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TURNING A CORNER ON THE GILBERT ELEVATED RAILWAY.

One of the problems of elevated railway construction in the narrow streets of cities, which doubtless has suggested itself to most engineers, is the leading of the structure around the corners of blocks, where a curve of very small radius becomes necessary. In order to show how this is accomplished we give the accompanying engraving, representing the turn at the corner of West 3d street and South Fifth avenue, in this city; and to further exhibit the construction of the road we add Figs. 2 and 3 (for which we are indebted to the *Railroad Gazette*), page 178, which show the mode of building adopted on the last mentioned thoroughfare. The distance between the curbs on West 3d street is about 30 feet, while the same distance on South Fifth avenue is about 40 feet. The angle to be turned is of course a right angle. Diagonally across South Fifth avenue, at the intersection of that street with West 3d street, is extended a long girder, reaching, as shown in our engraving, from corner to corner, northwesterly. From the southwest corner extends a cross girder to the middle of the long girder, and from the posts adjacent to that located on the corner extend two other girders placed at an angle. In order to obtain the curve of 90 feet radius, the longitudinal girders take a wide sweep, passing from the middle of the West 3d street structure over to the northerly side of that street, then turning almost tangent to the side of the inner arc, and then crossing over to the easterly side of South Fifth avenue before bending westerly again to regain the center of the thoroughfare.

The method of construction adopted on South Fifth avenue, as shown in Figs. 2 and 3 (page 178), resembles that already described as in use on Sixth avenue, but the posts are placed on the curbstones, and the cross girders span the whole width of the carriage way. The cross girders at the columns are forty feet long and three feet six inches deep. The top and bottom chords consist of two angles four inches by four inches by half an inch, and a plate sixteen inches wide and forty feet long, reinforced by other plates. The web consists of two plates a quarter of an inch thick, stiffened by angles. The intermediate girders, track stringers, etc., are the same as on Sixth avenue.

The structure, in passing through the streets above referred to, becomes more injurious to property than at any other portion of its route. In West 3d street it incloses the entire carriage way, already narrow, cutting off light and air from the lower stories of the buildings, while the upper ones will be rendered almost uninhabitable by the constant noise of the trains passing within a few feet of the windows. The case is not much better on South Fifth avenue, one of the largest streets in the city, which now presents the aspect of a gigantic tunnel.

A Plan to Utilize a Desert.

Throughout northern Africa and the drier portions of western and central Asia the date is the staff of life to millions. The date tree flourishes where agriculture is impossible, and is the source of large profit as well as common sustenance wherever it is cultivated.

It is now proposed by our Commissioner of Agriculture at Washington to make the date a staple American product also. The center of this new enterprise is to be the now useless desert regions of southern California and Arizona. Seed has been procured in Egypt and successfully planted, and more is coming. A recent letter from General Stone, an American officer on the staff of the Khedive, speaks very encouragingly of the project. He says: "Had I known that you desired to plant the date tree in large numbers, the quantity sent would have been very much greater, and I have now given orders for the collection of several thousand seeds in each of the northern districts where the best dates are grown.

"The provinces of Charkyeh, Garbieh, and Dakalieh, as well as the district of Roseta, all produce in their northern portions excellent varieties of dates, the cultivation of which is very profitable.

"From what I have seen of the date producing regions in this part of the world, and from what I know of the Desert of the Colorado between Carisa Creek and Fort Yuma, I am inclined to believe that the greater portion of the latter region can be made productive and very valuable by making plantations of the date palm. This tree not only does not require much water, but much water is prejudicial to it, and the climate of the Colorado Desert is singularly similar to that of some of the best date producing districts here. In any case I feel assured that all the New River portion of the Colorado Desert would grow the date tree without difficulty."

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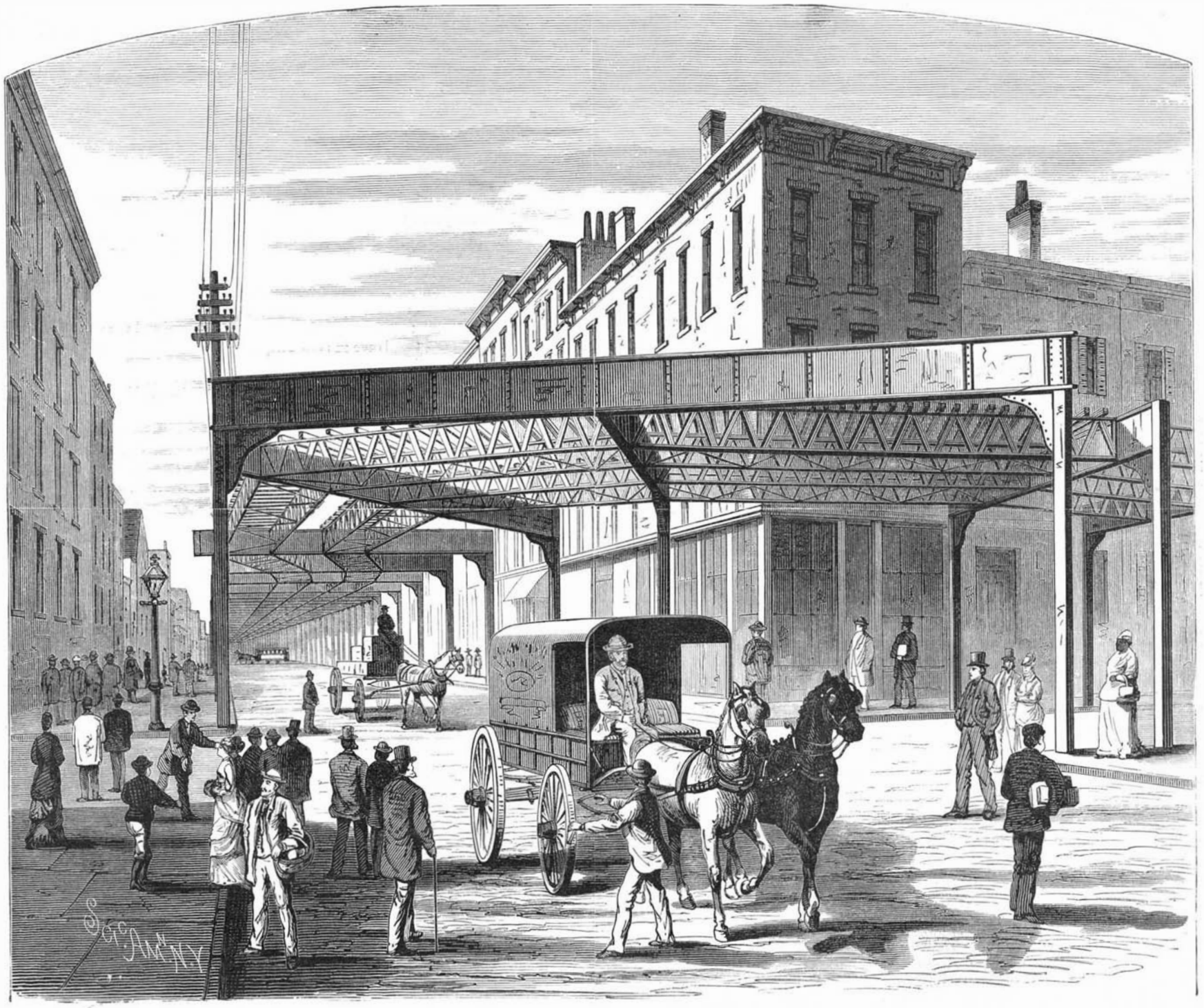

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IMPROVEMENTS WANTED IN WORKING GOLD AND SILVER ORES.

But few of the writers who treat of the working of gold and silver ores do more than describe the practiced methods, without attempting to criticise them or to suggest possible improvements; and especially is but little stress laid by any of them upon a point which seems to us to constitute one of the most necessary factors to successful working. We allude to fine comminution or pulverization of the ores.

The discovery and consequent working of our gold and silver mines introduced to us the prevailing methods and machinery of countries where cheap labor and lack of competition have always restrained inventive talent and conserved traditional ideas. In our ignorance and inexperience we were forced to accept and adopt these unsuitable guides, and, the choice being apparently justified by some isolated successes, the so-called "practical miners" seemed for years to be committed to a system of defence which gave no quarter to new ideas and improvements.

In evidence, however, that education, observation, and experience are gradually becoming substituted for the old order of things, we now find among mine managers a hopeful and growing belief that the science of metallurgy has not reached its limits; and, not seldom, a modesty of opinion which is most promising of progress and success.

It may not then be premature to inquire whether the stamps and pans of the present epoch satisfy the conditions for which they were intended. Because they are of simple construction and require but little intelligence or care on the part of superintendent or workmen, they have, naturally, maintained a preference over all other machines designed for the same work, a preference which has been strengthened by their successful use in mines of exceptional richness and celebrity.

And yet it may be fairly questioned whether experience has not demonstrated that a very frequent if not a principal cause of non-success has not been because these machines have failed to comminute the ore to the fineness requisite for an economical separation of the precious metals.

It is stated that some coarse gold ores have yielded nearly their assay value when reduced only fine enough to pass through a 10 mesh sieve, or 100 holes to the square inch.

A few years since preference was given to the 40 mesh sieve or screen for stamps, =1,600 holes per square inch, in successful mines. Now the 60 mesh is generally advocated, an evidence of progression which is very encouraging. From the stamps the ore, gold or silver, goes to the amalgamating pan or to the chlorinator. In the pans it is still further comminuted while being ground or rubbed into the mercury. This further comminution, slight as it is, as is apparent on an examination of the "tailings," is effected, however, at a most disproportionate expense; the cost of the wear on the pans being three or four times greater than on the stamps, for in grinding or rubbing the hard quartz or other stone has the advantage of iron. But the "tailings" still are sand, not powder, and these particles of sand may, and in many instances do, hold enveloped smaller particles of the precious metals which further comminution would have exposed to the action of the quicksilver.

The most approved writers on the subject agree that when the ores are in the most finely divided state the most satisfactory results are obtained in chlorination. But this assertion is not made when amalgamating in pans is treated of, because the pan process is a very imperfect one, and is not adapted to finely powdered ores.

Phillips says that in amalgamating the pan process gives better results than any other (naturally enough where stamps are used), and yet that the yield of the metal rarely amounts to 75 per cent, and that the average scarcely exceeds 65 per cent, and that the "tailings" from the pan process, after being exposed to the atmosphere for a few months (becoming further disintegrated), may sometimes be again advantageously worked over, thus increasing the total product to 85 per cent.

Küstel says that "not more than 50 to 60 per cent of the silver is ever obtained by this process; if it is higher it is owing to the presence of gold or silver glance." "The result of the operations depends considerably upon effecting a more or less perfect grinding in the pans."

The size of the apertures in the stamp grating or sieves, says Phillips, varies to a certain extent in conformity with the particular views of the superintendent of the mill on that subject.

It seems evident, then, that much finer comminution—say through a 90 or 100 mesh—would, in many instances, add 20 to 30 per cent to the product of mines now profitably worked, and would assure profits to many others which have been worked at a loss. But as the combination of stamps and pans cannot effect this, and as, even if the stamps were effective, the pans could not work such fine powder successfully, other machines must, in time, supplant them.

Stamps and pans are indispensable to each other, but stamps cannot economically make a fine powder of the ore so that all the metal shall be liberated from the matrix, nor can the pans successfully manipulate anything finer than sand. Both a new comminutor and a new amalgamator are needed.

It seems to us that the first principle of successful working is a thorough separation of the metal from its envelope, and, next, a presentation of the metal to the quicksilver without the rubbing and grinding which create "flouring" and "slimes."

WILL OUR MOON EVER RISE IN THE WEST?

When the periods of Encke's comet were found to be shortening it was suggested, by way of explanation, that the cause might be some appreciable resistance to the comet's motion by the luminiferous ether, it being one of the paradoxes of astronomy that resistance must cause a planet's motion to be accelerated. But this explanation was open to two serious objections: there was no other occasion for suspecting such action on the part of the luminiferous ether, and subsequent observations and computations showed that the quickening of the comet's motion was not uniform. In some of its periodic revolutions the velocity of the comet was accelerated, in others no acceleration appeared. Obviously some cause acting irregularly is at the bottom of the puzzle.

When it was discovered that the inner moon of Mars had an anomalously rapid motion, revolving around its primary three times while the planet revolved on its axis once, the puzzle rose to a problem of the most serious magnitude. Such a flat contradiction of what should have been expected, according to the nebular hypothesis, would be little less than fatal to that hypothesis unless it should appear that some cause had been acting with special force to shorten the radius of the moon's orbit and so accelerate its motion.

The most reasonable explanation of the anomaly yet offered is that of Professor Doolittle, of the United States Coast Survey; and his suggestion answers equally well for Encke's comet. Professor Doolittle rejects the hypothesis of resistance on the part of the luminiferous ether, since that substance, whatever it may be, is so different from ordinary matter that it is scarcely proper to say what is credible or incredible in regard to it. There is, however, in the interplanetary spaces a well known form of matter, in quantity presumably sufficient to produce the effects observed, namely, the matter of aërolites or shooting stars. It is well known that a larger number of these bodies strike the earth in front than in the rear, and it is quite possible that the impact of these bodies may cause resistance to planetary bodies sufficient to shorten their radii and accelerate their velocities. This action would tend to increase the relative velocity of satellites in three ways: (1) by striking the satellite and increasing its velocity by making it revolve in a smaller orbit; (2) by striking the primary, and thus increasing its mass and its attraction of the satellite; (3) by increasing the mass of the primary, and thereby consuming its original velocity of rotation through the taking up of this addition to its mass. However slight may be the average annual effect thus produced, any assignable diminution of radius and increase of velocity is thus attainable in a sufficient number of years.

By reason of its going faster than the surface of its primary the inner moon of Mars must, to an inhabitant of that planet, rise in the west and set in the east. And to this condition all the planets and satellites are destined to come if the causes now in operation continue to operate as in the past. Some curious changes may fall to the lot of our earth if the meteoric rain is not abated. The time will surely come when our moon, too, will rise in the west and set in the east. But before that there must be a period, perhaps very long, when the moon will revolve around the earth just once a day, and consequently hold an unvarying position in the sky, visible to half the world, invisible to the rest. Possibly during this period it may happen to fall in the shadow of the earth, and so suffer eclipses of long duration. Or it may chance to fall between the earth and the sun and be invisible save in slow eclipses of the earth's chief source of light and heat.

All this assuming that the meteoric storm goes on as heretofore. But Professor Doolittle suggests that after all the minor moon of Mars may continue as now an exception. It is known that aërolites belong largely, perhaps wholly, to the solar system. If so, their number must be finite and exhaustible—may be they are already nearly all picked up. Such being the case the acceleration of planetary motions through their action must gradually come to an end. This danger to the stability of the solar system will cease; and though our remote descendants will miss the sight of a moon rising in the west, their lot will not be without its compensations.

WORK AHEAD FOR INVENTORS.

It has been a favorite dogma with speculative philosophers that the surest road to human improvement and happiness lies through a limiting of man's wants. All our troubles and most of our crimes, they tell us, arise from the multiplicity of our artificial needs and desires—from our complicating life with innumerable inventions.

A practical philosopher, though a transcendentalist, has a truer conception of the order of human progress and the conditions of human happiness. The hope of the future rests not on Arcadian simplicity—an impossible civilization of bare-backed and empty handed philosophers—but on the continued conquest of the materials and forces of nature, and the widening of all men's wants, until every possibility of art and nature shall be made tributary to everyday life.

Emerson, in his latest utterance, "The Future of our Republic," takes this standpoint, and hints of the predominant part to be played by inventors in the great drama of the future. In the effort to meet one want a thousand others may be created and satisfied; and any one of these may mark an enormous advance in the progress of civilization and the elevation of human existence.

"Our modern needs," says Emerson, "stand on a few

staples. In our war one of these was exaggerated in importance—cotton. And what is cotton? One plant out of some two hundred thousand known to botanists, vastly the largest part of which are reckoned weeds. And what is a weed? A plant whose virtues have not yet been discovered. Yet every one of the two hundred thousand plants probably is yet to be of utility in the arts, as Bacchus of the vine, Ceres of the wheat. As Arkwright and Whitney were the demigods of cotton, so in time there will yet be an invention to every plant. There is not a property in nature but a mind is born to seek and find it. There is not a plant in the whole magazine of material nature that cannot be made a power in the hands of thinking men; and every new application is equivalent to a new material."

There is no danger that the inventor will ever lack material or opportunity, or that the profession will ever be overcrowded. And we believe that, in the long run, the common wisdom of civilized men will never suffer these, the highest benefactors of their kind, to be robbed of the fruits of their labors, or unfairly weighted in their struggle for material recompense.

THE NEW YORK HERALD'S BEST WORK.

If asked to name the most notable illustration of modern newspaper enterprise we should mention—not the achievements of Abyssinian or Bulgarian war correspondents, not the relief of Livingstone, not the survey of the Equatorial Lakes of Africa, not Stanley's conquest of the Congo; no, nor even the *Herald's* latest project to attack the north pole. We should name a service to humanity greater than any of these, and one less liable to suspicion as to its motives; that is, the work of the *Herald's* Weather Bureau. In this we find not only the noblest exhibition yet made of newspaper enterprise, but one of the most significant achievements in modern practical science.

A few days ago the *Herald* gave a review of the first year's work of its weather service, with a complete list of the warnings and predictions transmitted by cable to Europe, with the manner of their fulfillment.

The first warning issued was dated February 14, 1877, predicting the arrival of a storm on the European coast five days later. The prediction was fulfilled to the letter. During the ensuing three months eleven more warnings were cabled, and each was justified by the event. During May, June, and July, sixteen warnings were sent, and but one proved out of time. From August, 1877, to January, 1878, out of nineteen predictions cabled, seventeen were completely fulfilled, one was generally fulfilled, and one failed, the failure being due to a miscalculation of the progress of a slow cyclonic storm from the southwest. Thus out of forty-six warnings only two wholly failed of complete or partial fulfillment. Of the forty-four successes thirty-one were correct in every particular, eight were correct in general, and five were partly fulfilled by the arrival of storms on sections of the European coasts, but not affecting other sections to which their influence was believed likely to extend. It certainly speaks well for the truth both of the observations and the theory on which these predictions were made that over ninety-five per cent of them were fulfilled, and as nothing succeeds like success, it is not surprising that the warnings, which were received at first with derision, are now published regularly in the leading commercial and agricultural papers of England and France, and also find a place in the official International Bulletins of the Observatories of Paris and Brussels.

The storm movements on which the warnings are based are few and simple. Except in the Mediterranean regions the weather of the countries to the east of us is chiefly determined by the weather of the American continent, and as the telegraph outspeeds the wind the storms approaching the European coast can usually be foretold days in advance of their arrival. Nearly every storm that strikes the Norwegian, British, French, and Spanish coasts has affected in its course the weather of some portion of the United States or Canada. These storms generally strike the coasts northward of the Bay of Biscay, traveling in a northeasterly, easterly, or southeasterly direction. Those which come from the southwestward are usually, but not exclusively, of equatorial origin, or pass over the American continent by the southward route of the gulf from the Pacific Ocean. Cyclonic storms, such as the one which devastated southern Texas in 1875, take very direct courses toward Europe from the southwest. But instances are by no means rare of storms that have passed over the lake region from the northwestern territory and the Pacific, being carried southeastward to comparatively low latitudes, and then northeastward so as to reach Europe from the southwest.

After storms reach the European coast they pass either over Norway toward Northern and Central Russia, or eastward over Denmark and the Baltic to Northern Germany or Southern Russia, or else southeastward over the English Channel, the Netherlands, and France to Central Europe and the regions of the Danube Valley and Asia Minor. Nearly all the storms that affected the belligerents in Bulgaria during the recent campaign in Turkey were of the latter class.

After a protracted comparison of weather reports on both sides of the Atlantic, supplemented by observations of ship captains on the Atlantic and the Gulf, the *Herald* Bureau was able to deduce the laws of Atlantic storm movements on which its weather predictions and European warnings are based. From their scientific, not less than their commercial and agricultural value, these warnings are among the most notable achievements of the age.

THE HARVEST OF THE SEA.

At the meeting of the American Fish Culturists' Association, Professor G. B. Good gave statistics showing that the fisheries of this country yielded in 1876 a grand total of nearly thirteen hundred million pounds, valued at over $75,000,000. First in prominence were the oyster fisheries, the products of which were valued at $50,000,000. When it is remembered that to a large extent the oyster crop depends on artificial planting and systematic cultivation, the suggestion that the government ought to take proper steps to secure to the owners of oyster grounds a defensible right to the products thereof seems no more than just and reasonable. It is something new, to be sure, to grant individual title to land below low water mark; but since industry has given to such land, over large areas, a value equal to that of any dry land, and since the cultivation of such reclaimed sea-bed adds enormously to the common food supply, it would be but simple justice to put the sea farmer on the same footing before the law as the upland farmer. The legal right of an oyster planter to the ground he cultivates and the crop he produces should be put beyond dispute; and its wholesale invasion, now so common wherever oyster cultivation has been attempted, should be made impossible. It is no less than a national disgrace that an industry so honorable and useful should be practically outlawed.

Compared with the oyster crop other fisheries are of small value. The cod fisheries yielded in 1876, according to Professor Good's figures, $4,825,540; the whale, $2,841,000; the mackerel, $2,375,262; the menhaden, $1,657,790. The yield of the Great Lakes is valued at $1,600,000. Of river fisheries (shad, salmon, etc.) no estimate is given. The lobster catch is valued at $1,000,000. Of the various other shell fish (clams, scallops, etc.) no mention is made. The number of vessels employed in our fisheries is set down as 2,188, with a tonnage of 80,000, clearly an underestimate.

