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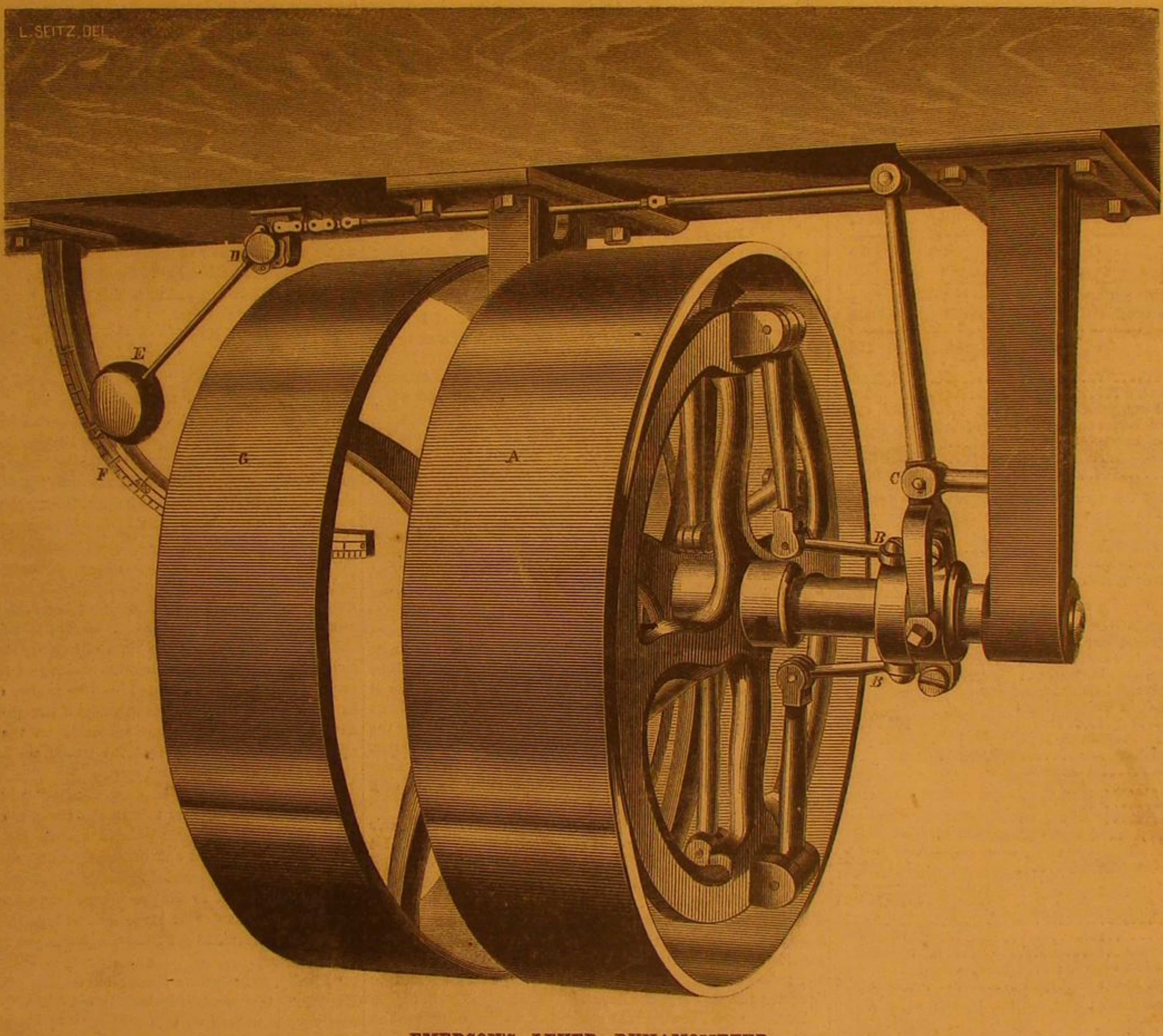


EMERSON'S LEVER DYNAMOMETER.

Improved Device for Measuring Power in Transmission.

The advantages of a reliable dynamometer have several times been commented upon in our columns—something that would show the amount of power transmitted at all times and under all circumstances. When the object is merely to ascertain the amount absorbed or required by a single machine, a series of machines, or a line of shafting, or the necessary means of transmitting power, a temporary attachment of the power measurer will be sufficient; but there are cases where a permanent attachment of the device is desirable. Such are all cases where the users of mechanical power are hirers, and pay so much per horse power used. The method of guessing or averaging, based on width of belt, size of pulleys, and weight of shafting is hardly accurate enough where the cost of production of power is felt, as where the power is supplied from a steam engine, or a water source liable to diminish in amount, or fail entirely. The dynamometer should also be so simple in construction, and so exact in operation, as to be readily understood, and afford no possible or justifiable cause for controversy between hirer and letter of power. Such is the design of the device herewith illustrated. We have seen several of them in use, and from inquiry have ascertained that their performance was satisfactory to both parties. This fact speaks loudly in favor of the machine.

It is very simple in construction, and direct in operation. The pulley, A, is loose on the shaft, and receives the power. Its connection with the shaft is made by means of a wheel, keyed or screwed firmly to the shaft in close contiguity with the receiving pulley, its hub, in fact, forming one of the guides to the position of the pulley on the shaft. To connect this fixed wheel with the loose receiving pulley, a bell crank lever is pivoted into projecting ears on the rim of the fixed wheel on opposite sides, the long arm of which connects with an annular slotted collar on the shaft by means of the short bars, B. The short arms of the bell crank levers connect on the inside of the fixed wheel with two radial bars, one parallel to the outer arm of the bell crank, and the other at right angles to it, receiving near its upper end a pivot passing through a swivel hung to the rim of the fixed wheel, and having its extreme end pivoted to a stud fixed on the inner side of the rim of the receiving pulley. It will be seen from this description that the strain of the power received through the belt on A, will necessarily react on the levers, and, through them, on the fixed wheel, which may be considered nothing more nor less than a support to these levers in sustaining them in position to connect the loose receiving pulley with the shaft.

