, which on their outer surface are slightly rounded, and are provided on their inner surface with circular grooves, thus obtaining a firm grip on the whole surface of the head, and saving the holes in the belt from being drawn out. The upper or bronze nut screw is of a coarse thread cut conically ; it is bored through-



out its length and a fine thread inside forms the nut for the other steel part. This steel screw has under its head a conical enlargement, which serves both to give increased strength to the screw, and to admit of a slot being cut in the head, into which the screw-driver can be inserted. This does not divide the head, and the screw-driver is thus prevented from slipping and scraping on the surface of the belt when fixing the screw. An ordinary screw-driver is sufficient to tighten up the belt screws. They possess the great advantage that, after having screwed the bronze part into the leather belt, which is greatly facilitated by this part being conical, the belts are already united, and the screw cannot drop out or screw back, but after the other part with the left-handed thread has been screwed into it, the whole is drawn tightly together and cannot get loose.

IMPROVED SPRING FOR SCROLL SAWS.

One of the reasons why scroll saws are sometimes unexpectedly fractured is that the spring pulling them upward is not as quickly acting as it should be, caused by its having too much weight and momentum, which always retards all rapid to-and-fro



motions. In the spring represented in the adjoined engraving this defect has been successfully obviated, and the result is a spring which cannot only be applied to jig saws, but to any machine requiring a very quickly acting spring, adjustable to various degrees of tension, and adapted to any size of saw blade. The maker claims that with its use an inferior machine can be made to work well, which is an important fact, as there are many inferior machines in use, which may all be improved by the substitution of this spring in place of the inferior one that renders many of these machines almost worthless, as it is impossible to run them at a great speed without danger of breaking the saw blades. It is claimed for this spring that a scroll saw can be run with it at the rate of 1,000 strokes per minute without the least risk. We therefore advise all who contemplate buying a new jig saw because they are not satisfied with what they have, to try this spring, and attach it to their machine.

In our engraving, the top A is attached to the stand above the table by means of wood screws ; this part is slotted for adjustment to the hight of the stoke, so as to allow for differing lengths of saws. B B are wooden arms, supporting the strap D, to which the saw is attached by means of the hook F ; the top of the strap D has two hooks lapping over the arms B B, which turn on pivots at their outer ends, and rest at G G upon wooden springs E E. The latter rest on fulcrums or bridges, affording a leverage which gives an easy motion to the springs. The movements of these springs are very slight, not over ¼ of an inch to the full stroke of the saw, showing that it is quite safe to run the machine at a very high speed. The strength and stiffness of these springs are regulated by the thumb screw I I, by which they can be easily adjusted to the tension required.

This spring is manufactured by I. R. Joslin, of 91 Liberty street, New York, to whom we are indebted for this illustration

USE OF PHOTOGRAPHY IN WOOD ENGRAVING.

In the practice of the ordinary method of wood engraving the artist whitens the surface of the block and makes his drawing thereon with India ink or pencil. The engraver then cuts upon the drawing, endeavouring to keep in mind the general effect of the original ; but the latter is of course gradually obliterated as the work of cutting proceeds. To this obliteration of the original drawing is probably due a part of that loss of artistic effect in the finished engraving, of which draughtsman are apt to complain.

The facilities offered by photography are now, however, being used by engravers and draughtsman to assist in the production of better engravings. Instead of drawing directly upon the wood, the artist now makes his finished picture upon paper, which is then photographed upon the wood in exact *facsimile ;* the engraver then proceeds to cut the photograph, and during the whole time of cutting he has before him the original paper drawing, to which he may refer for assistance in his endeavor to maintain and reproduce the spirit and feeling of the picture.

New Polygraph.—The latest method for the rapid reproduction of letters, drawings, etc., has been brought out in France, and is made as follows : A plastic mixture, composed of 500 parts (by weight) of white gelatine, 500 parts of glycerine, 50 parts of glucose, 50 parts of white glue, and 350 parts of water, is poured hot into a shallow tin box of suitable size. The ink used for writing or drawing is made by adding to a suitable quantity of water 20 grams of violet aniline and 300 drops of alcohol. The ink is allowed to dry on the paper, which may be of an ordinary quality, and then the written side is laid on the plastic paste and is gently pressed on with the hand. After waiting for a minute the paper is neatly raised, and the writing will be found to have been transferred to the surface of the paste. From this as many as 50 copies can be taken without the aid of of the press. What is left of the ink is carefully washed off by meaans of a warm sponge.