PATENT OFFICE MODELS.

The matter of providing accommodations for models in reconstructing the burned portions of the Patent Office will shortly come before Congress. Suitable apartments for the storage of those already on hand will have to be arranged, and some provision should also be made for the large annual increase in their numbers, which before many years will cause the room now capable of being rendered available to be insufficient. The new quarters will, of course, have to be constructed with especial view to their purpose, and so built as to protect their contents from the recurrence of such disasters as the recent fire. This will involve expenses and require consideration, which will be unnecessary if the obligatory furnishing of models in all cases is to be done away with, and therefore the present is a fitting time for the careful review of the arguments advanced in favor of this proceeding.

We recently gave a brief summary of Mr. H. Howson's very able pamphlet on the subject, and we now recur to the same in order to examine more fully some of the principal considerations which he suggests. Referring to the anomalous state of affairs now existing under the present system, he says: "An examiner, in acting on an application for a patent, has before him a specification and drawing, which he interprets by the light of a model; the application is allowed, and the patent goes out to be interpreted by the public without the aid of the model, the latter constituting no part of the patent." Hence it is argued that a specification and drawing are all that is necessary to afford an examiner a clear idea of the subject matter, and when these means fail to do so, it is certain that they are not in a proper condition to go before the public in the shape of a patent. Again, it is believed that the knowledge on the part of inventors, that if an invention is not set forth with proper clearness and exactness a model will be called for, will tend to render the specifications and drawings more accurate and comprehensible.

Whether the furnishing of a model be regarded in the light of a penalty or otherwise, it is certain that the removal of the obligation as it now stands will be a great relief to inventors. Mr. Howson states that the yearly tax from this cause cannot be less than $250,000, and he points out, as we have frequently already done, how onerous an imposition this becomes when the circumstances of the inventor, as often is the case, are straitened. Where a tax is oppressive and at the same time unnecessary it can have but one effect, and that is repression, and it is a legitimate conclusion consequently that many valuable inventions are "thus smothered in their infancy."

The same point which Mr. Howson makes as regards inventors preparing their papers in better manner because of the absence of models, he adduces with greater emphasis with reference to patent solicitors, and he asserts with much truth that these practitioners should not need models to obtain a clear comprehension of inventions committed to them, but that they should be able to take their clients' rough sketches and ideas and put them in proper and complete form. "A patent," he says, "should be simply a lesson, by which any member of the community familiar with the art to which it relates may acquire a positive knowledge of the thing patented, with the least possible trouble." Elaborate working drawings, therefore, should not find place in the patent; but a similar course should be adopted to that taken by scientific and technical journals in rendering their readers conversant with new and improved devices. Perspective drawings might, it is true, cost more, but their expense would be less than that of models, while the fact that inventors are constantly availing themselves of the former means of elucidation in presenting their devices in a business way to the public, plainly indicates their efficiency.

A large portion of Mr. Howson's argument is devoted to the elaboration of these views, and we commend it to the attentive perusal of inventors. He suggests as a corollary to his demonstration the opinion that the presence of a model must in some measure react unfavorably upon the preparation of drawings and specifications, owing to the fact that these are apt to be slighted and dependence placed upon the model to supply deficiencies. It would hardly be justifiable to postulate this as a rule, although it is an open possibility. Still, the argument may be conceded in so far as it reaches the conclusion that the abolition of the model will compel the writer of specifications "to exercise patience and forbearance in discovering the main points of the invention, and the consequence is that more brains will be put into the specification than if he had a model."

Mr. Howson's other points are, that the constant increase in the number of models will in course of time necessitate the provision of very extensive accommodations for them; that, as a rule, models fail to represent accurately the machines, etc., to which they relate; and that when collected, as at present, they do not furnish the "great museum of national industry" which some suppose. He further points out the dangers of fraud entering into attempts at reissues of patents on the models, and offers some good suggestions as to how a really valuable national industrial museum might be founded upon properly made models contributed voluntarily by patentees. To some of these topics we shall recur in another article.

CLOTHES MOTHS.

BY PROFESSOR C. V. RILEY.

This name includes several distinct but similar species of minute moths belonging to the family *Tineidæ*, which, in their larval state, are very destructive to woolen goods, fur, hair, and similar substances. Among them may be mentioned the clothes moth (*Tinea vestianella*), the carpet moth (*Tinea tapetzella*), the fur moth (*T. pellionella*), and the hair moth (*Tinea crinella*). These tineans have slender bodies and lanceolate, deeply fringed wings that expand $\frac{6}{10}$ or $\frac{8}{10}$ of an inch. The antennæ and palpi are short and thread-like, and there is a thick orange or brown tuft on the forehead. The colors range from buff to drab and dark gray. The eggs are laid in May and June (the moth dying immediately afterward), and hatch out in fifteen days. The young worms at once proceed to work, gnawing the substances within their reach and covering themselves with the fragments, which they shape into hollow rolls and line with silk. These rolls are by some carried on their backs as they move along, and by others fastened to the substance they are feeding upon; and they are enlarged from time to time by additions to the open extremities and by portions let into the sides, which are split open for this purpose. In such ambush the worms carry on their work of destruction through the summer; rest, in seeming torpor, during the winter; and change to chrysalids early in the spring. They transform again in twenty days, and issue from their shelter as winged moths, to fly about in the evening till they have paired and are ready to lay eggs. Then follows an invasion of dark closets, chests, and drawers, edges of carpets, folds of curtains, and hanging garments, and the foundation of a new colony is swiftly laid.

The early days of June should herald vigorous and exterminating warfare against these subtle pests. Closets, wardrobes, all receptacles for clothing, should be emptied and laid open, their contents thoroughly exposed to light and air, and well brushed and shaken before being replaced. In old houses much infested with moths, all cracks in floors, wainscots, shelves, or furniture should be brushed over with spirits of turpentine. Camphor or tobacco should be placed among all garments, furs, plumes, etc., when laid aside for the summer. To secure cloth linings of carriages from the attacks of moths, sponge them on both sides with a solution of corrosive sublimate of mercury in alcohol, made just strong enough not to leave a white mark on a black feather. Moths may be killed by fumigating the article containing them with tobacco or sulphur, or by putting it, if practicable, into an oven heated to about 150° Fah.

American Isinglass.

The best quality of American isinglass is made from the sounds of the hake. The crude material is collected during the summer and autumn, coming from Maine, New Brunswick, Nova Scotia, and Prince Edward's Island. The conversion of the crude material into the mercantile article takes place in winter. A low temperature is necessary, in order to turn out by machinery the fine ribbons of isinglass, and ice-water passes through the rolls. The total product is about 250,000 pounds. Besides the use of isinglass for fining beer, etc., it is employed as a dressing or glaze for straw goods in the United States.

A BETTER plan for improving the aroma of butter, in use in many parts of Switzerland noted for good milk and fine butter, is as follows: The milk, as soon as it is drawn, and while yet warm, is filtered through a sprig of washed fir tips, the stem of which is inserted loosely and upright in the hole of the funnel. The milk deposits hairs, skins, clots, or gelatinous sliminess on the leaves. It has imparted to it a most agreeable odor, and does not readily turn sour. A fresh sprig should be used each time.

THE STEAM BOILER EXPLOSION COMMISSION.

The President has recently sent to Congress two reports of the Commission appointed to inquire into the cause of steam boiler explosions. One of these was written and sent to the President just previous to the change of administration, but owing probably to the excitement attending the executive office at that time the report failed to reach its destination, or was overlooked somehow, and the Commission therefore forwarded a second copy of their report with that for the year ending December 31, 1877.

From these reports we learn that nearly three years have been spent in making and perfecting certain electrical instruments, by which the commission, it is said, will be able to know, at a safe distance from the boiler being experimented with, the exact condition of the water within it, as to its close contact with all parts of the heated surfaces, the exact temperature of the water and of the steam in all parts of the boiler, and also by the use of the telephone, as recently modified by the commission to adapt it to the purpose, to hear at a safe distance the sounds made by alteration of form, and by the slipping or the breaking of the stays or of the plates of the boiler. The instruments heretofore used, as stated in previous reports, proved altogether unreliable. The commission had procured all the instruments that gave the most promise, both American and foreign; but it was found impossible to obtain with them the desired knowledge of conditions within the boiler which the commission desired to have, and thought necessary to know, before a satisfactory answer could be given to the questions it was the duty of the commission to answer. The most important of these were: First, the condition of the water within the boiler as to its contact with the surfaces exposed to the action of the fire, as to its close contact or otherwise; and second, the condition of the water as to its temperature, whether it has the temperature due to the pressure or otherwise.

It has long been known, from the experiments of Leidenfrost, Klaproth, and others, that when metallic surfaces are raised to certain elevated temperatures water will not remain in close contact with them, the contact being prevented, as Professor Tyndall says, "by the recoil of molecular projectiles discharged from the water next the heated surfaces."

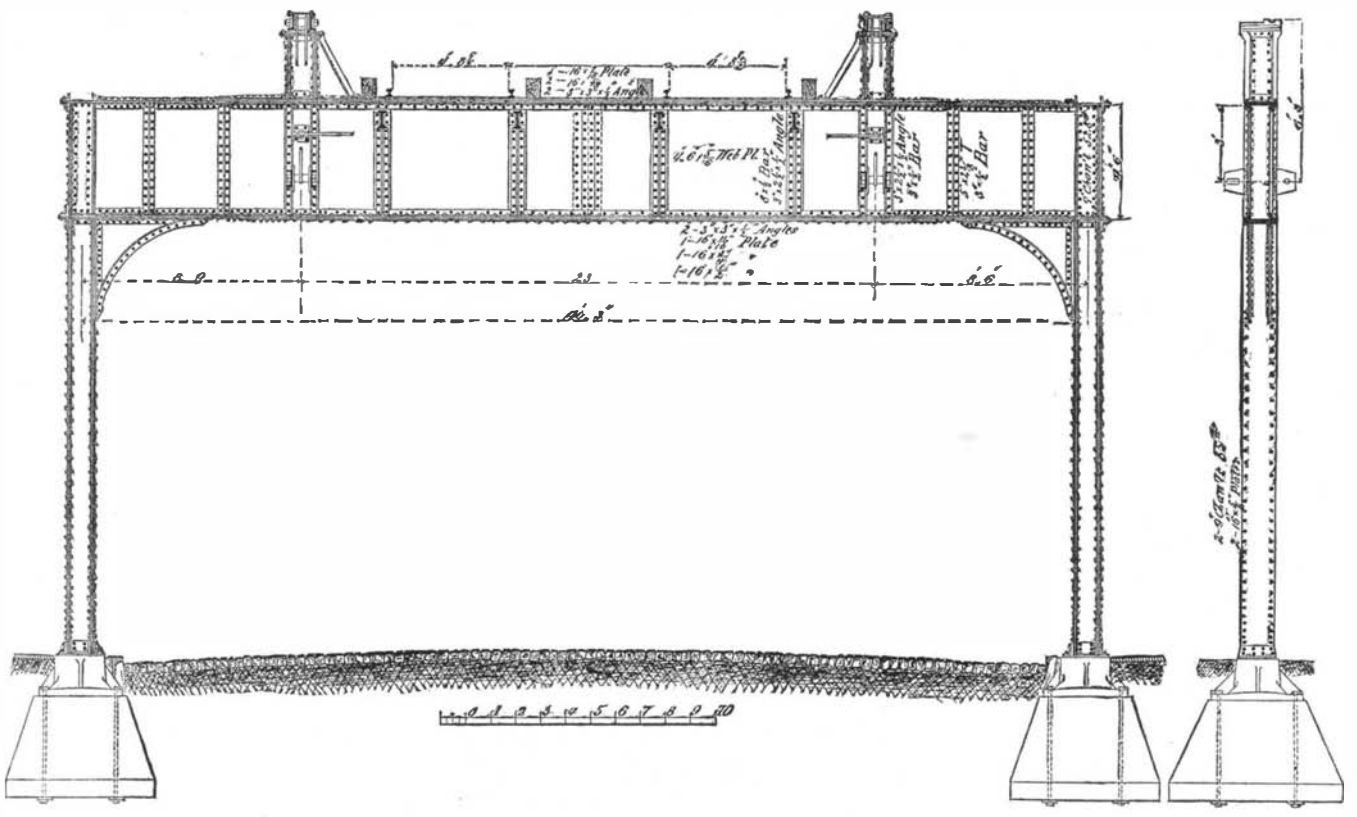
A committee of the Franklin Institute who had been investigating this matter found that when iron surfaces, say of a steam boiler, for instance, were raised to a temperature of about 400° Fah., the repulsion of the water was perfect. These experiments were made with small quantities of water, at atmospheric pressure, and it was supposed that pressure would tend to raise the temperature of perfect repulsion; but experiments made since those of the Franklin Institute seem to show that pressure alone does not raise the temperature of perfect repulsion, but that this matter is governed largely by the amount or strength of the circulation within the boiler.

In relation to the temperature of the water within the boiler, the experiments of Magnus, Donny, Dufour, and others, show that water may be raised to a temperature much above that due the pressure without boiling, and that when under these circumstances ebullition commences, the excess of heat above that due the pressure is given off explosively.

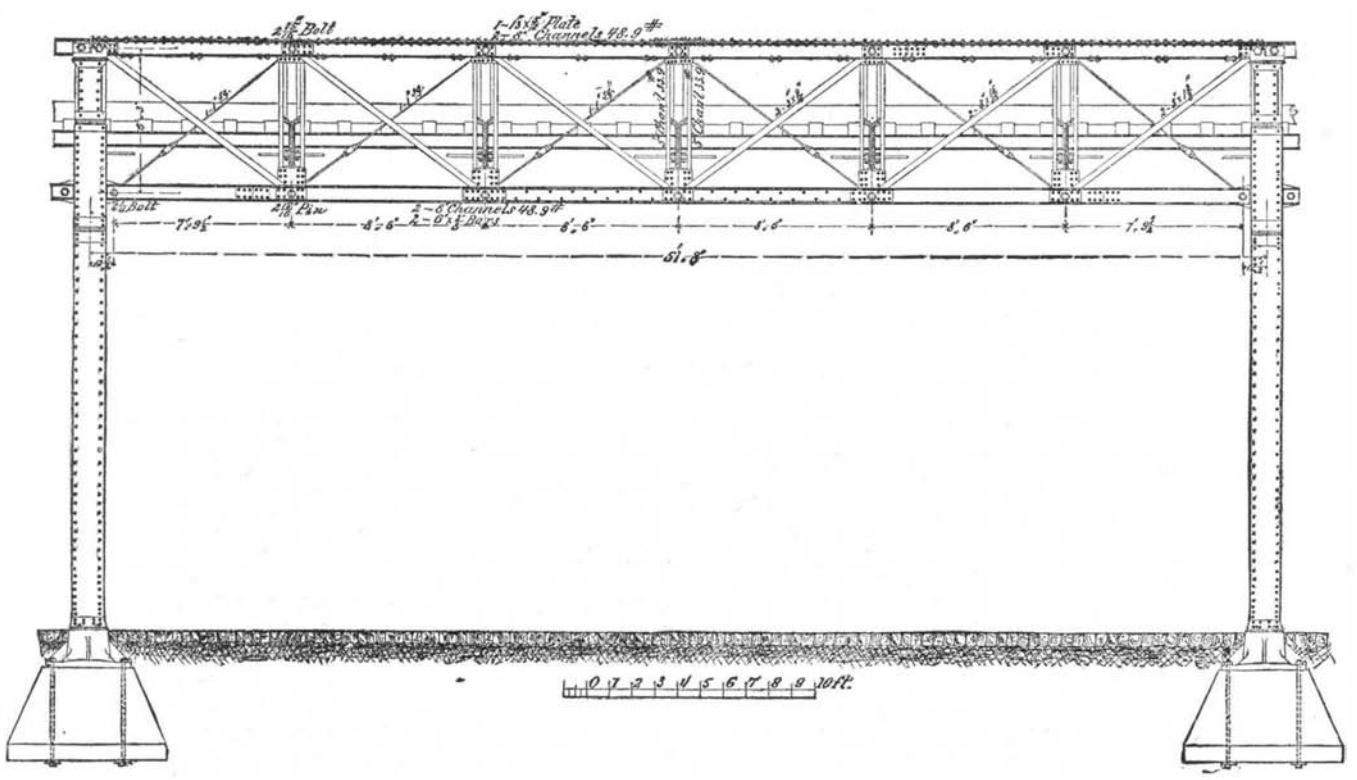
Dufour's experiments tend to show that solid matter, when present in water within a steam boiler, soon parts with its air, so that it does not prevent the abnormal heating of the water, although it has been supposed by many that the contrary was the case.

As it is believed by many investigators, Professor Tyndall among others, that these conditions of the water may cause a large proportion of the explosions that occur, the commission were of the opinion that experiments for learning the causes of steam boiler explosions, without instruments to show whether or not all parts of the boiler exposed to the action of the fire are in close contact with the water in the boiler, or to show the temperature of the water within the boiler, would be far from conclusive, to say the least, and the commission therefore decided to make no more experiments with the large boilers until suitable instruments had been made, as it seemed clear that the information to procure which the commission had been created could not be obtained by the bursting of any number of steam boilers, nor by the making of any number of experiments, without such instruments. The commission accordingly proceeded to devise and construct such instruments, and were just about to recommence their observations and experiments with their assistance when the decision of the Secretary of the Treasury was made that the unexpended balance of the appropriation (some $4,000) must be covered into the Treasury, so that nothing could be done with the instruments, although ready for operations.

The instruments, ground, boilers, tools, apparatus, etc., at Cambridge, Sandy Hook, and Pittsburgh are in charge of watchmen, who are serving without present pay in hopes that the balance covered into the Treasury may be re-appropriated. The commission ask that this may be done, and as the rent of grounds and the wages of the watchmen above referred to will probably require a large portion of the unexpended balance, a second appropriation of $30,000 is asked for, in order that all needed preparation for the resumption of experiments on boilers may be made as soon as the weather is suitable. As so much money has been spent in preparing for experiments, it would hardly seem wise to drop further tests at this stage; but it would be only common prudence to investigate the manner in which the large amount heretofore spent has been used, and then if a satisfactory showing of the expenditures is made it will be tolerably good evidence of the wisdom of making a second appropriation.



GILBERT ELEVATED RAILWAY.—Fig. 2.---[See first page.]



GILBERT ELEVATED RAILWAY.—Fig. 3.

Deepening without Digging.

One of our mine owners recently contracted with a couple of brawny miners to sink a shaft on his claim to the depth of 100 feet. The men went to work with a vim, and at the end of a month reported the work completed and ready for inspection. The gentleman had furnished them with a rope 100 feet long for hoisting purposes, but, to have a sure thing on the measure, he took along a tape line. On arriving at the shaft, one of the miners descended, and all of the rope reeled off of the windlass, proving that it was 100 feet deep; but to make assurance doubly sure, he fastened a stone to the end of his tape line and let it down until it paid out the same number of feet. That satisfied him, and he paid the men $500 for their month's labor. They left for Grass Valley, Cal., and a week afterward the owner again visited the location, and made the singular discovery that the shaft had shrunk 25 feet and was only 75 feet deep. The rope had also shortened the same amount, but as there was no interested party down in the shaft to reel out 25 feet on the tape line, that article held out. Now he says that "for ways that are dark and tricks that are vain, these miners were peculiar." He figures his loss at $125 on the 25 feet, and the price of 25 feet of brand new rope, cut off and thrown away. The boys did not work exactly with the "Golden Rule." The next men that try that game will probably listen to the old refrain, "Oh! not for Joe!"—*Eureka Sentinel.*

Reagent for Alcohol.

The reagent is a solution of nitrate of mercury obtained by treating the metal with a suitable proportion of nitric acid of mean strength. The action of this acid nitrate upon ethylic alcohol is rapid. If a little ammonia is added to the mixture after the reaction a black precipitate is obtained, the more intense the greater the proportion of alcohol present. Methylic alcohol and other analogous liquids behave quite differently, and do not give a black precipitate with ammonia.—*M. Jacquemart.*

GERMANY takes the third place in Europe as a producer of wool, ranking after Great Britain and Ireland, which produce about 1,360,000 cwts., annually, and Russia, the yield of which is 1,178,000 cwts The production of France about equals that of Germany, being 618,000 cwts. Spain stands on about the same level, her crop being 570,000 cwts.

ASTRONOMICAL NOTES.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, March 23, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Mercury sets	6 23 eve.	Saturn rises	5 52 mo.
Venus rises	4 12 mo.	Uranus in meridian	9 48 eve.
Mars sets	11 16 eve.	Uranus sets	4 40 mo.
Jupiter rises	3 25 mo.	Neptune sets	8 54 eve.

FIRST MAGNITUDE STARS.

	H.M.		H.M.
Antares rises	11 56 eve.	7 stars (cluster) set	11 03 eve.
Spica rises	7 50 eve.	Rigel sets	10 33 eve.
Altair rises	1 13 mo.	Capella sets	3 14 mo.
Vega rises	9 33 eve.	Betelgeuse sets	0 12 mo.
Deneb rises	10 36 eve.	Sirius in meridian	6 34 eve.
Algol (2d-4th mag.var.) sets	0 07 mo.	Regulus in meridian	9 56 eve.
Aldebaran sets	11 21 eve.	Procyon in meridian	7 27 eve.
Alpheratz sets	7 47 eve.	Arcturus in meridian	2 07 mo.

REMARKS.