At B it will be seen the levers are connected by pivots with the sliding collar, in the annular groove of which is seated a strap with which is connected a forked lever, the fulcrum at C. To the end of the long arm of this lever a rod with a short section of machine chain is attached. This chain runs over the cylindrical head, D, of a pendulum weight, E, having a pointer that traverses a fixed quadrant, F, properly divided by a scale to denote the relative pressure exerted through the medium of the receiving pulley on the shaft. The pulley, G, is fixed to the shaft, and delivers the power.

With this description of the parts, and an examination of the engraving, any of our readers may understand the operation of the device. It will be seen that all the motions are absolute, there being no chance for play and "backlash," except that of joints and pivots; and this, by good workmanship, can be reduced to the minimum—too little to be taken into consideration practically. There is no dependence upon springs, spiral, or other forms, which are so liable to be affected by changes of temperature, and so unreliable between extremes of demand. It is a weighing machine as correct in principle as the old fashioned steel yards or the platform scales; in fact, it is simply a rotary platform scale, and each machine is weighed and tested in place by hanging to the pulley, A, sealed weights, and marking the index as each weight is added. The length of the connecting bars and chain are adjustable. The machine is made of sizes, and in different styles suitable for testing all kinds of machinery. One kind especially adapted for spinning frames, looms, etc.; another to be connected by belt to a line of shafting, or any kind of machine. And one especially adapted for testing turbine water wheels, to which it is easily applied, with but comparative small expense.

Patented by James Emerson, July 7, 1868; whom address for further particulars at Lowell, Mass., Postoffice box, 582.

Supply of Iced Water to Paris.

Every one who has visited the cafés of Paris must have observed the *carrafes crappees*, that is to say, water-bottles with a great block of ice, often very curiously crystallized inside. The production of these frozen decanters has become a very important operation, which is carried on in the ice-houses situated in the Boulevard Lannes, on the Passy side of the Bois de Boulogne. The establishment, according to the *Journal of the Society of Arts*, consists of ten great underground ice-vaults protected from the action of the sun by buildings raised over them, and covered with straw. Each of the ice vaults is nearly 500 feet long, and about 36 feet high, and the ten are capable of holding 10,000 tuns of ice. The department in which the water bottles are frozen is a curiosity. These decanters are two-thirds filled with filtered water in the receptacles of the freezing machine, and the freezing is produced by means of salt water and vaporized ether, with the help of a steam engine of sixteen-horse power. When the water within the decanters is reduced below freezing point, it is rapidly stirred with a stick, when the freezing takes place as if by magic. More than 6,000 of these frozen *carrafes* are sent out daily in hot weather, at a very trifling charge, and each being filled up with fresh water as often as required, will serve during a long summer day, and cool ten gallons of water.—*American Gas Light Journal.*

STEEL hammered when "black hot" may be condensed in its substance to a spring temper, but for subsequent tempering it should not be hammered after the glow has departed.

THE COTTON MANUFACTURE IN THE SOUTH.

In a recent article we proffered some advice to the South, as to the proper course to pursue in the reconstruction of her industries. In that article we recognized the possibility that some of the industries which under the old system of things were prosperous, could not under the existing state of affairs be profitably restored, and suggested the substitution of others. Since that article was published a correspondent has called our attention to the feasibility of cotton manufacturing in the southern states, and as evidence of the correctness of his views, has furnished us with some interesting details of the Augusta (Georgia) Manufacturing Company, as shown in the report of its President, for the first six months of the present year. Mr. Wm. E. Jackson, the President, says in his report:

In presenting my twentieth semi-annual report it is with pleasure I can state the condition of the company is very favorable.

The gross earnings for past six months have been		$135,510 65
Interest received		3,921 65
		$139,432 30
From which is deducted expense account	$8,731 64	
Repairs account	3,475 11	
Taxes paid	19,691 41	
		$31,898 16
Leaving as net profits		$107,534 14

From which two dividends of five per cent each; amounting to $60,000 have been paid, enabling us to carry to the credit of profit and loss account $47,534·14, making the amount now to to the credit of that account, $224,798·22.

Goods manufactured from December 14, 1867 to June 13, 1868:

	lbs.	Pieces.	Yards.
4-4	707,018	54,139	2,135,418
7-8	363,801	33,475	1,324,691
Drills	60,685	4,589	178,143
8-4	53,341	6,145	250,049
	1,184,845	98,348	3,888,301

Bales goods on hand December 14, 1867:

	7-8	4-4	Drills.	3-4	Total.
	19	47	6	0	72
Made	1574	2567	254	294	4689
	1593	2614	260	294	4761
Sold	1558	2561	253	270	4642
On hand	35	53	7	24	119

	lbs.
Cotton consumed	1,362,571
Average cost of cotton	19·98
Average yds. per loom, per day	49·13
Average number of looms running	505
Average number of hands employed	507
Aggregate wages paid	$87,546·93
Aggregate sales	$519,965·01

The operations of the company for the past three years, or since the close of the war; viz., from June, 1865, to June 13th 1868, have been as follows:

Nominal balance 17th June, 1865,			$562,583 09
Amount paid creditors due them in Confederate notes,			35,775 22
			$598,358 31
Deduct depreciation in Hamburg and Columbia Railroad stock	$26,625 00		
Deduct depreciation in various assets,	446,284 05		
Deduct suspense account St. Louis,	4,703 71		—477,612 76
True balance, profit and loss account, 17th June, 1865, in United States currency,			100,745 55
Gross earnings from 17th June, 1865, to 13th June, 1868,		932,906 57	
Expense account,	$78,300 61		
Repairs,	33,386 72		
Taxes,	244,479 81		
New machinery,	92,686 76		
Dividends paid,	360,000 00	-808,853 90	
Add to profit and loss account,			124,052 67
			$224,798 22