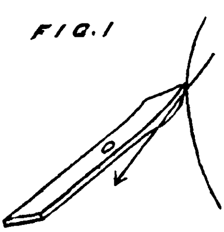
Raisins as a Recuperater.—It is an old story that of the Frenchman who declined to eat raisins or grapes, because he disliked taking his wine in the form of pills ; but now comes Sir Willian Gull, Queen Victoria's physician, who declares it better, in case of fatigue from overwork, to eat raisins than resort to alcohol. In his testimony before the Lord's Commission in London, a few months ago, he affirmed "that instead of flying to alcohol, as many people do when exhausted, they might very well drink water, or they might very well take food ; and they would be very much better without the alcohol." He added, as to the form of food he himself resorts to, "in case of fatigue from overwork, I would say that if I am thus fatigued, my food is very simple ; *I eat the raisins instead of drinking the wine.* For 30 years I have had large experience in this practice. I have recommended it to my personal friends. It is a limited experience, but I believe it is a very good and true experience.

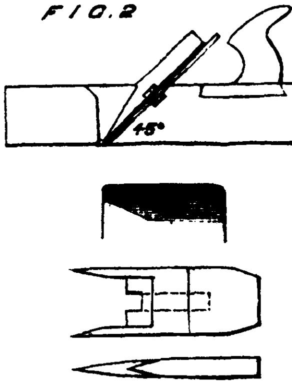
HOW TO MAKE A 6" SCREW-CUTTING LATHE.

Some weeks ago an appeal appeared in the columns of the *English Mechanic*, and as no one seems willing to come forward, I beg to offer my little quota, trusting that my readers will correct me in any mistakes I may make. The lathe, though a thread-worn topic, about which so much has been written, still presents itself, as must be the case, as a simple machine, and the basis of our tools—a machine used in nearly every trade from the potter's wheel to the watchmaker's lathe, and it was with some reluctance I encroached on the editor's good nature to write on this subject. After some consideration I have thought the description throughout of a 6" screw-cutting lathe would be acceptable to most. I will presume at the outset that some knowledge of the use of the hammer and chisel, the file and carpentering tools has been acquired, and that my reader has sufficient time, money, and perseverance to carry out the work *in toto*. It has been my experience to have been for some time engineering tutor in the best and perhaps only establishment of its kind in England, and it was my pleasure to watch several 6" screw-cutting lathes being turned out in a really creditable style; they were supplied with castings, and worked according to the standard working drawings, and it was my duty to tide the makers over their difficulties. Suppose, then, that we are supplied with a full set of working drawings fully dimensioned, and that we have the use of a good lathe, a grindstone, a smith's fire, some carpenters' tools, a drilling machine, and a good firm vise. First of all, after a good look at the general drawing, we must decide if we can make the patterns; if so, the bed and legs should be done first and the two headstocks. Now get some of the best white timber, free of knots and free of any smell of turpentine at the ends, or at all damp, and jack all the dirt off so that you will have your timber handy. Next decide how you will make your pattern, duly considering the thickness and dimensions of your timber, and leave plenty to come off afterwards, not forgetting besides the fact that all patterns should be made an $\frac{1}{8}$in. in the foot larger for iron, and 1-16 in. in the foot larger for brass, as the metal contracts in the sand. The next thing is to plane up the timber, for the purpose of glueing and screwing the pieces together. Should the reader not have been shown how to use the plane, he ought to practise a little first on some odd pieces. First of all, how to grind the plane iron; this must be held square to the grindstone for some time; if you are continually taking it off, either from a little water going down your sleeve or because your arm is tired, you will find your iron all sorts of