Mercury sets 7m. after, and Saturn rises 7m. before the sun, hence both are invisible. Venus is brightest March 28, her phase at that time being in form that of a crescent. The moon will pass within 2½ times her apparent diameter of Jupiter March 27, in the morning. Jupiter's first satellite passes into an eclipse March 21, 4h. 46m. morning. The third issues from behind the planet March 23, 4h. 37m. morning. The first begins a transit across the planet's disk March 29, 5h. 9m. morning.

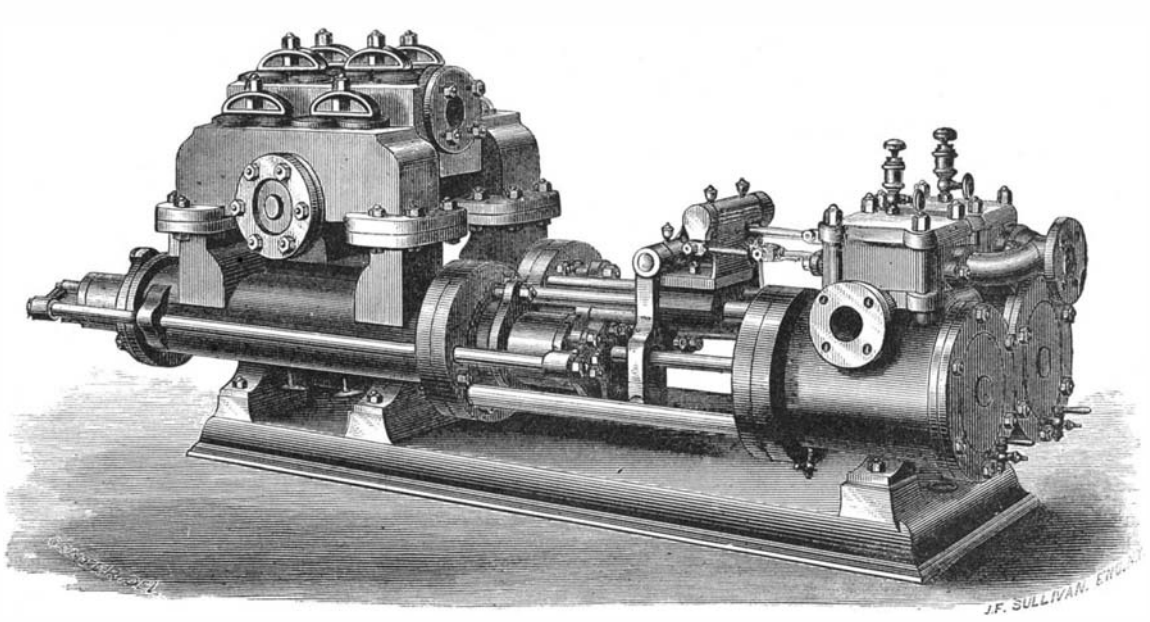
LARGE STEAM PUMPING ENGINES—A DUPLEX PRESSURE PUMP.

Among the pumps of largest capacity in this country are those constructed for water works by Henry R. Worthington, the inventor and patentee of a remarkably efficient type of pumping engines, known as Worthington's duplex steam pumps. At the Centennial Exhibition, Philadelphia, the largest and most expensive hydraulic exhibit was the pumping engine for supplying the entire Exhibition grounds with water, designed and constructed by this engineer. The capacity of this pumping engine was six million gallons daily. At Jersey City, N.J., there are two pumps, having together a capacity of sixteen million gallons; at Baltimore, Md., Toledo, Ohio, Toronto and Montreal, Canada, pumps with a capacity of ten million gallons; in Syracuse, N.Y., pumps of the same capacity were erected last year, and also in the same year were erected pumps for the Boston High Service, having a capacity of three million gallons daily. These are but a few of the many large pumps in successful operation, varying in capacity from half a million to sixteen million gallons daily.

Since 1844, the year when this engineer patented his first invention in steam pumps, he has taken out eleven patents in this country for inventions in this department of engineering.

The annexed engraving represents one of the smaller Worthington duplex "pressure" pumps, designed originally for driving hydraulic machinery, but also admirably adapted for mining, boiler feeding, severe and constant work generally. The form of the water end is peculiar, and intended for continuous pumping against heavy pressure, at moderate speed. Each piston drives two single-acting plungers, which have external adjustable packing.

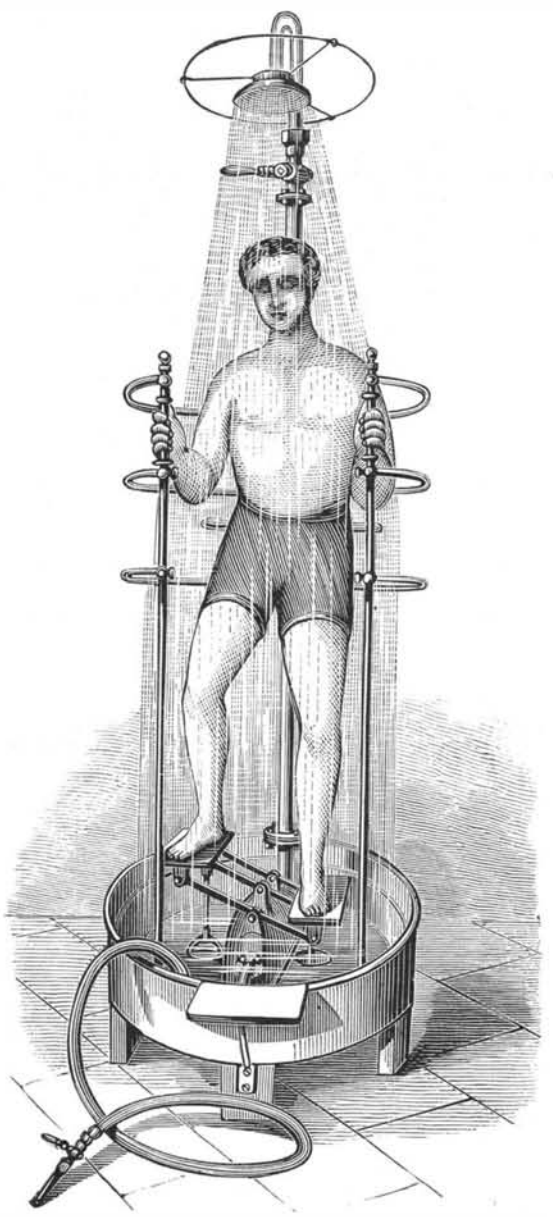
Reference being made to the engraving, it will be seen that the construction of this type of duplex pump varies materially from all others. The arrangement, which is very ingenious and gives great strength and compactness, is peculiarly the inventor's own, and original with him many years ago, is highly approved, and has been extensively copied by other pump manufacturers. All the parts are easily accessible for examination or adjustment. The moving pieces are made to gauge, and consequently can be readily renewed. Pumps of this description are constructed for special purposes and of various sizes. Special attention is called to the valve motion, which is the prominent and important peculiarity of this pump, as being that to which it owes its exemption from noise or concussive action. Two steam pumps are placed side by side, and so combined as to act reciprocally upon the steam valves of each other. The one piston acts to give steam to the other, after which it finishes its own stroke, and waits for its valve to be acted upon before it can renew its motion. This pause allows all the water valves to seat quietly, and removes everything like harshness of motion. As one or the other of the steam valves must be always open, there can be no center or dead point. The pump is therefore always ready to start when steam is admitted, and is managed by the simple opening and shutting of a valve. The office of Henry R. Worthington is at 239 Broadway, New York. The manufactory is at the Hydraulic Works, South Brooklyn, N. Y.



WORTHINGTON'S DUPLEX PRESSURE PUMP.

BOZERIAN'S NEW SHOWER BATH.

M. Gaston Bozerian, whose improved foot power engine we recently illustrated, has combined his apparatus with a pump, so as to produce a convenient shower bath, operated by the bather himself. In the tub shown in the annexed engraving, which we take from *La Nature*, is a cast iron air chamber, which also serves as a support for the pedal levers. Each lever operates a pump, which forces the water in the basin into the air chamber, so that the operator has only to move the weight of his body alternately first on one pedal and then on the other to work the pumps. The water is thus driven up a pipe connecting with this air chamber, and escapes in a shower from the perforated receptacle above. The same water is used over and over again, and the shower is maintained as long as the operator chooses. The apparatus is in successful use in water-cure establishments in Paris.



BOZERIAN'S SHOWER BATH.

Down in the Lower Levels.

Not many men who see the miners of the Savage lifted out at the top of the shaft at change of shift have the courage to descend into the lower regions of that mine. Very few even of the old residents of the Comstock would care to descend into the steaming regions below, and not one Eastern man in a thousand could be induced to make the trip after seeing the men popped out at the top of the shaft, steaming as though just lifted from out of a caldron of boiling water. Though they are shirtless—naked as at birth from the waist up—and wear only cotton overalls, they are dripping as if but a moment out of a pond of water; yet this is all from steam and perspiration. In all this great heat men must work. The wonder is that they are able to do anything but gasp and pant. It is a place better fitted for salamanders than for men. At the head of the main incline, where they have so long been engaged in putting in the V-bob, it is as hot as in the hottest vapor baths at Steamboat Springs.

One would think that men much in such a place would be quite secure against the rheumatism. On making inquiries in this regard of an underground foreman, he said that he never knew of any of the men working below to have the rheumatism. Some of our sufferers from the disease might try this cure—might have themselves lowered into the depths of the mine, there to sit and steam through one shift per day. But for the immense quantities of ice water they drink, the men could not endure the great heat in which they are placed or the floods of perspiration pumped from their pores. They swallow gallons on gallons of it, and it never hurts them in the least.—*Virginia Enterprise.*

Curious Habits of the Japanese.

The Japanese habit of reversing everything, if we may regard our own way of doing as the proper way, is very curious, and in some of its details very interesting. Mr. Griffiths, in his work on Japan, discusses it thus: "Another man is planing. He pulls the plane towards him. I notice a blacksmith at work. He pulls the bellows with his feet, while he is holding and hammering with both hands. He has several irons in the fire, and keeps his dinner pot boiling with the waste flame. His whole family, like the generations before them, seem to get their living in the hardware line. The cooper holds his tubs with his toes. All of them sit down while they work. Perhaps that is an important difference between a European and an Asiatic. One sits down to his work, the other stands up to it. Why is it that we do things contrariwise to the Japanese? Are we upside down, or they? The Japanese say that we are reversed. They call our penmanship 'crab writing,' because, say they, 'it goes backward.' The lines in our books cross the page like a crawfish, instead of going downward properly. In a Japanese stable we find the horse's flank where we look for his head. Japanese screws screw the other way. Their locks thrust to the left, our to the right. The baby toys of the Aryan race squeak when they are squeezed; the Turnonian gimcracks emit noise when pulled apart. A Caucasian, to injure his enemy, kills him; a Japanese kills himself to spite his foe. Which race is left-handed? Which has the negative, which the positive of truth? What is truth? What is down? What is up?"

Mr. Bennett's Polar Expedition.

A petition has been presented in the Senate by Mr. Conkling, from Mr. James Gordon Bennett, asking that an American register be granted to the Pandora, an English steamer which he proposes to man and equip at his own expense for a voyage of discovery toward the North Pole, taking the Spitzbergen or European route, simultaneously with the Howgate expedition *via* Greenland. It is thought that probably there will be more or less opposition on the part of the advocates of American shipbuilding; but if an American register be given to a foreign vessel for the Woodruff scheme, it is hard to see why one should not be given to another one for Mr. Bennett's expedition.

It is not known who is to be at the head of the expedition, but it is supposed that the adventurous Stanley, just returned from the burning sands of Africa, wishes to try his luck and endurance against the rigors of the Arctic winter which has conquered so many adventurous spirits.

Captain Howgate expresses much gratification at the proposed expedition of Mr. Bennett, because, when taken in connection with the proposed government expedition from the United States this year, it will test the practicability of the two most prominent routes to the North Pole. The Smith's Sound route, which Captain Howgate proposes to follow, is the favorite American route; while the Spitzbergen one is and has been advocated by foreign geographers, in the face of the many failures in that direction hitherto made. The two expeditions will probably differ widely in other respects, as the Howgate plan proposes an exhaustive study of the various scientific subjects upon which light can only be thrown by steady researches made within the polar area, and is not limited in its object to the mere discovery of the North Pole, that being only one of the items of the Howgate scheme.

Proposed Changes in the Patent Law.

The Committee on Patents of the United States Senate have lately reported a bill amendatory of the patent laws, which, according to an analysis prepared by the committee, has the following aims:

SEC. 1. Limitations. The period fixed is four years, to apply to all suits at law or in equity hereafter commenced, with a proviso allowing two years in which to bring suits on existing causes of action before the bar applies to them. If many suits are brought to preserve a right, the courts may stay proceedings in all except one.

SEC. 2. Profits and damages. This preserves the existing rule of damages. It changes the accounting in equity from the present rule of "savings" alone by providing that the amounts allowed as "profits" shall not exceed the profits actually realized in that part of the defendant's business connected with the use of the invention. The rule for apportionment of the actual profit among the different elements employed, excluding capital and personal services, remains unchanged. The court is allowed a discretion in all cases, both to increase and diminish the amount found, whereas it is now allowed only to increase, and that merely in an action at law. The court is also empowered to allow counsel fees and expenses in case of vexatious claims or willful infringement.

SEC. 3. Appeals. This is new, and gives to the Circuit Court the power to allow an appeal to determine the capital questions of validity or infringement before putting the parties to the delay and expense of an accounting which will become useless if the decision below is reversed.

SEC. 4. Appeals. This also is new, and enables the Circuit Court, subject to the direction of the Supreme Court, to exercise a control over the parties by injunction pending an appeal. In the present state of the Supreme Court docket a cause is not reached until three or four years after the appeal is taken.

SEC. 5. Reissues. This replaces Revised Statute 4,916, and changes it in these respects: First, it does not allow any evidence of what the invention is, except such as the papers filed in the office before the original patent issued afford, whereas the present law in certain cases allows evidence *aliunde* by *ex parte* affidavits. Second, it does not allow the model to be resorted to at all for purposes of reissue. This change has been introduced by the committee. Third, it directly makes it the duty of the court to inquire in suits on a reissued patent whether it is for anything except the same invention shown, contained, or substantially indicated in the specification or drawings of the original application or its amendments, and which the inventor would then have been entitled to patent.

SEC. 6. (New.) Provides that reissues shall not have a retroactive effect.

SEC. 7. Provides that if a patent be issued to two on the invention of one, or to one on the invention of two, this mistake may be corrected, as a clerical error, by the consent of all inventors and owners.

SEC. 8. Taking testimony *in perpetuam*. The existing law adopting the English chancery practice was intended for questions of titles relating to real estate, and does not meet the exigencies of patent litigation. The scheme of this section is that anybody may take testimony upon leave of court first obtained, and notice to the opposing party in interest that any person, whether a party to that proceeding or not, may use the evidence, but only as against those who were parties to the original proceeding, and actually served with notice or those claiming under them; that when a petitioner in such a proceeding perpetuates testimony upon any particular topic the opponent may, by leave of the court, introduce evidence in rebuttal or avoidance, and if any stranger avails himself of one part of this record he thereby makes the whole as competent against him as if he had been a party to the proceeding. This section is entirely new, and has been considerably amended by the committee.

SEC. 9. (New.) Allows suits to be brought by special leave of court to repeal and annul patents which are void. Existing laws afford no adequate remedy.

SEC. 10. (New.) Supplies a remedy for cases where a person injures the business of another by advertising that it infringes a patent, and yet refuses to bring a suit in which the validity of the patent or the question of infringement can be tried.

SEC. 11. Periodical fees. This is new, and has been already explained.

SEC. 12. The change introduced by this requires exclusive licenses to be recorded in the same manner as technical grants, because practically the two are equivalent. It shortens the time allowed for recording assignments from three months to one month. Improvements in the mail service since 1836 justify this. It allows all agreements about patents to be recorded, and makes certified copies from the records to be legal evidence.

SEC. 13. The law now is that each joint owner of a patent may grant licenses without the consent of the other. The object of this amendment is to give full effect to an agreement between them as to which shall exercise the power, if the agreement be in writing, signed by all the parties and recorded.

SEC. 14. (New.) This punishes, by not exceeding one year's imprisonment or $1,000 fine, whosoever "with intent to defraud" sells, as unincumbered, a patent which he actually knows he has no power to sell and convey.

SEC. 18. This proviso is new, and provides that the delay of the office after the patentee has completed all that he has to do shall not prejudice his rights.

SEC. 19. The law about granting patents in this country to those who have patented their inventions abroad has been changed several times, particularly by the act of March 2, 1861, in a manner which has caused considerable confusion. This section establishes what is believed to be a just and reasonable rule. It retains the provision that a foreign patent does not prevent a patent here to the same inventor, but that he cannot come here to get a patent for an invention that has been in use here for two years. It adds a new requirement that if he makes it known by patenting abroad he must apply here within two years or it can be used by the public. The old law provided that if the inventor patented abroad his United States patent must expire as soon as the foreign patent, but if he leaves it unpatented so that foreigners can use the invention freely, he is allowed the whole seventeen years here. This discrimination against our patentees is abolished.

SEC. 21. Applications. No change as to original applications. Applications for reissues may be signed and sworn to by the owner of the patent or his legal representatives. At one time the surrender of a patent and the application for a reissue were required to be sworn to by the owner; and at another time by the inventor. This amendment leaves it to be sworn to by the owner. The oath is of no importance, because the action of the Commissioner is to be based solely on the sworn statements filed by the inventor on his original application. To require his oath to the new application is to enable him to extort money from the person who has already bought and paid him for the invention.

SEC. 23. The law has always required the patentee to mark on the article the date of the patent. About 300 patents a week are now issued, all bearing the same date. This amendment requires him to add the number of his patent in order that it may be identified.

Several sections, particularly section 1 (limitations) and section 2 (damages and profits) apply not merely to existing patents, but to some extent to existing rights of action. After hearing elaborate arguments upon both sides of the question, the committee are satisfied that a patent right is "property" within the protection of the Constitution, and cannot be taken away or impaired by any legislative action. That right is under the terms of the law, and under the Constitution probably must be exclusive. This was declared by Mr. Chief Justice Marshall and by the Senate. But while Congress is bound to provide a remedy efficient and adequate to cause that right to be respected, and protected from invasion, it clearly has the right to select the precise remedy for that purpose. Though the patentee has a right to some sufficient remedy, because without it his right would be merely nominal and illusory, and therefore virtually be taken from him under the doctrines laid down in Bronson against Kinzie (1 How., 311), without due process of law, yet he has no right to any particular remedy. His right is to such efficient remedy as exists at the time of trial, and not necessarily to such as existed at the time the cause of action arose. The committee cannot doubt, therefore, that Congress can make some changes in the remedy for existing causes of action, and that the changes made by this bill leave them fully adequate and efficient to secure to the inventor the exclusive right which the Constitution contemplates that Congress shall secure to him.

Some of these proposed changes are good, and others are quite objectionable, as we shall show in a future discussion of the subject.

Muscular Power.

Fick and Wislicenus proved, in 1865, that muscular power is to a great extent produced by the oxidation of non-nitrogenous substances, such as fat. Frankland determined to put the matter beyond dispute by determining the amount of potential energy locked up in muscle, and its chief products of oxidation—urea, uric acid, and hippuric acid. A number of tables are given in the memoir, showing the amount of actual energy developed by 1 grain of various articles of food when oxidized in the body. These tables show that 0·55 lb. of fat will perform the work of 1·15 lb. of cheese, 5 lbs. of potatoes, 1·3 lb. of flour or pea-meal, or of 3½ lbs. of lean beef. The following conclusions were drawn from the author's results, coupled with those of Fick and Wislicenus:

1. "A muscle is a machine for the conversion of potential energy into mechanical force.

2. "The mechanical force of the muscles is derived chiefly, if not entirely, from the oxidation of matters either contained in the blood or deposited around the muscular fibers, and not from the oxidation of the muscles themselves.

3. "In man the chief materials used for the production of muscular power are non-nitrogenous; but nitrogenous matters can also be employed for the same purpose, and hence the greatly increased evolution of nitrogen, under the influence of a flesh diet, even with no increase of muscular exertion.

4. "Like every other part of the body, the muscles are constantly being renewed; but this renewal is scarcely perceptibly more rapid during great muscular activity than during comparative quiescence.

5. "After the supply of sufficient albuminoid matters in the food of man to provide for the necessary renewal of the tissues, the best materials for the production both of internal and external work are non-nitrogenous matters, such as oil, fat, sugars, starch, gum, etc.

6. "The non-nitrogenous matters of food which find their way into the blood yield up all their potential energy as actual energy; the nitrogenous matters, on the other hand, leave the body with a portion at least one seventh) of their potential energy unexpended.

7. "The transformation of potential energy into muscular power is necessarily accompanied by the production of heat within the body, even when the muscular power is exerted externally. This is doubtless the chief, and probably the only, source of natural heat."

Transatlantic Steamers.

We are indebted to Mr. Arthur J. Maginnis for a manuscript copy of a valuable paper on the subject of "Transatlantic Lines and Steamships," recently read by him before the Liverpool Engineering Society. It is quite lengthy, and hence we are debarred from publishing it *in extenso;* but it contains much useful information not easily obtainable and not, we believe, before made public. This is mainly found in the tables, which form an appendix to the essay proper, which deals chiefly with the history of the different lines and the progress made in introducing improvements in ocean steamers. In table No. 1 are given the names of the various Atlantic lines, with their aggregate tonnages brought up to the present year. Of these, the Allan line shows the largest total, having 18 vessels and a total gross registered tonnage of 52,650 tons. The other lines succeed in the following order: Hamburgh-American, National, Cunard, North German Lloyd, Inman, French, Anchor, White Star, Dominion, Netherlands, Leyland, Guion, State, American, Warren, Wilson, Netherlands-American, Beaver, and Great Western. The total number of steamers is 182, of which 125 (377,905 tons) are British; 5 (15,798 tons) American; 10 (39,325 tons) French; 32 (97,395 tons) German; and 10 (26,427 tons) Dutch. Total tonnage of all, 556,850 tons.