Bales goods made	23,545
Aggregate sales	$3,765,301·80
Aggregate wages paid	$622,280·15
Average yards per loom per day	45·9
Average number of hands employed	578

Production for three years:

	Pounds.	Pieces.	Yards.
4-4	3,726,014	292,540	11,337,660
7-8	2,120,137	200,154	7,711,451
Drills	362,173	28,275	1,065,759
3-4	53,341	6,145	250,049
	6,261,665	527,114	20,364,919

It may not be uninteresting to some of our present stockholders to state what has been accomplished in the past ten years. It will be remembered by those who were among the original purchasers, that the property was purchased of the city for $140,000 on ten years' credit, with interest at seven per cent, payable semi-annually, and one tenth of the principal annually, the purchasers paying in as commercial capital $60,000. This amount, in consequence of the dilapidated condition of the property, was almost entirely expended in the first two years, in repairs rendered necessary by the then condition of the property. We have, since the purchase, paid for the entire property without calling on the stockholders for another dollar; added largely to the property by purchase and building, bought about $100,000 worth of new machinery, increased the capital to $600,000 by the addition of a portion of the surplus; paid dividends regularly, and have now a property worth the par value ($600,000 in gold).

Our correspondent, who writes us from Nashville, Tenn., says:

Should you wonder how it is, that the people of the South (who are usually supposed to be quite ignorant in regard to manufacturing knowledge) could succeed so well in making so profitable a matter of a cotton mill, I can readily solve the mystery. In the first place, owing to the mildness and salubrity of our climate, equally free from the intense cold of winter, or the extreme heat of the further South, added to the unbounded fertility of our soil, we produce provisions of all kinds, not only the bare necessaries of life, but as well many of the luxuries at the lowest possible cost of capital or labor—here we have cheap labor and especially of that class (I mean the youth) who are most needed as operators in cotton manufacturing—and this class of labor too, is quite abundant, as there have been but very slight drafts as yet made on it. Beside cheap labor and cheap means of living, we have a great abundance of cheap fuel of all sorts—wood, away from the cities or large towns at a merely nominal cost—with a supply of bituminous coal enough to run every steam engine on the continent for centuries.

And again, we have the raw material (cotton) right at the doors of the mills that fabricate it into cloth, saving the enormous cost of transporting it to Lowell or Manchester, and retransporting its manufactured product back again.

If you will estimate this item alone, and suppose for argument sake (for it is not otherwise supposable) that the labor employed in converting it into cloth is as great as it is in New England, you will at once see that it allows as much profit as any reasonably avaricious man should desire.

Our correspondent assures us that the above is not an isolated case, and there are plenty of others which although their business has not been so extended, have achieved equal success in proportion to their investments. He says all that is needed to develop the resources he has enumerated is capital. The capital of Tennessee as of the other slaveholding states in past times, consisted largely in their slaves. This is lost to the South, and until it is in some way replaced in part at least, manufacturing growth must be inevitably retarded.

He states that clever, honest, industrious people will be welcomed to Tennessee, and their personal safety, and that of their property, willbe as assured there as in the North.

The journal from which we have copied the above extract challenges a comparison of the report of the Augusta Cotton Manufacturing Co., with that of any similar establishment in the Northern States, and thinks the cotton manufactures of New England had better look to their laurels.

Correspondence.

The Editors are not responsible for the Opinions expressed by their Correspondents.

Propulsion and Dynamical Levers.

MESSRS. EDITORS:—The prevailing opinion among engineers, and, in fact, with scientific men generally, is, that no power can be saved or gained by use of a lever. While this is absolutely true, as relates to the use of the statical lever, it is radically wrong and a very great fallacy as relates to dynamical levers, as will be seen by the following argument.

Under the head of statical levers are included the common scales, the pulleys, the wheels of fixed machinery, and every other kind of levers where the axis is fixed and stationary.

Dynamical levers are those where the supposed axis is not fixed or stationary, but actually the point and line of motion; and under this head are included the wheels of any vehicle, the oar, the legs of all animal and insect organisms, the wings of a bird, the fins of a fish, the duck's foot, and, in short, the one vital principle of the propulsion of all animate and much of inanimate nature is the dynamical lever.

Let us inquire whether or no anything is gained by this kind of lever. Now, it is a solid fact, that a horse can pull a tun weight on wheels, at a speed of two or three miles per hour; whereas, if the tun weight were not on wheels, he could scarcely move it at all. Why is this? The general answer given is, because the wheel overcomes a large amount of friction. This, of course, is correct, but does not give a full solution; for it may also be asked, why a mere wheel being round, produces this economy; the more philosophical answer being because the vital principle of the wheel is a lever of the dynamic series. From this fact, one of two deductions only can be made; namely, that economy or saving of power *is* produced by use of a dynamical lever, or that the wheel is not a lever.

Again, take another variety of this kind of lever—a man's legs. Given, A and B, two men of exactly equal powers, let A use his own legs, and B have stilts added to his, enabling him at each stride to step three times the distance of A, and it must be conceded that if there is no gain or economy in the dynamic lever, that A will be able to walk as far in any given time as B. But we know that this is impossible, hence the manifest gain by use of the lever; and those who would deny the gain or saving produced by the lever, will be forced to deny the fact that legs are levers.