FIG. 2

FIG. 1





angles. Beginners generally try to get an edge on quickly, by grinding thus (see Fig. 1), more especially if there is a nick in the edge from having planed over a nail. The edge of the iron should be straight in the middle and the corners just worked off (see Fig. 2.) I am alluding now to the smoothing or finishing plane. Look now at the edge and set it out as far as you want by alternately tapping the wedge to tighten, and the tail end of the plane to loosen the iron. The doubled iron should be screwed home 1-16in. off the edge of the cutting-iron; it turns the shavings up and causes them to break off and not choke the plane. A little wooden pot of tallow should be kept handy, to grease the underneath of the plane, as also to grease saws and wood-screws before they are put in. Now get a couple of bay wood or deal straight edges, and place them thus (see Fig. 3). If they do not look parallel, the surface is twisted, and the first thing to do is to make the two ends parallel; now chalk the straight edge,

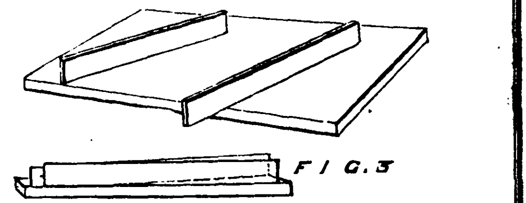


FIG. 3

which will show the lumps which the plane will take off in much the same way as a scraper is used to make a good surface, by spreading the hollows and lumps evenly over the surface. A little extra trouble in making good joints for glueing will be amply repaid by an appearance of solidity in the work so very essential in patterns which have to be carved about so much afterwards. Fig. 4 shows a bench and stop, which can be raised

FIG. 4

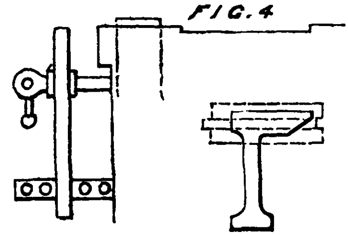
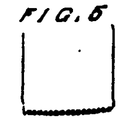
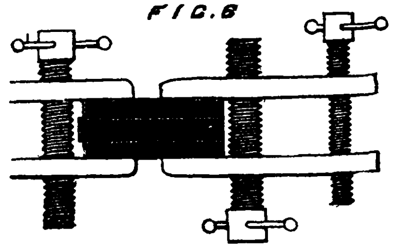


FIG. 5



for any thickness of timber; the vise screws may be iron or wood, and the jaw is kept parallel to the side of the bench by altering the pegs at the bottom. Fig. 4 shows how to build the top part of the lathe-bed with as many layers of wood as the thickness of the timber permits. No wood should be, as a rule, used in patterns that has any black marks of rot in it. When the joints have been planed, they should lie all over quite close, showing no crack, the main object being to exclude atmospheric pressure. Sometimes a rough plane is used (see Fig. 5), but, except in building segments, we do not approve its use, as it sometimes burrs the wood up. The next thing before glueing is to screw them together, looking carefully at the drawing to see that they are put where they can remain, after all the cutting away is done. Now take out the screws and nail one board on the bench, wipe the two surfaces and see that there is no dirt, and put some thin glue on evenly, and get some one to help you work the top piece once or twice over the under piece till they are fast, and wipe off any glue that has oozed out away with a wet rag, in fact, dip the rag in the hot water of the glue-pot. Next bind the two boards

FIG. 6



together with two or three wood clamps (see Fig. 6,) or tack them together till dry. When three layers are glued together the screws may be put in with some grease, the heads being countersunk at least $\frac{1}{4}$in. under the top. We have so far only done what is called joinering; while these pieces are drying get out, for the gap, front end of the lathe, webs, and ends of the lathe-bed, as much timber as will be wanted. The lathe-bed should be cast upside down, as all impurities and blows in casting iron float on the top of the casting, and the surface for the slide-rest should be as hard as possible. It will then be necessary to see what pieces require to be loose for moulding, and what snugs, &c., ribs, or nameplate require to be put on, care being taken to leave $\frac{1}{8}$in. or 3-16 in. for any future machine work.—*English Mechanic.*