In table No. 2 the dimensions of a dozen famous steamers are given, beginning with the old side-wheeler Britannia of the Cunard line, built in 1840, the dimensions, etc., of which were: Length, 230 feet; beam, 34 feet 5 inches; depth, 22 feet 5 inches; tonnage, 1,150; and horse power, 440; and ending with the Inman screw steamer City of Berlin, built in 1875, the data concerning which are: Length, 520 feet; beam, 44 feet; depth, 37 feet; tonnage, 5,491; and horse power, 1,000. Examination of the figures shows the constant increase of length and nearly as steady diminution of beam. From the two succeeding tables of quick passages, it appears that in July, 1840, the Britannia steamed from Liverpool to Boston, 2,755 miles, in 14 days and 8 hours; in August, 1877, the Britannic made the passage from Queenstown to New York, 2,802 miles, in 7 days 10 hours and 53 minutes, or a little over half the time, a remarkable instance of the progress in steam navigation in 40 years. Two valuable tables are given showing the average passages of Atlantic steamers. For the first nine months of 1877 the figures are as follows: Trips outward from the United States—Cunard, 9 days 7 hours 7 minutes; Inman, 8 days 20 hours 36 minutes; Guion, 9 days 13 hours 51 minutes; National, 10 days 5 hours 31 minutes; and White Star, 8 days 10 hours 30 minutes. In 1850 the average run of the Cunard line was 12 days 16 hours.

It is stated that in April, 1877, the Germania (White Star line), coming westward, logged 410 knots in a day of 24 hours and 55 minutes. This is at the rate of 19¼ statute miles per hour. The same vessel, going eastward in October, 1877, made a day's run averaging 19⅜ statute miles per hour. This performance can hardly be surpassed until the existing mode of propelling vessels has undergone a complete change, which shall reduce the costly wear and tear of machinery and still heavy consumption of fuel.

The Tide of Lake Superior.

A correspondent, Mr. John Smith, who has studied the eccentric fluctuations in level of Lake Superior, writes that he has come to the conclusion that it is unnecessary to resort to the hypothesis of unequal atmospheric pressure upon different portions of the lake, or any similarly remote cause, to account for the phenomena. His observations lead him to believe that these movements are entirely analogous to the oceanic tides, and that they are purely the effects of lunar and solar attraction; the repetition, or return waves, being explained as merely the rebound of the original tidal wave from the opposite shore.

THE United States Supervising Inspector-General of Steamboats gives notice to supervising and local inspectors of steam vessels, that their whole time must be devoted to their official duties, and that they will not, under any circumstances, be allowed to superintend the repairs on any steam vessels or draw the plans for the construction of boilers or machinery, or act as experts in any such matters for the agents or owners of steam vessels, either with or without pay, under the penalty of dismissal from office: *Provided, however*, That officers whose salaries are less than one thousand dollars ($1,000) per annum, may, when not officially employed, engage in other occupations that do not approximate their official duties, when the same can be done without detriment to the public service.

THE Belgian Government has appointed a commission consisting of twenty civil and mining engineers, iron manufacturers, architects, and railroad officers, to inquire into the best means of enlarging the field for the consumption of iron, so as to increase the demand for the products of the Belgian works, which have long suffered from a depressed state of trade.

The Objects of the Howgate Polar Expedition.

Favorable reports relative to Captain Howgate's plan for exploring the Arctic regions have been made in both Houses of Congress, and a bil providing for a suitable appropriation will shortly be considered. Captain Howgate has pointed out the cardinal objects of his plan with much clearness, and in a way which must go far to satisfy those who can see no national benefit to accrue from Polar expeditions, the ostensible end of which is the empty glory of showing the flag at the pole, annexing new territories of ice fields, and bringing polar bears and Esquimaux under the blessings of a Republican government. The fact is, however, that the benefits to be gained by Captain Howgate's scheme are really of great importance; and perhaps most especially so in the additions to our knowledge of the laws of meteorology which will be secured. In reducing meteorology to an exact science, an experienced German student and explorer has shown the necessity of a comprehension of the conditions existing in the Polar zones. The general movements of the atmosphere arise from the exchange of cold and warm, of dry and humid air, between the poles and the equator. How enormous must be the influence of the huge masses of polar ice upon the distribution of the earth's heat is obvious. Greenland and Iceland afford proofs how the movements of ice, driven by winds and oceanic currents, may affect the climate of a country, but our knowledge of these movements is very defective. Now it is possible that the ice of the Polar zones may be the regular cause of our own climatic conditions, the origin of many of the furious storms which sweep destructively along our coasts and over our own land. It is probably not saying too much, adds the same authority, when we assert that the Polar regions are the most important portions of our globe for the study of the natural sciences.

The extreme conditions under which the forces of nature act in the vicinity of the poles produce phenomena which offer us the best means of investigating the nature of the forces themselves. As in meteorology, so, also, in terrestrial magnetism and electricity, these have to do with forces of the most tremendous magnitude, often exhibited in destructive energy, but never yet subdued to the service of man. So, too, if it is desired to investigate the ocean currents, and the laws of the tides upon which depend the safety and success of ocean commerce, influences are found centering in the North which must be traced to their source. Probably there is not one of the laws which govern the elements in their movements, a better knowledge of which will not result in material benefit to the race in cheapening the means of supporting life, in increasing the sources of human happiness, or in averting the perils to which we are now subject.

Captain Howgate's plan is simply that the explorers shall go as far north as they can and settle there, building themselves a suitable habitation. As soon as fixed good weather or other conditions indicate the possibility of an advance, they are again to push forward and again settle when stopped, and thus it is believed, by slow, gradual progression, the adventurers, who meanwhile will become acclimated to the cold and other abnormal phenomena, will be enabled in time to reach the pole.

The Astor Library, New York.

The Astor Free Library in this city is rich in valuable scientific and technical books and works of reference in all departments of science. It is a student's library; and as doubtless many of our readers avail themselves of the facilities here presented, we intend to offer from time to time a list of the recent additions.

The following is a list of recent additions in the department of mechanics and engineering, which has been prepared by the courteous assistance of the librarian:

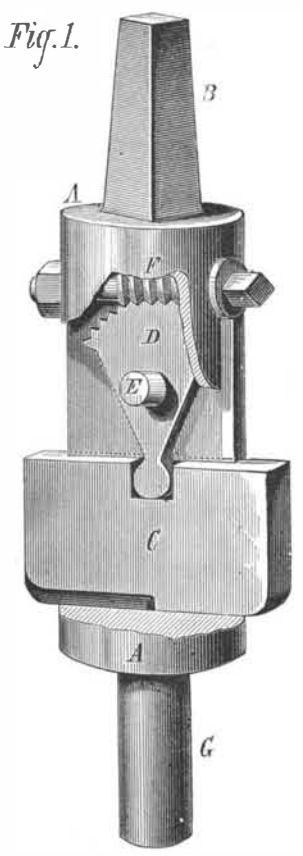
Shreve, Samuel H., Treatise on Strength of Bridges and Roofs, New York, 1873, 8vo. Matheson, Ewing, Works in Iron, London and New York, 1873, 8vo. Fanning, J. P., Practical Treatise on Water Supply Engineering, New York, 1877, 8vo. Krepp, Frederick Charles, The Sewage Question, London, 1867, 8vo. Spon's Dictionary of Engineering, 8 vols., New York, 1874, 8vo. Whipple, S., Elementary and Practical Treatise on Bridge Building, New York, 1873, 8vo. Auchincloss, Wm. S., Slide Valve and Link Motion, New York, 1875, 8vo. Burgh, N. P., Treatise on Boilers and Boiler Making, London, 1873, 4to. Francis, J. B., Lowell Hydraulic Experiments, New York, 1871, 4to. Burgh, N. P., Modern Marine Compound Engines, London and New York, 1874, 4to. Burgh, N. P., Treatise on Condensation of Steam, London, 1871, 8vo. Burgh, N. P., Link Motion and Expansion Gear, London, 1872, 8vo. McCord, C. W., Treatise on Movement of Slide Valves, New York, 1873, 4to. Spon, Ernest, Present Practice of Sinking and Boring Wells, London and New York, 1875, 8vo. Neville, John, Hydraulic Tables, etc., London, 1875, 8vo. Jackson, L. D'A., Hydraulic Manual, London, 1875, 8vo. Downing, Samuel, Elements of Practical Hydraulics, London, 1875, 8vo. Stevenson, Thomas, Design and Construction of Harbors, Edinburgh, 1874, 8vo. Clark, Daniel Kinnear, A Manual of Rules, Tables, etc., London, 1877, 8vo. Weissenborn, G., American Locomotive Engineering, 2 vols., 1 text, 1 plates. Humber, Wm., Treatise on Water Supply of Cities and Towns, London, 1876, folio. Merrill, Col. W. E., Iron Truss Bridges—Railroads, New York, 1875, 4to. Stevenson, David, Principles and Practice of Canal and River Engineering, Edinburgh, 1872, 8vo. Debauve, A., Manuel de l'Ingénieur, 8 vols., 6 text, 2 plates, Paris, 1871–3, 8vo.

A NEW TOOL.

A new and very useful tool has of late been introduced into the marine engine manufactories of Glasgow, Scotland, and it is likely to find an extended field of usefulness, because it is capable of performing a class of work which is somewhat troublesome to manipulate and usually requires a great deal of hand finishing. With this new tool, however, most, if not all the hand manipulation can be dispensed with.

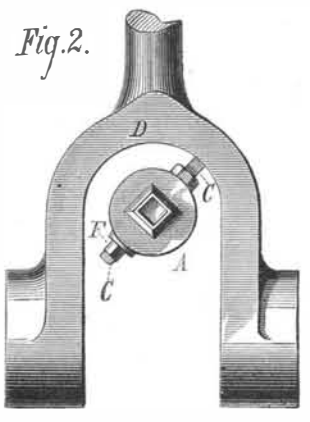
In our engravings, Fig. 1 shows the construction of the tool, which consists of the stock, A A, with the shank, B, made tapering to fit the socket of a boring or drilling machine. Through the body of the stock is a keyway or slot, in which is placed the cutter, C, provided in the center of the upper edge with a notch or recess. Into this slot fits the end of the piece, D, which is pivoted upon the pin, E. The radial edge of D has female worm teeth upon it. F is a worm screw in gear with the radial edge of D. Upon the outer end of F is a square projection to receive a handle, and it is obvious that by revolving the screw, F, the cutter, C, will be moved through the slot in the stock, and hence the size of the circle which the cutter will describe in a revolution of the stock, A, may be determined by operating the screw, F. Thus the tool is adjustable for different sizes of work, while it is rigidly held to any size without any tendency whatever either to slip or alter its form. The pin, G, is not an absolutely necessary part of the tool, but it is a valuable addition, as it steadies the tool. This is necessary when the spindle of the machine in which it is used has play in the bearings, which is very often the case with boring and drilling machines. The use of G is to act as a guide fixed in the table upon which the work is held, to prevent the tool from springing away from the cut, and hence enabling it to do much smoother work. It is usual to make the width of the cutter, C, to suit some piece of work of which there is a large quantity to do, because when the cutter is in the center of the stock both edges may perform cutting duty; in which case the tool can be fed to the cut twice as fast as when the cutter is used for an increased diameter, and one cutting edge only is operative. The tool may be put between the lathe centers and revolved, the work being fastened to the lathe saddle. In this way it is exceedingly useful in cutting out plain cores in half core boxes.

Fig. 1.



In addition to its value as an adjustable boring tool this device may be used to cut out sweeps and curves, and is especially adapted to cutting those of double eyes. This operation is shown in Fig. 2, in which D is the double eye, A is the tool stock, F is the adjusting screw, and C is the cutter. The circular ends of connecting rod strips and other similar work also fall within the province of this tool, and in the case of such work upon rods too long to be revolved this is an important item, as such work has now to be relegated to that slowest and most unhandy of all machine tools, the slotting machine. The tool was invented by one of the engineers of the transatlantic steamships, who unfortunately neglected to patent it.

Fig. 2.



Improvement in Car Lighting.

Some of the Western railroads—among them the Lake Shore and Michigan Southern—have recently adopted an improvement in car lighting which bids fair to supersede the old method of lighting by candles. This is a 300° fire test illuminating oil, made by Corrigan & Company, at Cleveland, Ohio, from petroleum, and the light it gives is stated to be 8 times greater than that of candles, while it is cheaper to produce. By the use of this oil the railway coaches are said to be brilliantly lighted and passengers are enabled to read with ease. The old system has been the cause of much complaint from the traveling public, who will welcome an improvement that, it is thought, will be adopted by railroads generally.

[For the Scientific American.]

WHY NUTS COME LOOSE AND BOLTS DROP OUT.

A correspondent asks: "Can you explain why it is that nuts come off, which they will do when subject to rapid motion or vibration, though they may be a tight fit upon the bolts and screwed tightly home with the wrench? Why indeed should it take two nuts to lock one bolt?"

The tendency of a nut to unwind and recede from the pressure upon its radial face is proportionate to the pitch of the thread and the diameter of the bolt, and the finer the thread upon a given diameter of bolt, or the larger the diameter of bolt with a given pitch of thread, the less is the tendency of the nut to move back. In the case of ordinary bolts and nuts a given diameter of bolt is given a standard pitch of thread, and these pitches are not so fine as to prevent the nuts from unscrewing in many cases unless checknuts are used.

It would appear that if the nut thread fits reasonably tight upon the bolt and the nut is screwed well home, it should remain there, but there are palpable explanations why it does not do so. Of these the principal are the errors which ensue from the alteration of form which takes place in the screw cutting tools during the hardening process. As a rule all steel increases in dimensions from being hardened. What the amount of increase or expansion is we have at present no very definite knowledge, because it varies considerably; although it is probably equal under equal conditions. Suppose, then, that a tap is made of the correct diameter to a vernier gauge, and that it increases in diameter and in length (as it almost invariably does) during the hardening, the pitch, the thickness, the depth, and the diameter of the thread will be altered and "out of true."

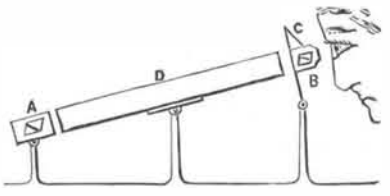
Unless both the tap and the die are tempered to precisely the same shade of color, the amount of the contraction will vary. As a result of these at present irremediable errors taps are made to suit existing solid dies, or adjustable dies are set to suit the taps, and though the nut may fit closely to the bolt so as to be just movable by hand, or under a moderate pressure of a wrench, yet the sides of the thread do not fit properly, nor can they be made to do so under any ordinary conditions. The result is that under vibration the threads give way on the contact sides, for vibration is a number of minute blows. Under reciprocating motion the result is precisely similar, for the whole pressure upon the nut is supported by that part of the surface of the thread which is in contact, which compresses or recedes. Any machinist who desires to test this matter may do so by taking a nut that fits very tightly upon a bolt, and, striking upon the sides, he will find it will lose the fit to the bolt.

J. R.

THE SACCHAROMETER.

BY SELIMO BOTTONE.

The action of the saccharometer depends on the fact that ordinary light, when transmitted through or reflected by certain bodies, acquires certain properties which it did not before possess. Among other properties conferred upon the light is that of displaying gorgeous prismatic colors when caused to traverse certain liquids and crystals. These colors, when brought into view by means of a solution of cane sugar, are the more vivid as the solution is more concentrated. In the best form of saccharometer, a tube about 10 in. long is closed at each end with a clear glass disk. An orifice, closed at will with a stopper, is left at about the center of the tube, so as to admit of the introduction of the sirup to be tested. This tube is placed between two prepared crystals of Iceland spar, called Nicol's prisms, which have the property of polarizing light which passes through



them. One, at which the eye of the observer is placed, is termed the analyzer; the other, through which the light enters, the polarizer. The analyzer is attached to the body of the instrument in such a manner that it can be made to rotate on its axis; and the amount of rotation can be measured by means of an index affixed to the analyzer, which points to divisions on a circle. To use the instrument, the analyzer is turned until the field of view (before the tube containing the sugar solution is interposed) appears dark by effect of polarization. At this point the index shows zero on the scale. The sugar solution is now introduced, when color immediately becomes visible, and the analyzer is rotated until a certain standard tint is produced. The angle of rotation is then compared with that required to produce the same given tint with a saturated solution of perfectly pure cane sugar. It is not absolutely necessary that the polarizing portion of the instrument should consist of prisms of Iceland spar, as the light reflected from a plate of glass may be made to answer, but the above arrangement is found more convenient in practice.

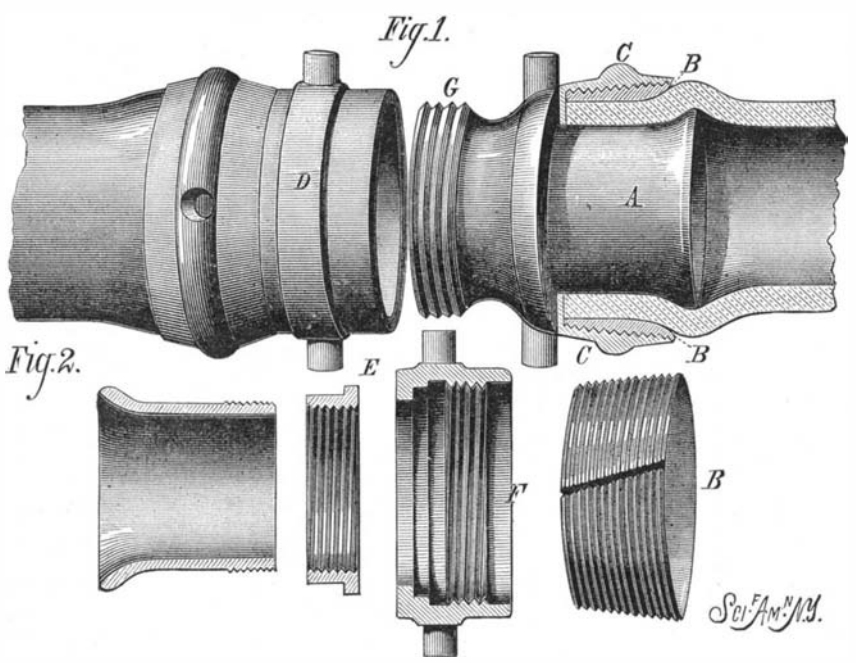
The illustration furnishes a rough sketch of the essential portions of a polarizing saccharometer, as seen in section. A, the polarizer, being a short piece of tube containing the Nicol's prism; B, the analyzer, a similar piece of tube containing also a Nicol's prism, free to rotate on its axis, the rotation being measured by the pointer, C; D, the tube in which the sirup is placed, closed at each end by plates of glass.

IMPROVED HOSE COUPLING.

We illustrate herewith an improved hose coupling, so connected with the hose ends as to be drawn tighter as the pressure to which it is subjected augments. The interior sleeve, A, Fig. 1, is made with a slight taper, and the hose end is secured upon it by a diagonally split and tapering band, B, having a screw thread on its exterior, and also on outer sleeve, C, threaded inside as shown. The screwing up of this sleeve closes the split in the band, B, and compresses the same tightly over the hose. The opening in the band, it will thus be seen, allows the latter to accommodate itself to different thicknesses of hose. The female coupling, D, turns loosely on the inner sleeve, being connected by a short intermediate collar, E, Fig. 2, that is screwed by an inner thread on the threaded end of the inside sleeve, so as to retain coupling, D, on the circumferential shoulder of the same. The female coupling, D, has a recess, F, which acts as a guide to steady it in making the connection with the threaded part, G, of the male coupling. The outer sleeves are applied by a suitable wrench that enters recesses in them.

The device is strong and durable, and excellently well suited to the uses of fire departments. It has also, we are informed, been successful under severe tests.

Patented through the Scientific American Patent Agency, Sept. 25, 1877. For further information address Mr. Frederick Stewart, Engineer No. 8, cor. 12th and Salisbury sts., St. Louis, Mo., or O. F. Scudder, Engineer No. 9, cor. Broadway and Mound st., St. Louis, Mo.



IMPROVED HOSE COUPLING.

Poisonous Candy and Beer.

It appears that though magenta made by the arsenic process is no longer used for coloring confectionery, sirups, liqueurs, etc., yet these articles are still found to contain traces of the poison. According to Ritter, of Rouen, the source of this evil is to be sought not in the magenta or other colors employed, but in the glucose or starch-sugar so often used. This substance is obtained by the action of dilute sulphuric acid upon starch; and the acid, being made from arsenical pyrites, contains traces of arsenic, which thus finds its way into articles of food. As in Germany the brewers employ little malt and very much starch-sugar, the beer is thus liable to be contaminated.