Furthermore, the closer the student of nature examines the wonderful structure of all living creatures, he finds that nothing is created by accident, everything that God has created being supplied with most perfect means for any desired end, and becomes more and more impressed with the wonders of the universe, and the goodness and absolute wisdom of its divine architect. Therefore, he who would still dispute the economy of the dynamic lever, must be prepared to deny the wisdom of the All Wise.

Were the practical effect of this fallacy limited to the mere expression of opinion, and did it not interpose a serious obstacle to the advancement of a very important branch of science, namely, that of propulsion and steam navigation, it would be an error of small importance.

The paddle-wheel, owing to its axis being the actual and true line of motion by which the speed of the boat may be measured, acts as a lever of the dynamic series, and much is to be gained in economy by the proper application of power; for from the application of power to the axle of the cart wheels, and to the axis of the levers we call legs, it is evident that the nearer the power is applied to the axis or line of motion, and the longer the lever used, the greater the economy. Therefore, it stands to reason, that the shorter the crank by which the axis is turned, the greater the economy—provided always, however, that this gain or saving shall not be lost or counterbalanced, owing to some radical defect in the present rotary system, as is actually the case.

Hence it is that well-informed engineers, and many scientific men, overlooking the fact of the difference in effects produced by statical and dynamical levers, and not realizing the fact that the paddle wheel acts as a dynamical lever, having its great economy overshadowed by the natural defects of the present rotary system of steam navigation, have *erroneously* decided that there is no economy or saving in the short crank. The writer has spent several years, and some thousands of dollars, in the practical study of propulsion, and has abundant evidence to show that, given the same boat, the same power, and the same paddle, if the crank be one half length of radius of paddle, the "slip" will be much greater than if some power is applied to a crank of one eighth or one tenth.

Now, as it can be proved that propulsion is simply a question of power and comparative resistance, and that the "slip" is diminished by shortening the crank, it follows, that if some other system, not rotary, could be adopted, that the application of the power as near the axis as possible, and as far away from the fulcrum (which in propulsion is the water at the propellers) that the limits of increased economy can only be estimated by mechanical possibilities.

The writer has invented such a system, possessing not only the advantages of great economy in fuel and machinery, but also many important mechanical advantages over either screw or paddle wheels, which will form the subject of another paper.

I hope these remarks will clearly show that there are two classes of levers; namely, the statical and dynamical, and that while nothing can be gained or saved by use of the former, that the economy produced by the latter is almost limitless; and that by so doing, one of the errors that obstruct the path of the world's progress may be removed.

New York city. F. R. P.

Poisonous Drugs and Cosmetics.

MESSRS EDITORS:—In your issue of November 25, I notice an article headed "Poisonous Drugs and Cosmetics." Now while the writer fully agrees with you that the evils to which attention is called are very great, he begs leave to differ as to the best curative measures, and he also thinks that the statement, "we believe there is no department of trade in which, as a rule, retailers know so little that is requisite to the proper conduct of their business as in the drug trade," was made without due consideration, and that it is altogether too sweeping a condemnation of the class.

The head of the largest drug house in New York remarked, after twenty-five years of daily dealings with retailers in every State in the Union, that, "outside of the learned professions, no class of men possessed so much intelligence." You fortify your statement by the fact that "a druggist doing a large prescription business did not know that vinegar contained acetic acid." Now, unfortunately for the public, they are very apt to give their patronage to the man who will sell the cheapest, in this trade as in others, forgetting that they cannot judge of the purity of drugs, or the ability of the dispenser, with the same accuracy as they can the quality of cloth, or the taste of the draper. Thus many a man builds up a large business who, judged by the standard of an experienced pharmacist would not be thought fit for a third assistant in a first-class store. If mistakes occur, and ignorance is shown, in such cases, who should bear the blame,—the class of intelligent apothecaries, or an unwise public? We answer, so long as the public will employ physicians or apothecaries who are not regularly educated they must take the consequences if mistakes occur. We advocate the most thorough education on the part of the apothecary, but we think that the public are bound on their part to liberally support such men.

That "nothing should be done blindly" is impressed upon the mind of the youngest boy in the trade, as one of his earliest lessons, in all well-regulated stores. No rule is more thoroughly established and constantly acted upon than this. If an overdose of a powerful medicine is ordered, the prescription is re-submitted to the prescriber; thus many times when physicians wish to order large doses of powerful medicines they find it difficult to get the prescription put up by the careful apothecary.

"Finally, prescriptions should be written plainly in plain English." One would suppose, to hear what is said, and to read what is written on this subject, that physicians adhered to obsolete and inconvenient Latin names for drugs, for the sole purpose of mystifying their patients. Let us examine this matter. That certain exact and invariable names, understood alike by the physician and the apothecary, must be used, is evident. The botanical names of plants, and the chemical name of chemicals, form the basis of the nomenclature of the United States Pharmacopœia. Should we gain anything by a resort to English names? Let us see. What, for instance, is the English name of the plant known in the Pharmacopœia as *Cypripedium pubescens?* It is called in various localities, nerve-root, nervine, moccasin plant, and ladies' slipper. What is the English for the *Gaultheria procumbens?* It is known as wintergreen, partridge berry, deer berry, tea berry, mountain tea, and checkerberry; and no two old ladies well versed in herbs will be found, who can agree that these names all refer to the same plant. "Wintergreen, indeed!—why that's another thing altogether," one says. To be sure, the common princess pine is also known as wintergreen. Indian hemp may mean the *Cannabis Indica*, or it may mean the *Apocynum Cannabinum*—two articles widely different both in nature and use.

Among chemicals, the synonyms are not so many, yet who would choose to give up the simple, exact, and descriptive chemical names for the inaccurate, and in many cases foolish common ones? If common names are not adopted, how are the mass of mankind to know what they are taking; for how many people in the hundred know even that Epsom salt is sulphate of magnesia? If people have studied medicine sufficiently to be able to judge "whether the dose presented to their lips is calculated to heal their infirmities or send them to eternity by the run," they ought at least to know the scientific names of medicines. The fact that these names are used is, too, something of a safeguard to the public, as it obliges the apothecary to know at least this much, although it is a very small part of the knowledge of the intelligent man, who will know thoroughly the thing itself, not barely its name.