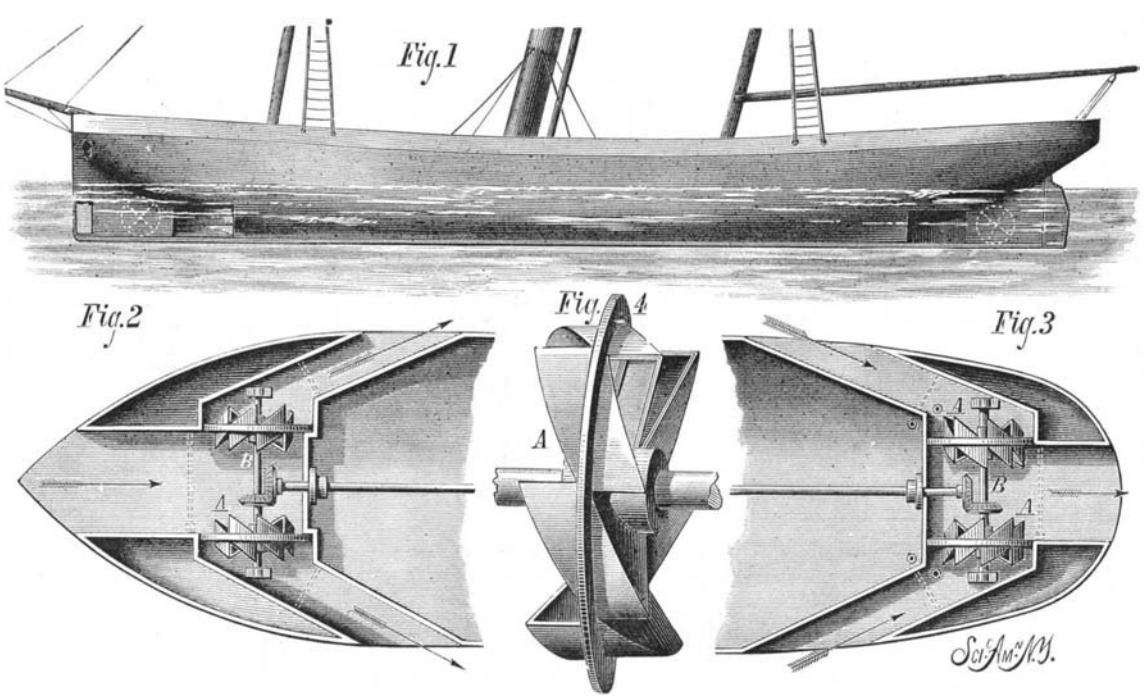
CURTIS' PROPELLING AND DRY DOCK ATTACHMENT FOR VESSELS.

The inventor of the new propeller illustrated in our engraving considers that the losses due to the screw propeller, as now placed thwartships a vessel, may be summed up as follows: The bending strain causes bending and loss by friction in the bearings, and causes the breakage of the shaft; the loss by unequal action of the various parts of the screw's surface, necessitating the dragging of the lagging portion by the most active; the loss by the opportunity and tendency of water to escape from pressure; the loss incurred by the paddle-like action of the screw dragging the vessel out of her course, entailing great labor on the helmsman; the rudder has to be obliqued and has to be dragged, and causes a pressure of water all along one side of the vessel; the loss incurred by friction of the end thrust of the main shaft which receives the force of the screw and imparts it to the ship by end-thrust pressure in its bearings, causing a useless waste of power. To avoid these difficulties is the object of the device herewith represented, for which it is claimed that there is no end thrust on either shaft, nor bending strain; the screw cannot race, as it never loses its hold of the water, and as all the water leaves in a straight line, the vessel steers easy and straight; all parts of its surface perform the work due to them and no part retards another. If any of the machinery needs repairs, it can be done whenever and wherever needed, while in the old-style propeller the ship would be buffeted about till she reached shore, and incur the expense of being dry docked. In shallow water this screw can be arranged to use a wheel of the required power, independent of the depth of the water.

The invention consists of balanced propelling wheels, A, one of which is shown in Fig. 4, that are attached to the ends of a lateral shaft, B, Figs. 2 and 3, which shaft is rotated by suitable gearing from the main shaft. The wheels balance each other as they draw the water from opposite sides under equal pressure. They may be arranged at the stern of the vessel or at the center of the same, or at both stern and bow, Fig. 1, the draw blades of the bow wheels, Fig. 2, being turned inside and the packing arranged outside. Their effect is to draw in the water in front and expel it at the sides, while the stern wheels draw in from the side and expel from the stern, as indicated by the arrows. End pressure is thus given to the column of water in the same way as in the case of ordinary propellers, but, it is claimed, with the advantage that the water column does not cause a loss of power. When the wheels are amidships, as for canal and river boats, longitudinal inlet and outlet trunks are arranged, which may be depressed to take up and discharge the water at the lowest possible points. The trunks are closed by suitable gates, which are shut when any injury occurs to the wheels. The water is then pumped out of the chamber so formed, and the latter thus becomes a submarine dry dock, which may be entered through a man-hole from the vessel.

The arrangement of the double-balanced propelling wheels at any part of the vessel is claimed to render the motion of the same steadier, especially when the wheels are placed at both bow and stern. The dry dock attachment formed by closing gates furnishes a convenient means of repairing the screws in mid ocean in case of accident. The main bulkhead through which the driving shaft passes is removable by taking off the driving wheel and withdrawing the shaft. An opening large enough to pass all the propelling parts, including the wheels, is thereby obtained, so that a vessel can have her machinery renewed or put in when afloat, without going into dry dock. The wheels also, being inside the lines of the vessel and incased, are not exposed to damage by coming in contact with floating bodies, and are therefore less liable to injury than the ordinary screw propeller. The inventor submits a calculation for a pair of four-foot balanced wheels as follows: A pair of these wheels discharges a column of water 44 inches square, and 15 inches long, for every one sixth of a revolution. Each wheel discharges 36 times in one revolution; opening in buckets, depth 8 inches, width 20¼ inches, length 15 inches. Each wheel has six buckets. From these data it is determined that a column of water 73·47 miles long is discharged from the wheels per hour, or 1,763·28 miles in 24 hours. Definite results as to the speed of the vessel have not yet been reached.

Patented through the Scientific American Patent Agency, December 11, 1877. For further particulars address James Curtis & Co., Middletown, Montgomery county, Mo.



CURTIS' IMPROVED PROPELLER.

New Agricultural Inventions.

Mr. R. B. Thomson, of Dansville, Mich., has invented an improved Colter Holder for Plows. A flange upon the lower rear portion fits into a corresponding groove in the top of the standard. At the top of the holder another flange rests upon the plow beam, to which it is secured by an adjustable bolt. This arrangement holds the colter securely in place, and admits of easy adjustment of the latter to or from the land or vertically, as may be desired.

A machine for Sharpening Mower and Reaper Knives has been patented by Messrs. H. F. and M. L. Bush, of Douglassville, Pa. The improvements consist, first, in the mechanism by which reciprocating motion is imparted to the knife-supporting bed plate; and, secondly, of a fulcrumed and weighted lever, which regulates the pressure of a V-shaped grindstone upon the knife, and supports the swinging frame of the stone in raised position for adjusting the knife upon the bed plate.

Mr. J. J. Carey, of La Salle, Ill., has invented an improved Corn Planter, in which the axle is rearwardly curved to allow room for a third wheel, which actuates the dropping attachment. This drive wheel may be raised from or lowered to the ground by a hand lever. There is also a guide for planting in accurate check row.

A Reciprocating Churn Dasher, invented by Mr. M. R. Heliker, of Wauseon, O., has two sets of bifurcated arms with inclined sides, the sides of alternate arms being inclined in opposite directions.

Mr. J. H. Mudgett, of Camanche, Iowa, has invented a Fence Post for wire fences, which has clips so arranged in the reentrant angles of flanges that their hooks are located back of a line intersecting the salient angles of two flanges. The head is hollow and of cylindrical form, so that it may be turned and drawn into the earth by a wrench or worm.

An improved Gate, patented by Mr. Jacob Kesselring, of Blissfield, Mich., is so constructed that it may be adjusted to swing at any desired height above the ground. A slotted bar, carried by the gate post, is secured to the latter by an adjustable bolt. Blocks upon the rear upright of the gate engage with this bar, and the height of the gate is thus regulated by it. There are two latches, upper and lower, connected by a link; and the handle is attached to the upper one.

Mr. Henry Barsalou, of St. Anne, Ill., has invented an improved Seeding Machine. A knotted check cord, stretched across the field, passes over pulleys on the frame of the machine and actuates the dropping mechanism in an original manner. Another novelty is the combination, with the seed dropping device, of a conductor plate fitted into the seed box, and provided with a feed slot having sharp edges to break up lumps.

Extensive Locomotive Works.

The North Staffordshire Institute of Mining and Mechanical Engineers paid a visit recently to the works of the Northwestern Railway Company, at Crewe, probably the largest of the kind in the world. They occupy 85 acres, the covered shops extending over more than 23 acres. About 150 new engines are made every year, and about 2,000 annually come into the shops for more or less extensive repairs. The visitors were shown a large locomotive that had been "erected" in 25½ hours by 10 men—a feat that has, however, been eclipsed recently in the United States. Among the most important features of the Crewe works are the furnaces and other plant for the manufacture and working of steel, which Mr. Webb, the engineer to the company, now uses in all locomotive boilers.

Costly Experiments.

The Titusville, Penn., *Herald* says: "A wealthy operator located eight dry wells last year. He is an 'oil smeller,' and costly experience will probably never rid his mind of the delusion that a hermetically sealed bottle held by a string near the ground will indicate the existence of petroleum one thousand or fifteen hundred feet below the surface. It is a species of mumbo-jumbo business that found favor in the early days of the oil excitement, and a few respectable and intelligent natives were fascinated by the craze and have never recovered from the affliction. The gentleman spoken of has more than one hundred thousand dollars' worth of dry holes to remind him of his foolishness."

EASEL FOR POTTERY DECORATION.

The annexed engraving represents a very convenient apparatus for holding ceramic ware while being decorated. The base contains two drawers for palettes, colors, and brushes. On the upper portion is a sliding piece, to which is hinged an arm rest, which is supported at any desired angle by the brace shown, entering a suitable notch. The rest is also held in place by a pin which passes through the sliding piece. At the end of the box is a turn table, which is free to rotate horizontally. On its face are a number of concentric circles which assist in centering the article to be decorated, and at the periphery are several pins placed at equal distances apart. These pins are engaged by the end of the arm rest when it is folded down, and are employed in regularly dividing the surface of the article ornamented. A ruler placed at the side of the box may be adjusted vertically or at any angle.

The vase to be decorated is placed on the turn table, as shown, and the arm rest is suitably adjusted. Irregular ornamentation is applied by the brush carried by the free hand only; but when it is desired to form a circumferential stripe, the handle of the brush rests in one of the notches in the end of the arm rest, and the table is rotated, while the brush remains stationary. In making vertical or diagonal stripes, the brush is guided by the ruler. The device may be closely folded together for packing.

It was patented through the Scientific American Patent Agency December 4, 1877, by Mr. W. H. Brownell, of Brooklyn, N. Y.

EASEL FOR POTTERY DECORATION.

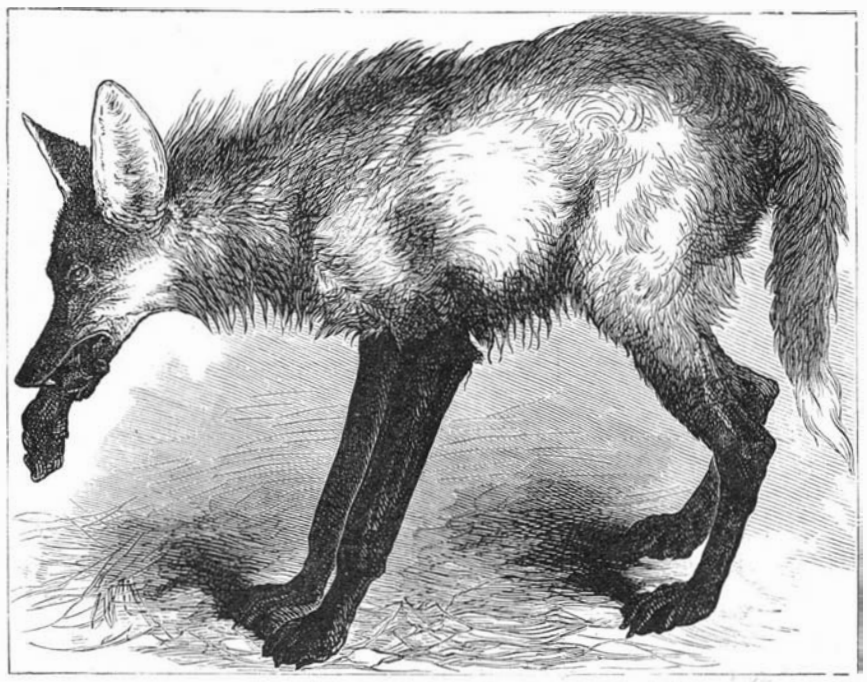
Hydrocarbon Oils in Lava.

In the basaltic zone which reaches from the foot of Mount Etna in a south-southeasterly direction, near the village of Palermo, there is, says *Nature*, a pre-historic doloritic lava containing olivine, which surrounds the clay deposits of a mud volcano, and which has been examined by Signor Orazio Silvestri. Under the microscope the lava shows an augitic principal mass with a quantity of olivine and many white transparent crystals of labradorite.

The lava contains numerous round or irregular cavities which are coated with arragonite and which are filled with mineral oil. This oil, of which there is about 1 per cent by weight in the whole mass, was taken from one of the cavities at 24° C. At about 17° C. it begins to solidify, and is of a yellowish green tint by transmitted light, while by reflected light it is opalescent and light green. Chemical analysis of the liquid proved it to contain: Liquid hydrocarbons (boiling point 79·28°), 17·97 per cent; hydrocarbons solidifying under 0° (b. p. 280°–400°), 31·95 per cent; paraffine, melting point, 52°–57°, 42·79 per cent; asphalt (leaving 12 per cent of ashes), 2·90 per cent; sulphur, 4·32 per cent; total, 99·93 per cent.

THE RED WOLF.

The animal shown in our illustration has been sometimes called the "maned wolf," but is more commonly known as the "red wolf," from its predominant color. The zoölogical name is *Canis jubatus*. It was first described by D'Azara, a South American traveler, who gave its native name as *aguaraguazu*, in the countries of the Rio de la Plata and Paraguay, where it is commonly found. It is, when full-grown, one of the larger beasts of the wolf kind, and its body is covered with long, stiff, shaggy hair, mostly of a reddish hue, but often with a white spot on the throat; the hair inside the ears and at the extremity of the tail is also whitish. The mane consists of stiff hairs, five or six inches long, which grow black at the tips; and this mane, which stands erect, extends from the occiput to behind the shoulder. The tail is rather bushy. The habits of this species of wolf are solitary; it frequents the low-lying plains and marshes of the Paraguay, and the sand banks in the La Plata, feeding here on land crabs, there on rats, guinea pigs, and small birds, or some kinds of vegetables. The specimen from which our engraving is taken is now in the collection of the London Zoölogical Society, and is said by the *Illustrated News* to be the first yet carried alive to England.



THE RED WOLF.

ARRANGEMENTS are being made for the holding of an international exhibition at Sydney, in 1879, under the auspices of the Agricultural Society of New South Wales. It is anticipated that many of the articles shown at the coming Paris Exhibition will be trans-shipped to Sydney.

Weed-Destroying Machines Needed.

There will probably soon be in this State a good opportunity for inventors of machines for uprooting or otherwise destroying weeds to introduce their devices with success. A bill has recently passed both houses of the Legislature which provides that every person owning or leasing cultivated or inclosed land abutting on any highway shall "cause all noxious weeds, briers, and brush growing upon said lands within the bounds of said highway, to be cut or destroyed between the 15th day of June and the 1st day of July, and between the 15th day of August and the 1st day of September," under certain penalties in case of neglect. The Governor's signature will render this measure a law.

There is nothing in its provisions to exempt railroads and canals from its operation, and as there are 5,525 miles of the first and 857 miles of the second, this is a material addition to the aggregate length of highway in the State. What this length is can hardly be estimated, inasmuch as it includes not merely roads, but streets everywhere, so that there is scarcely a land owner in the State outside of the cities who will not find that the law in some degree applies to him. Those who possess large tracts along the railroads will, however, probably find weed eradication an onerous affair, and machinery capable of rapid and effective operation a decided necessity. Mowing machines or grass cutters will not answer the purpose, as the idea is to destroy the weeds and not simply check their growth. Probably apparatus similar to the cotton stalk pullers in use in the South will be found requisite; or there is a chance for some enterprising individual to adapt a portable engine to the purpose—one that is capable of self locomotion—and run it alongside the railways, canals, and roads, making contracts with the land owners to clear the ground.

THE Sutro tunnel is gradually nearing the Comstock, and the blasts in the header can now be distinctly heard by the miners at work on the 2,000 foot level of the Savage and Hale & Norcross shafts.

Repeating Old Stupidity.

History constantly repeats itself. Follies similar to those being perpetrated at Washington over the money question have been exhibited in every age. When the Bank of England notes ran below par in gold, during and after the Napoleonic wars, the question arose, and was universally discussed in that country, whether the notes had fallen or specie had risen in value. More than two-thirds of Parliament decided that it was gold that had risen, and that the paper money had not depreciated. About as large a proportion of that body were averse to resuming coin payments. The ground was taken there, as here, that resumption was impossible. Even Cobbett, who was almost always right on the main question, was wrong on this. He demonstrated, after his fashion, that the interest on the public debt and the obligations of private debtors never could be paid except in paper money. England really seemed to be smothered under her gigantic debt. She had spent some five thousand million dollars for war purposes within a comparatively short period, and was over four thousand millions in debt. There was thus some reason for the delusion there; but a few brave, clear-sighted men saw through the darkness, and led the nation out triumphantly. The true principles of finance were extracted from the fiery crucible of her experience, and laid down in the famous Bullion Report, and to them the nation was finally converted, only after long years of hostility and conflict.

If Congress manifests exceeding ignorance on the financial question, it may be some consolation to reflect that the British Parliament exhibited just as much. If Congress believes that the United States can and should pay only in bogus money, England was once of the same opinion in regard to her debt. Let us hope the parallel may continue, and that Congress may, like Parliament, be soon educated out of its ignorance.—*New York Sun.*

A Simple Electroscope.

M. Rameaux lately brought before the Société des Sciences of Nancy a very simple and sensitive electroscope. It consists of a fine fiber of white silk, fixed at one end by means of a little wax to any support, and free to oscillate in any direction under its point of attachment.

A single thread would, of course, suffice for the ordinary purposes of electroscopy properly so called, but it is preferable to employ two near each other, taking care to space them so that they cannot foul each other during their swing, or influence each other reciprocally.

One of the threads is charged to strong repulsions by means of a glass rod charged with positive electricity; the other is charged in a similar manner with a stick of resin charged with negative electricity. Every body which attracts one of the threads so charged, and repels the other, is necessarily electrified. Its electricity is of the same sign as that of the thread which it repels.

The sensibility of these electroscopes is greater, within certain limits, as the threads are made finer, longer, and less conducting.

If the finest sewing silk of commerce be untwisted, each of the parts or strands obtained will make an excellent electroscopic pendulum, which, if about sixty centimeters long, is very handy, and suffices for almost all tests. White silk is preferable to colored.

The motions of these threads, if well charged, are very considerable, even when the bodies presented to them contain but slight charges of electricity. When the threads are not excessively fine, disturbances of the air do not destroy the observations so much as might be supposed. In the first place, these disturbances can be almost entirely removed; and, furthermore, the threads, even when agitated, obey so well any electric attractions and repulsions that it is absolutely impossible to mistake or detract from their evidence.

M. Rameaux has found this arrangement in all cases more sensitive and sure than a carefully constructed gold leaf electroscope which he used for comparison.

This system also recommends itself in several ways, for instance:

1. It is so simple that every one can construct and use it.
2. It costs nothing; no special support being necessary. The threads can be fixed to any projecting piece, as the edge of a table; the only condition being that they may hang freely.
3. It can be set up in a moment, and consequently is at

once ready for any unexpected requirement; whereas a gold leaf electroscope long unused requires to be dried for hours.

4. It works perfectly, whatever the hygrometric state of the atmosphere.

5. It can be employed to show electric phenomena to a numerous auditory. With long, thin fibers and highly electrified bodies, the experiments are very telling.—*Bulletin de l'Association Scientifique de France.*

A Tribute to the Past.

The re-survey of the southern boundary of New York furnishes evidence of most commendable accuracy on the part of Mr. David Rittenhouse, who surveyed the first line nearly a century ago. At the request of the Boundary Commission the new survey was undertaken by two assistants of the United States Coast Survey, Professor Edwin Smith, in charge of the astronomical part, and Mr. J. B. Baylor, in charge of field operations. The exact geographical positions of four points on the line between New York and Pennsylvania were established.

To accomplish this the following observations were made: First, at Station Travis, eastern extremity of the boundary, for latitude, thirty-seven observations of ten pairs of stars on five nights; for longitude, forty-five observations of twenty pairs of stars on four nights; for time, signals were exchanged with Washington on three nights. Second, at Station Clarke, one mile east of the western extremity of the boundary, forty-three observations of ten pairs of stars on five nights were made for latitude; and one set of observations of Polaris for value of micrometer. Third, at Station Burt, south of Wellsburg, New York, for latitude, fifty-one observations of fifteen pairs of stars were made on six nights; for longitude, fifty observations of twenty-three pairs on seven nights. For time, signals were exchanged with Washington on two nights. Fourth, at Station Finn, near Great Bend, Pennsylvania, forty-seven observations of twelve pairs of stars on five nights were made for latitude; one set of observations of Polaris for value of micrometer; for longitude, fifty observations of thirty-four stars on five nights. For time, signals were exchanged with Washington on four nights.

The reduction of these observations was made in the Office of the Coast Survey. The results showed the 42d parallel to be about 300 feet south of the present boundary at Station Travis; about 125 feet south, at Station Clarke; about 800 feet south, at Station Burt; and about 350 feet north of the present boundary at Station Finn.

Award of Prizes.—Paris Academy of Sciences.

The Academy at its annual meeting, January 28, 1878, made the following awards:

The two great prizes in mathematics and physics were not awarded this year.

In mechanics, the Poncelet prize was awarded to M. Laguerre for his mathematical works; the Montyon prize to M. Caspari for his work on chronometers; the Plumey prize to M. Freminville for his improvements in steam engines; the Fourneyron prize to M. Mallet for his tramway engine.

In astronomy, the Lalande prize was given to Professor Asaph Hall, of Washington, D. C., the discoverer of the satellites of Mars; the Vaillant prize to M. Schuloff for his method of detecting the small planets; the Valz prizes to MM. Paul and Prosper Henry for their star maps.

In physics, the Lacaze prize was awarded to M. A. Cornu for his researches on the determination of the rate of light.

In botany, the Barbier prize was divided between M. Galippe for his toxicological studies on cantharides, MM. Lepage and Patrouillard for their services to medicine and pharmacy, and M. Manouvriez for various physiological researches. The Desmazières prize was divided in part between Dr. Quélet for his work on the fungi of the Jura and the Vosges, and M. Bagnis for his memoir on the puccinia. From the Bordin prize an encouragement of 1,000 francs was awarded to M. Charles Eugène Bertram for his work on the lycopodiaceæ; another Bordin prize was awarded to the same botanist for his work in connection with angiosperms and gymnosperms.

In chemistry, the Jecker prize was awarded to M. A. Houzeau for his researches on the production of ozone; the Lacaze prize to M. Troost for his many valuable chemical researches.

In anatomy and physiology, the Shore prize was awarded to M. Jousset de Bellesme for his researches on the physiology of insects.

Among prizes in medicine and surgery, one of 2,500 francs was given to Professor Hannover, of Copenhagen, for his work on the retina of man and the vertebrates; and 1,500 francs to Dr. Topinard for his work on anthropology.

In physiology, the Montyon prize was divided between Professor Ferrier and MM. Carville and Duret. The Lacaze prize was given to M. Dareste for his researches on the artificial production of monstrosities.

CHESTNUTS.—The chestnut forms the chief food of the poor population of the central plateau of France and Corsica. The production in 1874 amounted to over 14,000,000 lbs. Improved by cultivation, rendered larger and regularly round by its solitary development in the involucre, it is known as the marron, of which there are a great number of varieties, which are obtained by grafting on the common chestnut.

THE EYES OF REPTILES AND FISHES.

In examining the eyes of reptiles, the first thing that strikes us is their fixidity. The muscles which, in the higher vertebrates, direct the eye-ball and give it its wonderful mobility, are but little developed in the majority of reptiles. Their eyelids, too, are slow of movement. Crocodiles and tortoises, like birds, have three. In frogs and toads, the first two eyelids are but slightly developed; the third (which is the one called the "winking membrane" in birds) is the only one of any real use to the animal.

Lizards have, so to speak, but a single eyelid, pierced through its center by a slit, which the animal can enlarge at pleasure. In the eye of the chameleon this slit is so small that only the pupil can be seen. Serpents have no eyelids at all; their eyes are simply covered with a dry, transparent skin. In the majority of cases the iris of the reptilian eye is of a beautiful golden yellow. In the eyes of the crocodile the pupil is linear, as in those of the cat; in frogs it is lozenge-shaped; in tortoises, lizards, and the chameleon it is round.

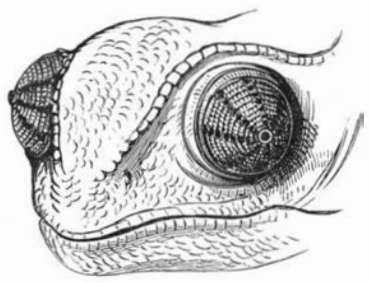


Fig. 1.—Eyes of Chameleon.

The eyes of the last mentioned animal are worthy of a moment's attention. They consist of large globes protruding from beneath a skin which covers them entirely, up to the edge of the pupil (Fig. 1). These reptiles possess the singular faculty of directing their eyes in different directions at the same time; one eye, for instance, looking upwards while the other is looking downwards.

It is a well known fact that chameleons change their color to assume, very often, that of the object upon which they may chance to be resting. This extraordinary power (likewise the property of some other reptiles and a few fishes, but in a lesser degree) was known as long ago as the time of Aristotle. Some experiments made not very long ago by M. Pouchet show that the eyes are the prime mover in this change of color. The experimenter, having removed the eyes from chameleons, and also from certain fishes that shared with them the faculty of changing color, found that the animals became entirely black, and did not again quit this hue. More recently still, an eminent young scientist, M. Paul Bert, has by his investigations rendered those of M. Pouchet more complete in demonstrating that, although the eyes are the first inciters to the change of color, yet the nervous system is also an essential agent of this phenomenon. M. Bert having severed the nerves that vitalized certain members of the chameleon, these parts of the animal became black and remained so.

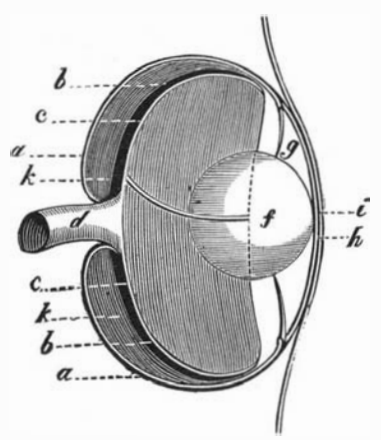


Fig. 2.—Eye of a Fish. *a a*, Sclerotic; *b b*, Choroid; *c c*, Retina; *d*, Optic Nerve; *f*, Crystalline Lens; *g*, Anterior Chamber; *h*, Cornea; *i*, a thin Skin; *k k*, Bony Pedicel.

In the eyes of fishes, as in those of serpents, the eyelids are replaced by a transparent skin, which hangs down in front of the cornea and adheres to it. This absence of eyelids, however, is not common to all fishes, for the shark possesses them, and the ray displays the rudiments of a "winking membrane."

The pupil of a fish's eye is nearly contractile; its crystalline lens is spherical, a form which we know to be necessary to permit of perfect sight in water. The transparent ball which constitutes this lens (Fig. 2, *f*) is applied directly against the iris in front, and is separated by a small space only from the retina. The result is that the eyes of these animals, instead of being spherical, as in the mammalia, have a flattened form; and they are often retained in this shape by a circle, either cartilaginous or bony, contained in the sclerotic coat.

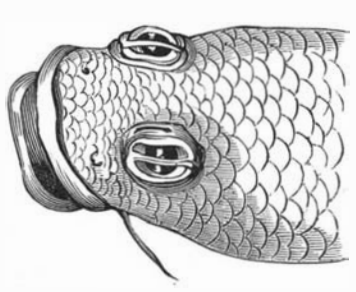


Fig. 3.—Eyes of Anableps.

There are also several fishes which have eyes mounted on a bony pedicel, thus giving them great power of resistance against exterior violence, and at the same time great mobility. There is a fish which, at first sight, seems to be endowed with four eyes. It is called *Anableps*, and is found in the river Surinam, in Guiana. Were these four eyes really distinct (Fig. 3), a like anomaly would upset one of the most constant laws of zoölogy. But a close examination shows that the two eyes, which are on either side of the head, although exhibiting, each one, distinct corneas and pupils, have but a single crystalline lens and retina in common, and form, in fact, but a single eye with a double pupil and cornea.

It has been remarked that vagrant fishes have keener vision than those which never quit their native shores; and those that inhabit muddy places have eyes that are very imperfect, and sometimes even none at all. Such are the *myxine* and *apterichte*, described by Dumeril. These fishes are absolutely blind, yet they have preserved the rudiments of eyes in the form of black spots hidden under the skin, as if to indicate simply the place where eyes should have been.

New Inventions.

A Pocket Book Frame, patented by Messrs. D. M. Read and Louis Prahar, of New York city, is designed to prevent the escape of small coins. This is effected by the combination of a detachable cap plate with one side of the frame, together with a catch and bolt suitably arranged.

Mr. E. P. Cowan, of Germantown, Pa., has invented a Combined Shawl Strap and Head Rest for travelers' use. The head rest forms the handle of the shawl strap, and the various parts are compactly arranged, so that the combination is convenient for either purpose.

A Tuning Pin for Pianos, invented by Mr. John Lautenschlager, of Ashland, Ky., consists of two parts, a main and an auxiliary pin, to which each string is applied, the auxiliary pin taking up a part of the strain and retaining the main pin rigidly in position.

Mr. J. C. Moss, of New York city, has invented a Ruling Instrument, which consists of a pen and graver guide and support, provided with an adjustable spacing device, so that the pen or graver guided by it produces parallel or converging lines with regular or graduated intervening spaces.

Mr. John Dawson, of Williamsburg, N. Y., has patented an improved Commode Chair, which may also be used as an ordinary chair when required.

An improved Scarf has been invented by Mr. C. W. Lyford, of Brooklyn, N. Y. Its novelty consists in a double shield cover, each part being separately attached, so that when one of the covers becomes worn it may be removed, so as to expose the unused one. Thus the part subject to the greatest wear may be readily renewed.

An improved Fruit Jar has been patented by Mr. G. W. Gomber, of Sybertsville, Pa. The fastening consists of a bail secured by a ring-shaped portion to a neck and button of the glass cover, and fastened by the bent ends or lips of the bails to inclined edges or rims on the neck of the jar. The bail is made of two parts, which encircle the neck of the button, and are soldered together at both sides of it, so as to be retained in connection.

A Duster Coat invented by Mr. A. P. Silva, of Elmira, N. Y., has a covering vest, which may be closed over the common vest and shirt or folded back and attached to interior buttons of the duster. The sleeves are provided with wristbands or guards to protect the cuffs.

Mr. C. C. Kribs, of Trempealeau, Wis., has invented an improved Coffee Pot, which consists in the combination, with a vessel of the usual shape, of a water circulator and a perforated coffee receptacle, the circulator consisting of two or more upright pipes fixed on a base plate or false bottom and bent downward at their upper ends, and the receptacle being suspended between these pipes on hooks attached to them.

A Spring Rocking Chair invented by Mr. John Krapp, of Brooklyn, N. Y., has elliptic springs, and otherwise differs from the many chairs of similar nature lately patented, in the mode of arrangement of the oscillating and stop devices, the design of the inventor being to keep the strain always at right angles to the springs.

In a Lantern devised by Mr. C. W. Colony, of Sandy Creek, N. Y., the globe is raised and retained by a notched bail, and is held closed by a spiral spring when the bail is unlocked.

Mr. John Fox, of New York city, has invented a Postage Stamp which is applied to letters and canceled in the same way as ordinary stamps, but which, it is claimed, cannot be removed, cleaned, and used again after being canceled. The paper of the stamp is cut entirely through, so as to form several distinct pieces, and these parts are united by a backing of tissue paper or some other delicate substance.

A new Sash Fastener has been invented by Messrs. I. N. Wood and Alexander Morton, of Wilmington, Del. The sash has a rack at one side, in connection with an intermeshing pinion upon the casing. The pinion may be locked, engaged, or cleared by a fulcrumed spring pawl, actuated by a cam lever or other means.

An improved Lid for Car Axle Boxes has been recently patented by Messrs. J. E. Meth and W. Lindemann, of Grand Island, Neb. The lid or cap is hinged at the upper edge to the inside of the box, and is acted upon by a spring, to close tightly the opening of the face plate.

Mr. J. N. Coffin, of Biddeford, Me., has invented an improved Bearer for Harness Collars and Breeching. The bearer is formed of a plate and a loop or keeper, cast in one piece, and having a buckle and fastener cast upon the ends of the plate. The fastener is made with a shoulder recessed to receive the end of the sweat leather, and with a slot to receive a piece of leather for the stitches to pass through in sewing the fastener in place.

An invention intended to lessen the dangers of mining has been made by Mr. George Hayes, of Girardville, Pa. It is

an improvement on the ordinary form of Squib used in blasting, and consists in an interior explosive alarm device, which indicates that the squib is doing its work, and thus gives warning that the charge is about to explode.

Mr. James Forsyth, of New York city, has made some improvements in Roller Skates, by which the latter may be guided forward, backward, or diagonally in any direction by tipping the foot, without rocking or oscillating.

A Process of Manufacturing Oil from Organic Substances, such as pitch pine, cotton seed, sassafras, etc., which consists in injecting steam and carbonic acid gas into the retort containing the material and heated to a high temperature, has been invented by Mr. D. M. Buie, of Wilmington, N. C.

A Combination Fuse for Projectiles has been patented by MM. Eduard Rubin and August Fornerod-Stadler, of Thun, Switzerland. The invention consists in the combination of a percussion fuse, which is ignited by the sudden force imparted to the shell at the moment of firing, with a double-graduated ring fuse and a powder chamber. There is also a second percussion fuse which is thrown into action when the shell strikes an object.

Mr. John Cottner, of New York city, has patented an improved Trunk, the lid of which has a hinged receptacle divided by a horizontal partition, a drawer, hat box space, looking glass (hinged and protected by a cushion), a secret jewel receptacle, and a hinged desk, all arranged compactly.

In a new Fire Escape, the invention of Mr. Geo. Kenyon, of Springfield, Ill., the new features are essentially as follows: A hand device is added for operating the brake band of a pulley, upon which the escape rope is reeled, and it consists of a fixed handle, spring, and movable handle, the latter receiving the rings of the brake band. The pulley and brake descend with the person, the upper end of the rope being secured by a spring snap hook to a staple or other support.

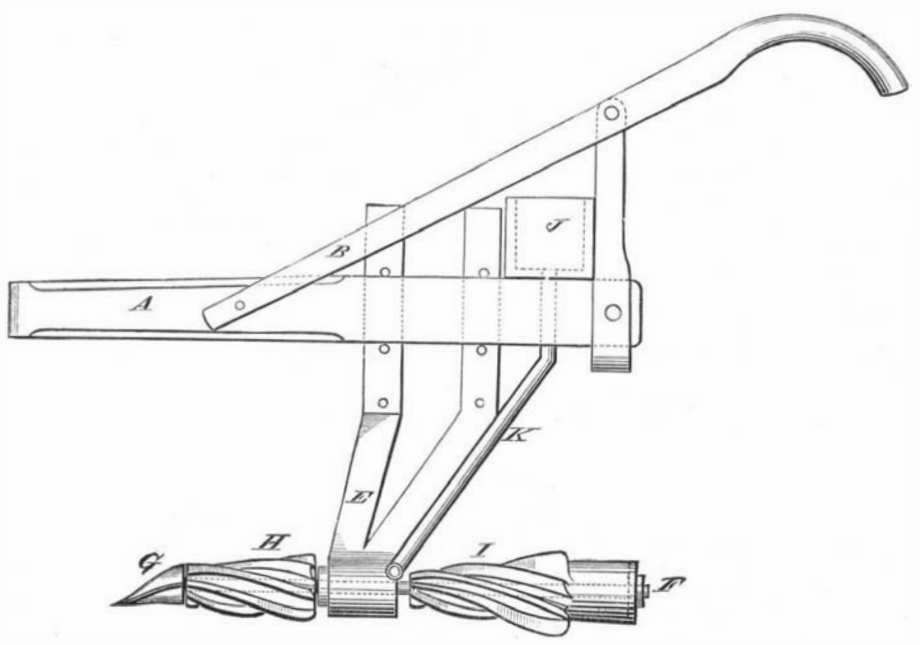
A Torpedo for use in oil wells has been invented by Mr. J. J. Boyer, of Lamartine, Pa. It is so constructed as to be capable of being exploded at any desired depth, but not under fluid; and it consists of a torpedo shell or case, with bottom socket for inserting an anchor, solid anvil, and interior guide tube for a weighted drop wire, which is also guided in a top guard of supporting bails. The anvil forms a support for percussion caps, which are exploded by lowering the drop wire.

Mr. S. O. Parker, of Littleton, N. H., has invented a Glove, in which each finger is made in one piece, with the seam on the back.

Mr. G. F. Whitaker, of Hudson, Mass., has invented an improvement in Wagon Tops, which consists in so arranging rear or side doors with spring catches and frames that loss of contents by jarring out, thefts, entrance of insects, dust, etc., may be prevented, at the same time allowing convenient access to the interior, and furnishing a cover for the driver while standing at the door.

A NEW MODE OF DITCHING.

We illustrate herewith a ditching apparatus, which cuts a subterranean flue and also packs the soil around the same so as to convert it into a pipe. Upon the lower end of the branched standard, E, is formed a cylindrical head, through which passes a rod, F. To the forward end of the rod is attached a cutter, G, which is made with wings upon its sides and top, so that it may be drawn easily through the ground. The rear end of this cutter is recessed to receive the cutter, H, which is placed upon the rod, F, between the cutter, G, and the standard, E. The cutter, H, is made slightly conical in form and with spiral corrugations upon its sides, which ribs make about one third of a turn and are formed with sharp edges, so as to cut the soil and press it upward and sidewise as the cutter is revolved by the pressure of the soil. Upon the rod, F, in the rear of the standard, E, is placed the cutter and packer, I. This, for a little more than half its length, is made slightly conical, and is ribbed spirally so as to cut the soil and press it upward and sidewise. The rear part of the cutter and packer, I, is made slightly conical and smooth so as to pack the soil and thus form a flue. To the rear end of the beam, A, is attached a water box, J, from the bottom of which a small tube, K, passes down along the rear edge of the standard, E, and terminates in a sprinkler at the forward end of the cutter and packer, I, to moisten the soil, so as to form an arch or tile out of the soil itself as it is worked and packed.



SNYDER'S DITCHING MACHINE.

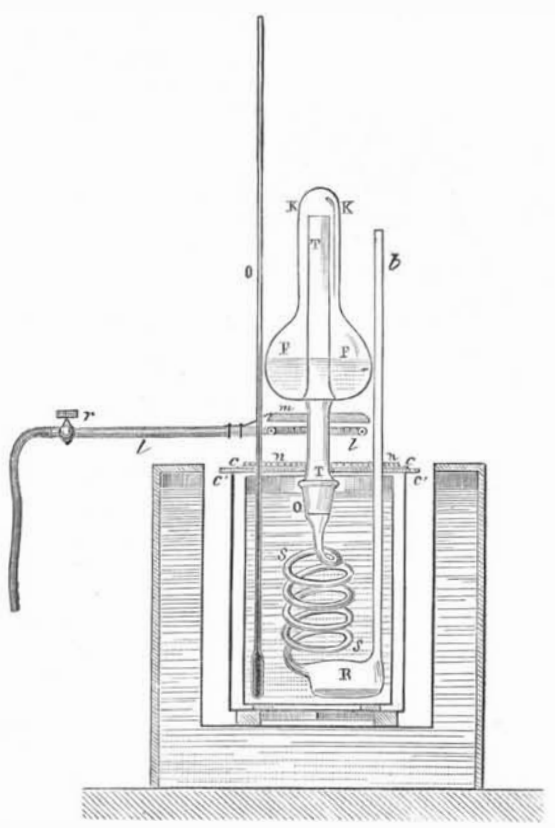
This device was patented through the Scientific American Patent Agency, April 17, 1877, by Mr. W. W. Snyder, of Martinsville, Ohio.

A New Lubricating Material for Belts.

Several correspondents have asked us to name some good material that will serve to prevent belts from slipping, which will be both cheap and efficient. Mr. John D. Parker, agent of the Union Lubricator Manufacturing Company's Lubricator, of No. 6 Haymarket square, Boston, calls our attention to that material, and sends us a testimonial from a well known millwright, who states that the lubricator renders leather belts soft and pliable and causes them to carry unusual loads without slipping. The writer of this opinion has had large experience, and those of our readers who are troubled with slipping belts may find it to their interest to adopt the same means, which he states he has always used "with complete success."

NEW APPARATUS FOR MEASURING THE VAPORIZING HEAT OF LIQUIDS.

The annexed illustration, from *Les Mondes*, represents a new device by which the total heat given off by a liquid between



LIQUID CALORIMETER.

vaporization and the normal temperature is accurately measured. F F is a flask, the neck, K K, of which is hermetically sealed. Through this passes a vertical tube, T, which extends a few inches below the bottom and connects with a worm, O S S R, which is plunged in a calorimeter. Between the flask and the latter is a thin sheet of pasteboard, *c*, and a plate of wood, *c'* (serving as screens and pierced for the passage of the tube, T), a piece of wire gauze, *n*, a circular lamp, *l*, and the sheet of wire gauze, *m*.

The flask being previously weighed, first singly and then filled with liquid, and the lamp being lit during the first period of the operation in which the temperature of the liquid is elevated, the rise of the calorimetric thermometer, *o*, is noted. The second period is that of distillation, which lasts from 2 to 4 minutes, determining an elevation of from 3° to 4° C. in the water of the calorimeter. The latter contains some 30 ounces of water, and the weight of liquid volatilized is about 1 ounce. The lamp is then extinguished, the flask removed, cooled, and again weighed, and the exact weight of the vaporized liquid is thus determined.

The movement of the thermometer is meanwhile followed until it becomes regular—that is to say, agreeing with the cooling (previously studied) of the calorimeter, filled simply with the same weight of water at the same temperature. The data are thus obtained for calculating the problem above indicated; the specific heat being known by other trials, the heat of vaporization is readily deduced. Thus, for example, M. Berthelot finds for the total heat ceded by the vapor of water (weight equaling 8·24 grammes, 6·86 grammes, and 7·08 grammes) between 0° and 100° C. (32° and 212° Fah.) the numbers 635·2, 637·2, and 636·2; average, 636·2. Regnault obtains 636·6. The inventor has used this apparatus for measuring the heat of vaporization of anhydrous and monohydrated acetic acids, monohydrated nitric acid, of chloral and its hydrate, and other substances.