The nomenclature of our Pharmacopœia, as well as the body of the work is revised once in ten years by a committee of able and scientific men, of whom Dr. Squibb has done, perhaps, more than any other man to perfect it.

The subject of abbreviations has been often and well discussed, and those sanctioned by use are such as cannot without gross carelessness be mistaken, if plainly written. We deny that the profession is behind any other in intelligence, or in a desire for advancement, and would ask all skeptics to read the *Journal of Pharmacy* and the proceedings of the American Pharmaceutical Association, at its annual meetings. Five colleges of pharmacy are already in existence, where lectures on botany, chemistry, materia medica, and the art of pharmacy are delivered by able professors. Young men are encouraged by their employers to attend these lectures, and to gain the diploma of these institutions. But something more is needed—it is this: a wise legislation which shall provide in every State a board of examiners whose duty shall be to test the qualifications of all who desire to practise the art, and whose certificate of ability shall be necessary before they are allowed to do so. Then, the public will have some protection, and not till then.

The public, also, must be educated to look upon the business in its true light, and it must be as willing to pay the educated pharmacist for faithfully compounding a prescription, as it is now to pay the physician who prescribes it. Then, perhaps, the assistant who works now, for fourteen hours a day, for from $12 to $18 a week, may earn as much as a mechanic.

All "cosmetics" and secret preparations should be obliged to pass examination before a Government assayer before they are allowed to be vended to a credulous and ignorant public; then perhaps we shall hear of fewer cases of poisoning from this source. I beg leave respectfully to commend these suggestions to our legislators as the view of

A PHARMACIST.

[We cordially give place to the above excellent communication, and add that the suggestion that all ready-made preparations kept for sale by druggists should be submitted to examination by an official appointed for that purpose meets with our entire approval.

In the matter of prescriptions, we do not object to the use of Latin names when there is any ambiguity involved in the use of an English one; but the names of drugs are not all that is contained in a prescription—there are also quantities and directions for use. We yet fail to see why "every other hour" should be written in Latin: "*alterna quaque hora,*" and abbreviated at that into "*alt. q. h.,*" or why "*cochl. amp.*" is better than "a tablespoonful;" "*bis indies,*" abbreviated into "*bis ind.,*" better than "twice a day," and so on. When our correspondent shows why they are better we will unsay what we have said on the subject of prescriptions.

If the suggestions we made in the article referred to by our correspondent were carried out, there would be no danger that the public would patronize incompetent druggists on account of cheapness; there would be none of that character to patronize.

We admit that all people are not competent to judge whether drugs prescribed are beneficial or hurtful; but when, as in the instance we alluded to in the article questioned by our correspondent, a mistake is made in so powerful a drug as opium, and one patient is able to detect that the dose is too large when the prescription reads "*Tinc. Opii,*" more could be found who could detect the same error, the drug being called simply "laudanum."

Practical Tanning.

MESSRS. EDITORS.—The article on tanning, in No. 18, current volume, is more theoretical than practical in its details. As a practical tanner in the good old way I should like to make some remarks showing the inconsistency of the correspondent in regard to tanning. The making of leather is a chemical process and therefore rests upon a principle that knows no change either in France or America. The first thing done, is (so the article reads) to throw the hides in the lime to loosen the hair. Now a good tanner would laugh in his sleeve at the simplicity of the idea, for, if that was all, then we could easily dispense with the liming process, as we do in making "sole" in our large tanneries. I was taught that it was for the purpose of softening the gelatine, a constituent of the skin, and leaving nothing but the cuticle or true skin to work upon. Lime having the solvent quality, performs its office in a perfect manner, at the same time loosening the hair so that it can be easily removed. The next step in practical tanning is of the utmost importance, and one which the article referred to completely ignores. My opinion is, that the tanners at Pont Audemer threw dust in the eyes of the correspondent, so that he was left in the dark as to their method of preparing the skins for the ooze. In liming we have softened the tissue and the next step is to remove the gelatine or gluey substance so that we can have a soft pliable skin to work upon. This is done by what dyers call a mordant.

Now I doubt very much if the waters that run through Pont Audemer possess the power, although the correspondent says they threw the skins in the river to remove the lime, and thence to the vats and cover them with "juice of tar" which is a ridiculous blunder on his part. The mordant used in this country and England is the droppings of the hen or pigeon house; others are used, but these are the principal ones employed in all sections for upper and calf. We, practical tanners, call this process "bating," that is, we mix a certain amount of this manure with water, and throw our hides or skins into it. Once or twice a day they are raised, and as soon as they begin to soften, work them over on the beam; this is done until they are cleansed from lime and glue and present a soft pliable appearance when they are ready for the tan, but not the "tar."

The idea of putting skins from the "bate" into strong ooze is simply absurd, as it would be to eat alum or a green persimmon before taking a piece of pie or sweet cake. French calf is remarkable for its fine grain and soft velvet appearance which can only be secured by careful handling in a weak solution of tan. To put green skins in strong tan would draw the grain hard and coarse, it being an astringent in its nature; and hence the philosophy of handling in weak ooze and gradually raising the strength until a good color and grain are secured when you can bring on the "tan." The idea of laying away in dust may do, yet there is nothing gained by the operation, as the leather cannot absorb the tan without moisture, hence you only loose time. You want sufficient to cover the mass and let it lay three to four months; then change and make a degree stronger, until your leather is completely tanned, even if it takes a year or two, the longer the better. I wish some of your scientific readers would give the reason why the tanning principle in bark grows weaker as you go West. I have conversed with tanners in various western States who have emigrated West and they all agree upon this, that it takes more bark than it did East to tan a given number of hides.

S. P. W.

Mechanicsburg, Ill.

[We are always happy to receive letters from practical men—and hope our correspondent will follow up the subject by sending us other articles. "Juice of tar," in the original article may have been a typographical error.—EDS.

A Central Invention Bureau.

MESSRS. EDITOR:—I am much pleased to see you advocating the necessity of a "National Invention Bureau." I have thought a great deal in regard to such a thing, and have decided that the country calls for it. About eighteen months ago I sent a letter, containing hints of the necessity of an association of the kind, to the Farmers' Institute Club, in New York; it was published in the New York *Tribune*, but that seemed to be the end of it. Probably its source was too obscure to demand attention. If Henry Ward Beecher, Horace Greeley, or some other shining light had made the suggestion, doubtless it would have been heeded. An association, or stock company, organized for the purposes as mentioned by you in the SCIENTIFIC AMERICAN, would, beyond doubt, be a source of much profit to the association, a good thing for the inventor, and a still greater benefit to the country at large. As soon as it would be known by inventors that they could have their machinery advertised and exhibited by competent mechanics, at the commercial metropolis of the United States, they would make application, and either pay a sum for exhibition, or have their rights for sale on commission, at a place where the people generally could see them. No better advertisement could possibly be obtained. It would be an inducement to inventors to construct their models in a workman-like manner, and put them in good running trim. All the inventors in the country would visit a place like that; all noted patent right dealers would go there for information. It would save the country from being imposed upon by bogus patents; it would save a vast deal of false circular printing; it would throw on the market, at once, any invention which might be useful to the farmer or the mechanic; it would save thousands of dollars to individuals, spent now "lawing" each other over some infringement in bogus sale. In fact, the present system looks very much like a headless man walking about over the country—making numerous mis-steps, for want of brains and eyes. In truth, we want a head and shoulders, as a grand center directory for the exhibition and sale of the new productions of the country.

Please stir the subject till the right men take hold of the matter. As for myself, I have three or four patents, and probably may have more in a short time, and I feel personally anxious about the matter.

JAMES H. REYNERSON.

Clayton, Indiana.

Preservation of Wood from Decay.

MESSRS. EDITORS:—For the past thirty-six years my attention has been directed to the subject of defending every species of wood from decay, and also to make it incombustible or fire proof. Beside making thousands of experiments, I have assisted others to institute them, and have watched the progress which has been made by the various patents issued for this purpose, such as kyanizing by the use of bichloride of mercury; the Burnett process, (chloride of zinc); the Earl process, (protosulphate of iron); Behr's plan, (solution of borax); Heinemann's patent, by the use of resin; the carbolizing method, the subject of two patents, one for cold carbolic acid, and one for hot acid; the tar and petroleum method as used in the Nicolson pavement, and many others, which have been brought out from time to time, but without having achieved permanent success.

I claim the first application of silicates in their various forms to all organic substances, such as woody fiber, paper, pasteboard, etc., for preventing the attack of the *teredo navalis*, fire, and water. I have frequently shown that by applying, by double chemical affinity, the silicate of soda and lime water, as I will presently describe, I convert the woody fiber into a mineral substance. This process is the most reliable and economical of any I have seen.

Railroad sleepers have to be replaced, under the circumstances most favorable to their durability, every five years, never remaining sound over seven years, and generally lasting only three years. I saw in California, in the gold diggings, timber that had rotted in two years, and was informed that cross ties seldom lasted longer than that period. If we calculate the number of railroad sleepers to the mile, which is 2,112, and their cost at 50 cents each, keeping in mind the fact that we have 40,000 miles of railroads in the United States, the annual cost per mile of replacing sleepers appears to be about $150, even if they lasted an average of seven years. Statistics show that farm houses of wood, wooden bridges, etc., last on an average about 20 years, and demand no less than $100,000,000 annually for repairs. A large proportion, if not the most of this immense sum, could be saved by the use of soluble glass.

My method, described years ago, is simply to steam the timber, then inject a solution of silicate of soda for eight hours, and then soak the wood the same period in lime water.

DR. L. FEUCHTWANGER.

What Farmers Want.—Inventors take Notice.

MESSRS. EDITORS:—While machinery has done very much for the farm, there are yet some unsupplied gaps to be filled to make the mechanical aid complete. One in the hay-making process. We have excellent mowing machines, and horse tedders, and horse rakes, and good horse forks for unloading hay in the barn, where there are no cross beams in front of the mow, but it costs as much as it ever did to get the hay from the field to the barn. We want a machine—a kind of rake—on wheels, eight or ten feet apart, drawn by a single horse, that will go into the spread hay, rake up and load upon itself eight or ten hundred pounds of hay, and bring it to the barn without further aid than the boy that drives it can render.

Most farmers have two horses, and most meadows are not one quarter of a mile from the barn; and with two such machines, ten times the amount of hay usually gathered by the two-horse hay wagon, and the pitcher, and loader, and raker after, could be stored in the same time and with much less labor. The farm pays heavily for the machinery it wants, and for some that it does not want. And the inventor who can make a simple machine for the purpose named (first reading editorial article in SCIENTIFIC AMERICAN, entitled, "Poor Mechanical Work on Agricultural Machinery," December 16, p. 93) need have no apprehension about its not paying. Give over velocipedes and rat traps, and give the old "Mother of Arts" a hoist.

A. N. C.

Sheffield, Mass.

What a Mechanic Thinks.