New Mechanical Inventions.

Mr. Louis Durand, of Quebec, Canada, has secured a patent for the combination, in a Dough Mixing Machine, of a revolving ring-shaped trough of tapering body, with one or more kneaders revolving in an opposite direction to the trough, and having straight sides corresponding to the inclination of the sides of the trough, and curved intermediate sides for the purpose of thoroughly incorporating the dough.

Mr. G. W. Lewthwaite, of Fort Miller, N. Y., has made an improvement in Felt Washers for Paper Making Machines, which is intended to clean the felt without injuring it, and which consists in the combination of fluted washer rolls and a washer box with the frame and perforated water pipe of a paper making machine.

Mr. Cornelius Young, of Sandy Hill, N. Y., has invented an improved Suction Box for Paper Making Machines. It is a box designed to be arranged in close connection with the wire screen, between the "deckle" and the "dandy roll," and is provided with rollers. The invention further consists in a novel mode of exhausting air from the vacuum box, dispensing with the usual pumps.

Improvements in Adjustable Saw Teeth and Holders are the subject of a patent recently issued to Messrs. S. J. Randall and James O'Brien, of Port Ludlow, W. T. The tooth is arc-shaped, sliding by a grooved edge in a tongued recess of the saw, and retained by a split spring holder, which is grooved on three sides, seated in a recess of the saw, and provided with a projection which enters into recesses of one of the grooved edges of the tooth, so as to lock the latter by means of a pin or rivet.

An improved Steering Propeller is combined with the rudder of a vessel, and connected with the power by a shaft having universal joints, which permits the screw to be moved laterally with the rudder. This is the invention of Mr. T. F. Levens, of Cascades, W. T.

Setting Milk.

The Vermont Dairymen's Association has recently held a meeting, and numerous subjects of practical importance to farmers have been discussed. Among other matters, that of setting milk has received considerable attention. Mr. J. W. Williams, of Glastonbury, Conn., stated that with the Cooley creamer extreme cold was specially desirable only during the first few hours after placing the milk in the water. The cream when gathered should stand a day or two to ripen, as time in churning would thus be saved. Mr. J. F. Ferguson, of Burlington, Vt., exhibited a new pan which is set upon wheels and is large enough to hold one milking. When strained the milk is shoved back into a portable ventilated apartment, fitted with ice chamber, wire screens, convenient doors, and arrangements for skimming the milk and cooling the cream. Mr. E. S. Wood described the following experiments in setting milk at various temperatures. The trials were made in per cent glasses, the morning's milk from the same cow being set at each trial. The range of temperature is that noted during the day, no one sitting up nights to watch the experiments. At the time of making each record, the cream line was clear and distinct. At the first trial the temperature near the glasses was between 80° and 90°. In 3½ hours there was twenty per cent of cream; in 10 hours eighteen per cent, and the same at the end of 24 hours. At the second trial the mercury stood at from 35° to 40°; in 3½ hours there was forty per cent of cream, but at the end of 10 hours it had shrunk to thirty-two per cent. It was then removed to a warm room, where at the end of 24 hours it stood at twenty-two per cent. At the third trial the mercury stood at from 70° to 73°. At the end of 2 hours there was thirty-four per cent of cream, in 10 hours twenty-two per cent, and at the expiration of 24 hours but nineteen per cent.

Neutralizing Poison.

A poison of any conceivable description and degree of potency, which has been intentionally or accidentally swallowed, may, it is said, be rendered almost instantly harmless by simply swallowing two gills of sweet oil. A person with a very strong constitution should take nearly twice the quantity. This oil, it is alleged, will most positively neutralize every form of vegetable, animal, or mineral poison with which physicians and chemists are acquainted.

THE SPONTANEOUS GENERATION CONTROVERSY.

In a brief note recently made by us of Professor Tyndall's late investigations into the question of spontaneous generation we mentioned his statement that his results effectually upset the views of the adherents of that theory, but expressed the opinion that the latter, and especially Dr. Bastian as their leader, would not rest quietly under any such sweeping assertion. Professor Tyndall has chosen the pages of the *Nineteenth Century* as his battle ground, and in the January number of that review he presents a historical retrospect of the subject, and a *résumé* of the experiments and arguments deduced therefrom upon which he relies. In the succeeding number of the same periodical Dr. Bastian replies, and biologists therefore now have before them succinct discussions of the rival theories from the two eminent scientists who lead the opposing camps.

Professor Tyndall, in reviewing past investigations, notes first those of Redi, in 1668, whereby it was proved that the maggots of putrefying flesh are derived from eggs of flies, thus destroying the belief that they were due to spontaneous generation in the meat. He then glances briefly at the labors of Needham, and their overthrowing by those of Spallanzani, and notes the proof obtained by Schwann that putrefaction itself is a concomitant of far lower forms of life than those dealt with by Redi. Pasteur's important discoveries, and notably that of the non-generative power of air on the Alpine glaciers or in subterranean caves in Paris, are reviewed, and with this much introduction the writer brings forward his own researches. Fifty flasks filled with strong organic infusions are heated first to 250°, and the necks are hermetically sealed. Of these twenty-seven are opened at an elevation on the Alps 7,000 feet high; the remainder are unsealed in a hay loft. All are then placed over a stove in a temperature varying from 50° to 90° Fah., and in three days out of all the flasks opened in the hay loft but two remained free from organisms, while of those opened on the mountain, although kept warm for three weeks, not one became infected. Professor Tyndall regards the inference from this as imperative that something in the air produced the effects observed, and that something might be the dust. He then proceeds to detail experiments in which organic infusions of all kinds were submitted to purified air for more than a year without putrescence setting in, whereas when exposed to dust-laden air the reverse took place in a few days. This, he argues, must prove that the dust particles are the cause of putrefactive life. The submission of the flasks to higher temperatures in a Turkish bath caused no change in the results. Other experiments are quoted to show that the resistance to heat of germs widely varies, the limit of time being eight hours' exposure to boiling. Probably more extended researches, it is urged, would reveal germs more obstinate still, so that there is no foundation for speaking of a death point of bacteria and their germs. Still further experimenting is adduced to show that either in a clear mineral solution containing in proper proportions all the substances which enter into the composition of bacteria, or in a turnip solution, the addition of an infected piece causes life in twenty-four hours. If, however, instead of the infected piece, a pinch of laboratory dust be added to each clear solution, the mineral solution remains unaffected. The inference is that while both liquids are able to feed the bacteria and to enable them to increase and multiply after they have been once fully developed, only one of the liquids is able to develop into bacteria—the germinal dust of the air. Professor Tyndall concludes his paper with a number of instances going to disprove the argument that bacteria and their germs being destroyed at 140° must if they appear after exposure to 212° be spontaneously generated.

Dr. Bastian, in his reply, says that all this discussion about the nature of atmospheric dust, with the elaborate experiments to prove its infective nature, so far as fermentations are concerned, has not advanced the question one iota; that Professor Tyndall has never been able to get beyond Schwann's simple conclusion that the air contains a "something" that is infective. The issue, Dr. Bastian says, rests upon the extent to which it can be proved that living things resist the action of water at a high temperature, and not at all upon the points brought out in Tyndall's experiments. He refers to his researches of 1873, which conclusively prove that the bacteria and all the reproductive particles which they may possess were killed at a temperature of 140° Fah., and the confirmation of this result by Cohn and Horrath. He denies any confounding of germ and its offspring, or that he attempts to make special kinds of living matter do duty for all kinds, as was imputed by Tyndall, and presents a table showing the fatal temperatures to various organisms, from those of a simple aquatic nature to eggs. Regarding Professor Tyndall's statement that further researches might reveal germs capable of withstanding more than eight hours' boiling, Dr. Bastian says: "He argues from a one-sided analogy that bacteria *must* spring from seeds, and then uses this *must* as the ready interpretation of all his experiments, shutting his eyes apparently to all other considerations, even though this interpretation 'violates all antecedent knowledge,' as it certainly does. What present warrant is there for supposing that a naked or almost naked speck of protoplasm can withstand four, six, or eight hours' boiling? To which I only answer, None."

Dr. Bastian quotes Professor Lester, who considers it extremely improbable that bacteria have germs, and states that he has never found any organisms in the moist state which resisted the temperature of 212° continued for half an hour. Dr. Burdon Sanderson agrees with Professor Lester, that no proof has been given of any such seed with reference to common bacteria. Finally, Dr. Bastian states that those who would show that the balance of evidence is against spontaneous generation being a common process, at the present day can only do so by bringing forward proofs that ferment organisms are really able to withstand a brief exposure to 212° Fah. in fluids—proofs that are stronger than the evidence which up to 1870 had engendered the almost universal belief that nothing of the kind was possible.

The Evaporative Power of Locomotive Boilers.

In a recent communication to the Institution of Civil Engineers, by Mr. J. A. Longridge, M. Inst. C. E., the author endeavored to set at rest certain widely diverging opinions which existed among practical men, with reference to the evaporative efficiency of the various elements of a locomotive boiler—such as the area of the fire grate compared with the total heating surface, the ratio between the tube surface and the fire box surface, and the rate of combustion per square foot of fire grate. The cause of such divergence of opinion was due to the multitude of variable conditions, and it was only by embodying these in a symbolic formula that the relative effects could be estimated.

After adverting to Mr. D. K. Clark's formula, $w = ar^2 + bc$, and pointing out that, from its empirical nature, it was only applicable within certain limits, the author investigated a new formula, based upon well known physical laws and mathematical principles. Assuming any given consumption of fuel per hour, the amount of heat generated was first determined; then, from the laws of the transmission of heat through plates, the quantity which passed through the fire box surface into the water was deduced, and from what remained the temperature of the gases entering the tubes was found. From this the loss of temperature in passing through the tubes was calculated, based upon the same law of transmission, and thus there was obtained the temperature of the gases in the smoke box. From the loss of temperature in passing through the tubes the evaporative effect of the tube surface was ascertained, and this, added to that of the fire box, gave the total evaporative effect of the boiler.

From the author's formula the evaporative powers of twenty engines were calculated, and the results compared with actual experiment, and with those given by Mr. D. K. Clark's formula. It was shown that the tube surface was a very important element, and that on an average the tubes effected nearly 80 per cent of the whole evaporation. Also that the generally received idea, that 1 foot of fire box surface was equal to 3 feet of tube surface, was fallacious; indeed the proportion was very variable, for while in the Ixion 1 foot of box surface was only equal to 1·7 foot of tube surface, yet in No. 33, Caledonian engine, 1 foot of box surface was equal to 5 feet of tube surface. Consequently no fixed ratio could afford a safe rule for practice. It was then demonstrated that the length of the tubes had nothing to do with economy of evaporation, but that this depended simply upon the ratio between the consumption of fuel per hour and the total absorbing surface. The question of the diameter of the tubes was next discussed, the late Mr. Zerah Colburn's views being dissented from; and it was shown that the diameter was a matter of no consequence so long as the proper amount of surface was obtained. The same remark might be made regarding the ratios between the fire grate and the heating surface. It was not the area of the fire grate, but the weight of fuel consumed per hour which had to be considered; and as regarded economy of evaporation it mattered little whether 50 lbs. of coke per square foot per hour were burned in a grate of 20 square feet area, or 100 lbs. per square foot per hour in a grate of 10 square feet area. In each case, if the absorbing surface were the same the economy of evaporation would be the same.

The question how far the combustion of fuel was perfect was then examined, and it was pointed out that in many cases it was very far from being so, some French experiments exhibiting losses of from 22 to 39 per cent.

The general conclusions arrived at might be thus summed up: That no fixed rule could be established as the best for the relative proportions of the fire grate, fire box, and tube surfaces; that length of tube had nothing to do with economic effect; that the diameter of the tube was also a matter of indifference; that economy of fuel did not depend upon the rate of firing; that when the quantity of fuel burnt was moderate, say 50 lbs. or 60 lbs. per square foot of grate per hour, the combustion was nearly perfect, while with hard firing there was considerable loss from carbonic oxide passing away unconsumed; and that a large increase of heating surface in proportion to coal burnt only slightly increased the economic effect, which within the limits of practice in locomotive engines was nearly in proportion to the fourth root of the heating surface.

In an addendum the action of the blast pipe was discussed. It was contended that, though a powerful agent in effecting rapid combustion, it was, *per se*, a very extravagant one; yet in general in the case of locomotive engines this extravagance was not chargeable to it, since there was a large quantity of steam which was available, and would otherwise be wasted. A formula was given for calculating the power of a jet of steam as an agent for creating a draught, based upon experiments made by the author in 1851 and 1852. When applied to the blast pipe of the locomotive this showed that on an average the power required to force the air and gases through the fire grate and tubes was only about 8½ per cent of the potential power of the steam escaping through the blast pipe. In conclusion it was pointed out that a large increase of effect would be obtained by subdividing the exhaust steam into a number of small jets instead of relying upon one large one, and that under certain circumstances this increase of power would be of great utility.

Improved Helioscope.

To the Editor of the Scientific American:

Your number of March 16 contains, on page 163, under the name of Helioscope, the illustrated description of an instrument in which a polarizing contrivance is used to absorb part of the sunlight, so as to make it endurable to the eye during solar observations. Allow me to state that I used this method more than 30 years ago. As my apparatus is much simpler and more convenient it may be of public interest to give its details. At that time I did not suppose that there was much merit or novelty in it, and hence that I did not publish it before; but as it appears to be expected that the arrangement of Herr Metz, inconvenient as it looks to me, "will soon be one of the implements at every observatory and scientific academy," I enter my simple arrangement in competition. All are welcome to use it.

I take a piece of plate glass of the same width as the diameter of the objective, and about three times as long, ground at the back so as to destroy the exterior reflection of that surface, and coat it with black varnish. I attach this before the objective under an angle of 35° 25′ with the axis of the telescope, so that the solar rays entering the instrument are polarized by the reflection of the polished surface. To the eyepiece I simply attach as analyzer a Nicol prism, and by turning the latter round its axis I reduce the intensity of the solar light to any degree desired.

I will add that I have adapted this arrangement to one of my large microscopes for the observation of sun spots, etc. For this purpose the polarizing reflector described is attached below the secondary stage, and in the latter a small long focus objective is placed, while the ordinary short focus microscopic objective is removed. The tube is elongated so as to make it correspond to the focal length of the objective, and a telescopic eyepiece with Nicol prism used as explained above.

Another arrangement, perhaps not so good, is to place the Nicol prism in the place of the ordinary microscopic objective, so as to avoid its use near or in the eyepiece. The course of the light is in any case this: First, reflection by polarizer under an angle of 35° 25′, passage through the objective, passage through the Nicol prism (the analyzer) either before or after the image has been formed, and lastly, inspection of the image by the eyepiece.

I use also a tube bent at an angle of $2\times(90° - 35° 25′) = 109° 10′$; in the bend a piece of plate glass is placed under the proper angle, serving as an analyzer. This bent tube is placed under the eyepiece, and does away with the somewhat expensive Nicol prism, but it is not as convenient, as it does not allow the observer, when he turns it round, to keep his eye in the same position in the axis of the instrument.

P. H. VANDER WEYDE, M.D.

The Liquefaction of Gases.

M. Dumas has thought that the marvelous experiment of the liquefaction of hydrogen by M. Pictet, of Geneva, facilitated in exact manner the determination of the density of oxygen. It suffices in fact, to weigh the quantity of liquid obtained by M. Pictet in order to see what is the volume of this same quantity. Now M. Pictet, having obtained the considerable quantity, relatively, of forty-five grammes of liquid oxygen, and this liquid occupying in the tube a space of forty-five cubic centimeters, it is seen at once that the density of the liquefied oxygen is, like that of water, equal to unity. Theory had already established this quantity, but it is now confirmed by experience.

M. Dumas has also given a *résumé* of a second communication from M. Pictet, showing, without the possibility of doubt, that not only has oxygen been liquefied in his apparatus, but also solidified, which is the complete realization of the prophecy of Lavoisier, the renowned creator of modern chemistry. In fact, the jet of liquefied oxygen issuing from the tube, illuminated by the electric light, has been examined with the polariscope, and it has given indisputable signs of polarization. Now it is known that for this phenomenon to be produced it is necessary that the light should be reflected from solid isolated particles. In the liquid itself there are in suspension small crystals of oxygen "snow," as crystals of watery "snow" are seen in the middle of those white clouds known to meteorologists under the name of "cirrus."

Doubt is no longer possible that liquid or solid oxygen is really obtainable, it is, therefore, clearly evident that chemists may succeed quite easily in solidifying the atmospheric air, now that it has been liquefied; and thus will be realized the curious result of the transformation of a volume of air into a solid block.

The solidified hydrogen was preserved in this state for several minutes by M. Pictet, and produced in falling on the ground the sound of metallic grains. The liquid jet or stream had a steel blue color.—*W. Harrison, in British Journal of Photography.*

DR. HUGGINS has received a letter, dated January 15, from Mr. E. J. Stone, in which the Royal Astronomer at the Cape says, that, from an examination of the observations of the transit of Venus, he finds the solar parallax to be 8·88″, or a distance as nearly as possible of 92,000,000 miles. This value agrees within 0·03″ with that deduced by Mr. Stone from the observations of the transit in 1769.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line.

NEW BOOKS AND PUBLICATIONS.

MAGNETIC VARIATION IN THE UNITED STATES. By J. B. Stone, Ph.B.C.S. Published by the author, P. O. Box 446, Boonton, N. J. Price $1.50.

This is a compilation of observations made in America from the year 1640 up to the present time, tabulated and arranged for the use of surveyors. The author in his practice has found no tables giving the allowance to be made for difference in variation, and in the present work he supplies the need, the data given being of especial use in surveys by the compass for the recovery of old lines. A valuable *résumé* is given of the progress in the investigation of the subject of magnetic variation from the earliest periods of its discovery in England to the present time. The book is excellently written, and the tables are clearly and accurately printed. The work will doubtless prove of much practical value to surveyors generally.

A HANDBOOK OF VOLUMETRIC ANALYSIS. By Edward Hart, S.B. John Wiley & Sons, Publishers, 15 Astor Place, New York city. Price $2.50.

A clearly written and well illustrated text book, succinctly yet fully covering its subject. The methods described are in accordance with the latest advances, and the instruction given is practical and well calculated to interest the student. The publishers deserve great credit for the excellent typography of this and some other text books they have recently issued. Nothing is so annoying to the learner as fine or poor type and inferior illustrations, while, on the other hand, large clean characters and clear comprehensible engravings, such as are here before us, render many a dry subject inviting.

WOODWARD'S ORNAMENTAL AND FANCY ALPHABETS. Published by Geo. E. Woodward, 136 Chambers street, New York city.

This contains one of the largest collections of ornamental alphabets that we have ever seen published—and all the designs are tasteful. Monograms of almost all conceivable combinations of letters are an especial feature of the book, and the author shows much artistic skill and ingenuity in devising new fancy initials. The work is well suited to the needs of architects, draughtsmen, and designers generally.

The *Journal of Physiology* is the title of a new journal just introduced by Messrs. Macmillan & Co. It is edited by Dr. Michael Forster, F.R.S., with the co-operation of Professors Gamgee (Manchester), Rutherford (Edinburgh), J. B. Sanderson (London), England, and of Professors Bowditch (Boston), and Martin (Baltimore), America.

Notes & Queries

F. C. S.—See SCIENTIFIC AMERICAN, March 16, 1878, p. 172.—E. C. C.—See answer to L. A. G., SCIENTIFIC AMERICAN, March 9, 1878, p. 155.—B. C.—See answer No. 12, "Notes and Queries," March 2, 1878.—C. L. C.—Your method of solving the example is correct. It is a very good way.—"Boiler Owner."—You do not send sufficient data; but you will find rules by which you can make the calculation for yourself, in the SCIENTIFIC AMERICAN of November 7, 1874, p. 288.—A. G. L.—See SCIENTIFIC AMERICAN, November 27, 1875, p. 339.—C. A. H.—See SCIENTIFIC AMERICAN, May 1, 1875. p. 273.—P. C. M., A. B. C., J. J. S., and others.—We do not recommend special manufactures in these columns.—W. D. P.—Apply to the makers who advertise in the SCIENTIFIC AMERICAN, or insert a notice in the "Business and Personal" column.—O. G. B.—You do not send sufficient data in regard to the engine. Anthracite is generally more efficient than average bituminous coal, in a well designed furnace.—F. S. D.—We think the steam pipe is rather small.—A. J., A. D., and others.—If you will address some of the booksellers who advertise in our columns, you can obtain information in regard to a number of such books.—R. K. T.—Your data are insufficient. Consult Trautwine's "Engineer's Pocket Book," which will enable you to make the calculations.—A. E. C.—A model maker will cut the gear for you. It can also be done in most machine shops.—C. J. W.—See SCIENTIFIC AMERICAN, December 27, 1873.—C. F. G.—We could not answer the question from the data sent. The boiler may not be steaming well, or the engine may be wasteful. These matters can only be determined by experiment.—J. C.—Your data are insufficient.—J. S. R.—The description would occupy more space than we have at command. Consult some good treatise, or examine the process.—M. S.—It would require several days to make the calculation properly. You should refer the matter to an engineer. Dry docks are preferable to slips for large vessels, generally subjecting them to less strain. Both slips and docks pay well when they are in constant use.—G. W. S.—You can make the balloon either of silk or cotton. Full directions for determining the proportions are given in the SCIENTIFIC AMERICAN for January 30, 1875. For addresses of manufacturers insert a notice in the "Business and Personal" column.—J. C. B.—Address the manufacturers.—P. H.—Concerning U. S. mining laws see p. 1644, SCIENTIFIC AMERICAN SUPPLEMENT, No. 103.—C. M. R.—Please send sample of paper referred to in No. 16, SCIENTIFIC AMERICAN of February 16, 1878.—W. H. DeV.—See specifications of patents, 119,394; 150,179; 187,511.