MESSRS. EDITORS:—It gives me the greatest pleasure to send in this $3 for the SCIENTIFIC AMERICAN another year. I cannot help giving vent to my feelings by saying a word in praise of the SCIENTIFIC AMERICAN. It meets from me a hearty welcome every week. I often wonder how such a paper can be got up for $3 a year, when we have to pay that amount for common papers, printed on poor paper, poor type, done up badly, and sent any how; and a person is none the wiser who reads them.

I have worked in a machine shop, and run steam engines for more than twelve years, and the SCIENTIFIC AMERICAN just hits my case; I have learned more from it than any one thing I ever read. People often say that the SCIENTIFIC AMERICAN is just the paper for me, because it is a mechanical paper. Now I contend it is just the paper for them also. I value my SCIENTIFIC AMERICAN papers very highly—so much so that I have them nicely bound—and I should not take for them what they cost me. They make a book to be proud of. I was the means of your having a few subscribers for the SCIENTIFIC AMERICAN last year. In fact, I often advise my shopmates to take it. I often wonder how some mechanics slide along, year after year, and only learn what is pounded into them.

One more important thing and I close. I often read of boiler explosions, and I wonder why they are not more frequent. I think if those using steam power should furnish their engineer with a copy of your paper, they would be the gainers by it.

EDWIN FLINT.

East Canaan, N. H.

Dangerous Hair Washes.

MESSRS. EDITORS:—The article in your paper of 9th inst., on "Hair Washes," should receive the widest publication, as a warning against their use. Nearly all of the boasted "Vegetable(?) Hair Restorers," which are so extensively advertized, and correspondingly extensively used by the innocent public, contain lead in one or more chemical forms—mostly sugar of lead—the poisonous qualities of which ingredient can be attested by any one acquainted with medicine or chemistry, and by those who have been using any of these restorers. If the country is to be flooded with articles for the purpose of satisfying the vanity of those who have lost their beauty, by the blanching of their former raven locks, the makers of these compounds should know the peril to which they subject all who use them.

It would also be proper, if "hair restorers," or "hair color restorers," are to be used, to invite the attention of inventors or chemists to the propriety of the production of such articles as will have the desired effect, without the danger which now threatens those who use them.

By devoting your columns to the ventilation of this subject you will be adding much to their usefulness, and be doing at the same time a favor for much suffering

Philadelphia, Pa.

HUMANITY.

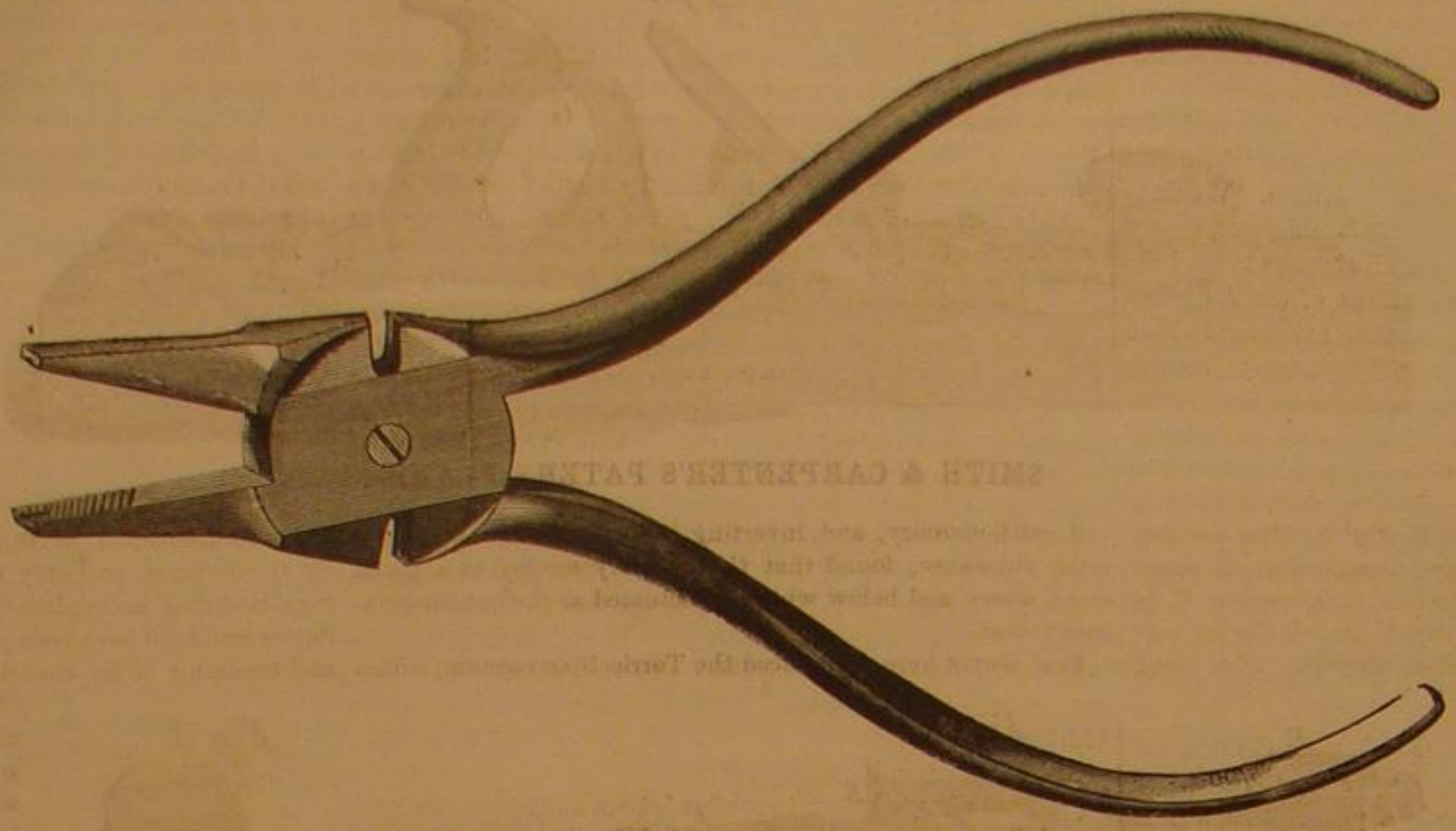
Patent Wire Shears and Pliers Combined.