(1) J. F. P. asks: Is steam visible? A. No.

(2) M. T. H. asks: Why is borax used in welding steel? A. To prevent oxidation of the surfaces to be united.

(3) L. A. C. asks: What would be the proper lift of valves of a fire engine piston pump, to obtain the best results? A. Make the lift sufficient to give openings equal to the area through the valve seat.

(4) G. F. F. asks: What canal company offered a premium for a steam canal boat which would not wash the banks? A. You probably refer to the premium offered by the State of New York, which has been awarded.

(5) C. S. M. asks: Can I magnetize a piece of good steel ¼ of an inch in diameter, with a Callaud battery of 16 jars? It is for the bar in a telephone. A. Yes.

(6) G. W. asks: 1. In the choice of an occupation, how does mechanical engineering compare with business pursuits in point of financial returns? A. While some of the largest fortunes have been made in mercantile pursuits, a professional life offers almost as many inducements in a financial point of view, and more, perhaps, on other accounts. 2. Which is the more advantageous, to enter a good machine shop or take a course of study at a scientific school? A. If you have made up your mind to be an engineer, we would recommend two or three years of steady application in a machine shop, and then a course at a technical school.

(7) E. E. H. writes: We have no dentist in this county. Can you give me some instructions as to how a tooth should be filled? A. You will find instructions for home dentistry in the SCIENTIFIC AMERICAN, March 2, 1878, p. 136. In all cases where it is practicable, it is advisable to consult a skillful dentist, even though this necessitates a trip to some place where there is one.

(8) D. J. B. writes: Some of the papers state that locomotives have been built at Jackson, Mich., in 3 hours. We do some quick work in our shop, but that story discourages us. A. We should be pleased to hear from the parties to whom this rapid work is credited.

(9) O. E. S. asks whether there is any virtue in "divining rods," and where he can obtain one. A. We believe the only treasure ever discovered by these rods is that which passes from the pockets of the credulous to those of charlatans.

(10) W. O.—1. The method of crossing river bars is as described by you. 2. To mark the squares on a chessboard it might be better to paint them; but you can use a decoction of logwood, afterwards applying a solution of pearlash.

(11) W. P. H. asks: Will a locomotive exert a greater propelling force with the quarter center above or below, or is the force the same? A. The same.

(12) J. L. asks: Which is stronger, the boiler sheet or the seam where it is riveted, in any ¼ inch shell boiler riveted with ⅝ rivets, 2 inches lap, rivets 2¼ inches apart? A. The sheet is about twice as strong as the seam, generally.

(13) J. O. D. asks: Which is the most advantageous in a sharp 15 foot boat, to have a small screw geared to revolve rapidly, or a large screw directly actuated by the engine, economy of space and cost not to be considered? A. It is best to use as large a screw as can be kept well submerged.

(14) J. H. T. asks: What will prevent stovepipes from leaking, where wood stoves are used in a steam drying room? A. A good draught prevents ordinary leaks. Extraordinary ones require refitting or wrapping the pipes.

(15) S. C. P. asks: How are the high degrees of heat, in melting metals, measured? A. The air thermometer is sometimes used for the measurement of high temperatures. There are a number of pyrometers used, in which the principle is the expansion of various refractory substances by heat. Siemens' pyrometer is an electrical apparatus for the same purpose. Sometimes an amalgam or alloy, the fusing point of which is known, is used. Besides these there are the various forms of calorimeter invented by Rumford and others.

(16) W. P. writes: I have a return flue boiler set in an arch. In the lower part of each end is a handhole exposed to heat. I find it difficult to keep it packed. I have tried sheet lead, but it melted, and am now using rubber and white lead. Is there such an article as fireproof packing? A. You might use asbestos packing.

(17) J. W. S. writes: We have an engine running 70 revolutions per minute, and an upright shaft connected to the engine shaft with bevel gear, which runs 50 revolutions. Now A. claims that by running the engine 40 revolutions, and changing the gear so as to make the upright shaft run 50 revolutions, he can do the same work as at present. B. thinks that he cannot. Who is right? A. You cannot do as much work as before, after reducing the speed of the engine, whatever sizes of gear wheels you use.

(18) W. C. H. asks: Can you give me some formula whereby cotton cloth can be made waterproof and lightproof? If not lightproof, of yellow or some other non-actinic color. I wish to make a photographic dark tent convertible into a camp tent. A. Boil the fabric in a solution of 1 oz. aluminum acetate and 1 quart of water; then for 20 minutes or more in an aqueous solution of 4 ozs. quercitron and 2 ozs. copper sulphate; wash, and pass first through a solution of 5 ozs. of potassium bichromate, then through the aluminum acetate bath, and finally through boiling soapsuds.

(19) F. W. B. asks: 1. Will rubber, after being dissolved in bisulphide of carbon and spirit, return to its former state on being moulded? A. As we understand you, yes. 2. Where can bisulphide of carbon be obtained? A. Through any dealer in chemicals.

(20) F. A. B. asks: Does the paper for printing postage stamps require to be damp before printing? A. We believe so.

(21) E. M. asks: How are lithographic crayons made? A. White wax, 4 parts, gum lac, 2 parts; melt over a gentle fire; then add dry soap shavings, 2 parts; stir until dissolved, and add white tallow 2 parts; copal varnish and lampblack, each 1 part; continue the heat and stirring until a cooled sample will bear cutting to a fine point.

(22) A. & S. ask: How may blocks of wood be prepared to receive a photograph for subsequent engraving and electrotyping? A. Most readily by Newton's or other dry emulsion process. It is better to buy the emulsions ready prepared, with instructions for use, from a dealer in photographic materials.

(23) G. F. B. asks: How is the cheapest electric light obtained? A. At present we know of no electric light cheaper than that produced by the magneto-electric machines which have been described in our columns. The subject is under investigation.

(24) F. P. asks: Is there a practicable way of melting cast iron in small quantities, from 100 to 500 lbs.? If so, what style and proportions would a furnace have to be to answer the purpose? A. A small cupola furnace is best suited for the purpose; but the charge may be fused in a number of large blacklead crucibles in a suitable crucible furnace with a strong draught or blast.

(25) G. B. S. asks: Is there anything that will cut in alcohol or mix with shellac and give it a yellowish cast? A. Use turmeric.

(26) J. A. writes: I have been making vinegar for eight or ten years, using the same barrels and mill. The mill is the Keystone cider mill. My vinegar is getting a darker color every year. The barrels (some 25 in number) were liquor barrels (mostly whisky) with oak staves. What is the trouble, and is there any remedy? I first thought that it might be some iron about the mill, but I have almost come to the conclusion that it is the barrels. A. Better wash out the first in series repeatedly with hot proof spirits, and add occasionally a little gelatin to its contents. The last stock may be filtered with clean, granular, well burned charcoal. If iron is present it may be detected by concentrating a small sample and adding a slight excess of ammonia water or potassium ferrocyanide—the former gives with iron a dark rusty precipitate; the latter, Prussian blue.

(27) W. C. E. asks: 1. How can I polish, permanently, snakewood and similar hard woods? A. Apply several coats of good copal varnish, and when perfectly dry, rub down with moistened pumice stone; then go over it with a flowing coat of clear spirit copal, polishing when dry with rottenstone and a trace of oil. 2. How can silver or nickel be cemented to such woods? A. Melt together equal parts of pitch and gutta percha; apply a film of this hot.

(28) J. H. C. asks: How are objects best preserved for the microscope? A. Use oil of cloves; if previously surrounded by watery solution, wash in alcohol and dry first. Where the preparation will not admit of this treatment, use good glycerin. Mount in dammar lac or balsam.

Which of the metals is the best conductor of heat? A. Silver.

Would not a man weigh less 30 miles above the earth than at its surface? Yes, a little. See p. 207, vol. 37, and answer No. 10, p. 43, current volume SCIENTIFIC AMERICAN.

(29) C. A. S. writes: A furnace has a cold air box leading from out doors. A slide cuts off the air from out doors, and a door lets the air in from the cellar; cellar has standing water in it some 6 x 8 feet square in one end of it. What is your advice as to using air from cellar instead of from out doors, in regard to health of persons living in the house? A. We recommend that the supply be taken from the outer air.

(30) R. C. writes: Early last fall, wanting to conduct water from a well in a somewhat elevated position, to an adjoining field, say 900 feet, I laid down an iron pipe of ¾ inch bore. The incline being pretty regular, and the water in the well standing some 12 or 14 inches above where the pipe entered, and which is some 3 feet above where the water leaves the pipe, I was of opinion that the water would run quite freely, but on the contrary it only dribbled slowly from the pipe. So, as an experiment, I blocked up the lower end of the pipe, and in about 3 or 4 hours, when the water had risen in the well some 4 feet, I took out the plug, when to my surprise the water ran quite as slowly as before. Now supposing the pipe to be clear of any dirt, which I feel quite sure it is, how can you account for the water running so slowly? A. From your account, it is probable that there are high points in the pipe where air collects and obstructs the flow.

(31) G. N. writes: I want to galvanize some iron. What acids are used in preparing the iron before putting it into the melted metal? A. Sulphuric or hydrochloric acid and water, equal parts.

(32) A. D. asks: Is there any device patented to obviate the difficulty of one wheel sliding while a train is passing around a curve? A. Yes.

(33) M. B. asks: Can cast iron cut gears be coated with any material which will deaden or pretty much destroy the sound consequent upon running? Is there any metal that they can be made of that will wear well for light work that will be nearly noiseless when running? A. If the gear teeth are of proper shape and properly cut they will run almost noiselessly. Composition brass runs as quietly as anything. Excellent results have also been obtained from gears made of compressed raw hide.

(34) O. M. H. asks: 1. Is turning brass a real trade? A. Brass finishing is a trade in itself. 2. Do locomotive wristpins wear flat on each side, so that when the rods stand in a line with the center of the cylinder, and if the boxes are tightened up there, they will bind when it turns round? A. No. 3. Would you advise a young man eighteen years of age, and of common education and a natural talent for machinery, to learn a machinist's trade, such as building locomotives? A. Locomotive building is an excellent and large field of mechanics.

(35) L. R. writes: I am told that cast iron can be mended like any other metal. Is it so? A. Cast iron may be mended by soldering or by brazing.

(36) A. G. writes: We have in our stock some Holland gin, which has by long confinement in wood become very yellow. I would like some simple method of clearing it without injuring it or spoiling the flavor. The color is a great objection to its sale. A. It cannot be readily improved without altering the tone or flavor.

(37) J. C. B. writes: I have been melting brass in a crucible and running into sand moulds, but always get an imperfect casting. I have tried dry moulds and wet ones, and gave plenty of vent. How can I improve my work? A. Try running the metal hotter.

(38) J. P. A. asks: What is Paris green, and how is it made? A. Paris green is an arsenite of copper, the chemical symbol being $2CuO,H_2O,As_2O_3$. It is prepared by dissolving arsenious acid in a solution of carbonate of potash, and decomposing the arsenite of potash thus produced, by adding sulphate of copper, when the arsenite of copper is precipitated.

(39) H. G. asks: How much water does a steam boiler require in, say, one hour to furnish an engine of 10 horse power? A. It varies, in different engines in common use, from 300 to 1,000 lbs.

(40) W. H. asks: What is the best instrument in use to test or register the temperature at a glass factory, where the heat rises to 2,500° Fah. or more? A. An air thermometer, or a Siemens pyrometer, can be used for the purpose.

(41) J. C. M. writes: I have a mercurial barometer, the column of which is broken about 6 inches from the bottom. There appears to be an air bubble, about ¼ of an inch long. How can I unite the mercury? A. We think it will be necessary to remove the mercury, boil it, and then refill the tube.

(42) J. B. writes: I have a steam engine which has been in use two years. The first year I could take hold of the flywheel and turn it around with all ease, when everything was cold; but now I cannot move it, unless I first let steam into the cylinder to warm it. The cylinder is true, and so are the rings; they have not been moved since they left the shop. I use none but extra winter strained lard oil. What is the trouble? A. We presume from your account that the engine is out of line.

(43) J. K. asks for a harmless method of eradicating dandruff. A. Dandruff (*Pityriasis*) is a chronic inflammation of the skin, characterized by the production of minute white scales or scurf in excessive quantity. The affection is often very rebellious to treatment. Various preparations are sold which are claimed to be beneficial, and physicians sometimes prescribe tonic infusions, purgatives, and the application of sedative lotions. In obstinate cases an internal dose in which arsenic is the essential element is sometimes prescribed. The efficacy and safety of such measures are to be doubted. Probably the best plan is to keep the hair short and shampoo it frequently with a solution of borax in warm water, avoiding rough treatment, which has a tendency to increase the irritation.

(44) M. E. T. asks: Can street lamps burning kerosene oil be lighted by electricity? A. We do not know of any electric lighting apparatus which could be advantageously used for this purpose.

(45) A. S. asks: 1. What thickness and what kind of glass are generally used for microscopic slides? A. Usually finest lime glass plate, one millimeter (about $\frac{1}{25}$th inch) thick. 2. Are there not two layers of glass? How are they fastened together? A. Yes, generally. Fastened by marine glue, dammar lac, balsam, etc. Consult Davies' "Preparation and Mounting of Objects."

(46) C. M. writes: Will you please settle a dispute between a friend and myself in regard to the use of chloroform and its effects on a human being? 1. I claim that if administered to a person while asleep it will produce the same effect as it would if the person were awake. He claims that it awakens the person the instant it is applied. Who is right? A. The effect is the same. 2. How much does it require to produce unconsciousness, if applied with a handkerchief? A. It depends upon the person, the age and condition. 3. Does it have the same effect on an intemperate person as upon one who is temperate? A. Yes, generally. 4. Would it be advisable to try an experiment? A. No.

(47) G. P. W. asks: What is the best coating for the finished iron work of machinery, to prevent rust, and to be easily removed when desired? A. A mixture of white lead and tallow is frequently used.

(48) J.D.M. asks: 1. Does increased distance from the motor cause a load to pull any heavier? A. No; if the weight of the connections is disregarded. 2. Does the diameter of a wheel make any difference on a level surface? A. As we understand you, it generally does, in practice.

(49) T. S. L. asks: Is there a rule in geometry for dividing a circle into any odd number of parts, for example, 3, 5, 7, 11, 13 parts? A. We do not think there is any rule quite so general as this. A number of polygons with an odd number of sides can, however, be described geometrically. See Barlow's "Theory of Numbers."

(50) J. H. W. asks: Will a gauge at the top of the steam drum and another at the bottom of a boiler indicate the same pressure? A. No; because the gauge at the bottom is pressed by the water, while the other is not.

(51) H. W. D. asks: What is the best plan for uniting large belts? A. Leather lacing is generally preferred. See SCIENTIFIC AMERICAN, August 7, 1875, p. 83; also, January 23, 1875, p. 52.

(52) A. F. asks: Is steam that is condensed from an iron boiler more healthful for drinking and cooking purposes than well water? A. It is more healthy than some well water, and is equal to the best; though not, perhaps, in taste.

(53) W. S. writes: We have an injector to throw water from a heater into a tank above. When the water is cold it works, but stops as soon as the water gets hot. Can you give us a remedy? A. The only remedy that occurs to us, if you must continue to use the present injector, is to abandon the heater.

(54) D. E. R. asks: Do you think petroleum oil would be a damage or a benefit to boilers, if passed through the cylinder and pumped into the boiler with the feed water? A. If a moderate quantity is used, and the boiler is frequently blown off and cleaned, the use of the oil does no damage, and is sometimes beneficial.

(55) W. M. writes: I wish to run a circular saw 4 inches in diameter, with a coiled spring. If after being wound up it would make one cut through hard wood (oak) 2 inches in diameter without rewinding it would be sufficient. A. There are spring motors in the market which would probably answer your purpose. Insert a notice in the "Business and Personal" column.

(56) E. S. B. asks: How is floor wax made? A. Two ozs. of pearlash, 10 ozs. of wax, and about half a pint of water are heated to boiling in a dish, which is frequently agitated, until a thick fluid mass is formed, from which, upon removal from the fire, no watery liquid separates. Boiling water is now cautiously added to the mass, until no watery drops are distinguishable. The dish is again set on the fire, but its contents are not allowed to boil (otherwise myricin would separate out), 8 or 9 pints of water being added, little by little, with constant stirring. Coloring matter may be added if desired.

(57) J. H. C. writes: A steam engineer friend of mine is making a test gauge, and claims that if a square inch be thrown into a circle, the diameter would be 1·25 inch, and undertook to prove it to me by taking a strip of tin 4 inches in length, and showing that it just meets around a mandrel of that size. A. The area of a circle equals the square of the diameter, multiplied by the decimal ·7854, and conversely, the square of the diameter will equal the area, divided by the decimal ·7854. In the case you mention the area is 1 square inch, and its diameter is therefore $\sqrt{1{\cdot}273}$. By inadvertence 1·273 appeared as the diameter (in No. 3, answer No. 17) instead of $\sqrt{1{\cdot}273} = 1{\cdot}128$ of an inch.

(58) S. M. writes: We are using a wooden wheel covered with glue and emery, to scour metal castings, but the glue scales off. Can you tell us what to put in, or how to prepare the glue to prevent the scaling? A. We judge that the best plans are trade secrets, which are worth the price charged for them to those who buy wheels from successful manufacturers.

(59) W. C. M. asks: 1. Can a man lift more in weight in a coal mine 300 feet deep than he can at the surface? A. Yes, under the same conditions; but the difference would be so slight as to be inappreciable. The pendulum experiments of Professor Airy at great depths in English collieries indicated this difference, but for practical purposes it may be disregarded. 2. Why should there be a falling off in the force of gravity toward the center of the earth? A. Because, as one goes deeper, there is less matter to attract bodies toward the center, while the portion of the crust above exercises a counterbalancing attraction.

(60) C. A. G. writes: Will you please let me know which boiler will give more steam, a return tubular boiler or a locomotive boiler, both having the same size of firebox and the same amount of heating surface, and pressure of steam, and the same draught; both to fire with wood, the workmanship alike, with same size of tubes, but longer in the locomotive boiler? A. The difference, if any, will usually be in favor of the return tubular boiler.

(61) D. H. writes: Supposing it were possible or practicable to construct a wooden trough 10 miles long, and for convenience' sake say 6 feet wide and 6 feet in depth, the trough to be perfectly level in all its parts according to a spirit level, would or would not the water in the trough (supposing it to be half filled with water) be perfectly level according to a spirit level, and the water be the same depth at each end and in the middle? A. Any difference of depth that might exist would be too small to be detected by an ordinary measurement.

(62) C. D. asks: Would an air chamber placed on the suction pipe of a No. 8 Blake steam pump, which draws water from a pond 150 feet from pump with a 12 foot lift, and discharges through a pipe running 186 feet horizontal and 60 feet perpendicular, prevent the knocking of the pump piston and the jar in suction pipe? With this exception the pump works well. A. Probably it would, or at all events, it would greatly reduce the shock.

(63) W. G. L. asks: What is the proper way to temper curved dies, for cutting out steel shovel plates, so as to avoid springing and cracks? A. Fill the holes with fire clay and wire to keep it in place. Heat evenly and slowly in a furnace. Lift the dies from the furnace with the face vertical, and plunge vertically into water heated to about 50° and containing about ½ lb. salt per gallon. Hold them still at the bottom of the water until cooled.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

J. M. S.—The following represents the average of two analyses of the mineral keilhauite, by Erdmann: SiO_2 29·72, TiO_2 28·57, Al_2O_3 5·99, Fe_2O_3 6·41, Mn_2O_3 0·76, Ce_2O_3 0·47, CaO 18·80, YO 9·68. Gravity of sample = 3·519 to 3·733. Hardness 6·5.—D. S.—It is quartzite containing graphite and mica schist.—R. E. K.—No. 71 consists principally of a micaceous hornblendic schist from the degeneration of a syenite. Contains a trace of manganese. No. 49.—Quartz and orthoclase. No. 56.—Send larger sample if possible.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges with much pleasure the receipt of original papers and contributions on the following subjects:

Double Postal Cards. By G. W. H.
Howe Truss Angle Block. By W. W. R.
Approximating Curve Areas. By L. S. B.
New Fire Escape. By L. B. B.
Atmospheric Contraction and Expansion. By H. R. B.
History of Glass. By A. O. B.
Transatlantic Steam Navigation. By A. J. M.
Plant Propagation. By J. P.
Extension of Patents. By G. W. H.
Infinity of Time and Space. By H. D. T.
Conformator Diagrams. By G. H. M.
Hydraulic Engines. By D. C.
Bicycle Travel. By L. L. F.
Stroke of Locomotive Engines. By J. A. H.
Aerial Navigation. By H. S. B.
Cotton Machinery. By T. W. W.

OFFICIAL.

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

February 12, 1878,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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Washing machine, W. J. Stewart	200,356
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Weather strip, A. W. Comstock	200,177
Well tube clamp, F. B. O'Donnell	200,329
Wells, drop weight for oil, M. T. McCormick	200,144
Wells, working barrel for oil, E. E. Swett	200,357
Wheel car, C. E. Candee	200,254
Wire cloth, joining sheet metal to, S. M. Cook	200,130
Wrench, S. Schwerdt	200,348
Wrench, C. C. Coleman	200,175
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