Artisans have long felt the need of such a tool as the annexed engraving represents. Its advantages over others for the same purpose are very great. The jaws of the pliers are constructed in the required form, without the knives at the sides to obstruct their free use, as in the old combined cutting pliers.

The shears are made in the joint, which is formed of two smoothly faced surfaces held firmly together, and moving on a common center in opposite directions, as the pliers are opened and closed.

These surfaces are, in fact, two circular plates of steel, which being angularly notched at the periphery in one or more places, form the most perfect wire cutters in use. They are arranged so as to operate to the best possible advantage, either for ease of cutting or durability. The superiority of the shear cut, together with the increased leverage, enable the operator to cut a wire by one hand with these shears that cannot be cut by both hands with the ordinary cutting pliers; and while the mere attempt in the latter case would be almost certain destruction to the tool, the shears will cut the wire without showing any evidence of having been used. The utility of these combined pliers is obvious. Beside being useful to all who work in wire, such as tinsmiths, machinists, telegraph builders, hoop-skirt manufacturers, etc., every farmer and every housekeeper will find them quite as useful as a hammer or saw. They are made from best cast-steel, and are said to be equal in quality to the best Stubbs goods. The manufacturer has so much confidence in the success of these pliers that he will supply responsible parties in the trade with them, to be returned at his expense if found unsalable.

All orders or letters of inquiry addressed to L. Button, manufacturer of steam and hand fire engines, steam pumps, etc., Waterford, N. Y., will receive prompt attention.



WIRE SHEARS AND COMBINED PLIERS.

Inter-Communication---The Pacific Railroad and the Proposed Darien Ship Canal.

The New York *Shipping and Commercial List*, in favorably quoting our brief article on page 345, last volume, on the facilities for international communication, very truthfully says:

Our cotemporary's views, with regard to the relative cost of water and land transportation, are substantially correct. Still, a good many light costly goods, from Japan and China, such as silks, opium, etc., must inevitably come by the Pacific Railroad. But the transportation of tea, in any considerable quantities, over this route, may reasonably be doubted, as, in the opinion of the trade, the length of the carriage by rail would result in so pulverizing the article, as to detract materially from its value. There cannot be the slightest doubt, however, that the traffic between the Eastern and Western portions of the Continent, together with the business which a short route to China is certain to bring, will afford the Pacific Railroad all the business which it can accommodate, to say nothing of an important intermediate commerce, which it must build up. Nothing is more certain than that this great highway will, within a brief period, be instrumental in thickly populating a vast extent of country, stretching away from the Missouri River to the Rocky Mountains, thus rendering necessary a network of railroads similar to that in the Middle and Northern States. East of the Mississippi and Missouri Rivers there was, in 1860, a population of twenty-seven millions: westward there was less than one thirtieth the population, though double the area. And yet this great area is full of mineral and agricultural wealth; so full, that thirty-five millions of dollars of gold and silver are drawn from it every year, and the rich valleys of the pregnant rivers yield a maximum of agricultural products in return for a minimum of toil. The greatness of the traffic which will come to the great national highway between the Atlantic and Pacific, all contributing to its success and profit, can hardly be over estimated. That it will be so vast, a few years hence, as to necessitate one or more through roads may, we think, be taken for granted. But, for our countrymen to control the rich trade of China, India, and Japan, a cheaper and shorter water route is absolutely essential. This want will be supplied, as soon as science shall assure us the projected Darien Canal; the Isthmus being unquestionably the key to commerce between the Atlantic and Pacific Oceans. Since Cortez first viewed the two oceans from an elevation on the Isthmus, this magnificent project has been the dream of philanthropy and of liberal enterprise. The Spaniards, the French, and the English have repeatedly, during the last three centuries, sent expeditions to solve the problem. No less than nineteen canal routes, and seven railroad and common road lines, have been contemplated, only one of which—the Panama Railroad, an American enterprise—has been accomplished. This avenue, in connection with the steamship lines, has been a potent element in the development of commerce; but what it has accomplished, cannot be regarded as an accurate index of the success that would be likely to attend the canal. We are pleased to know that this grand project is assuming a shape that will, sooner or later, insure its consummation. The leading merchants and capitalists of the United States have taken it in hand, and with them "there is no such word as fail."

"The Wheel, the Axle, and the Rail."

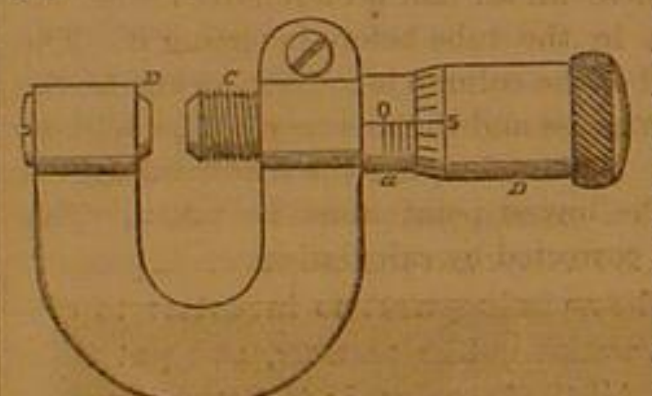
This is the title of a circular containing valuable tables and other information for railroad men, compiled for the Ramapo (N. Y.) Wheel and Foundery Co., by W. G. Hamilton, engineer. We extract from it the following statistical information about car wheels:

There are in daily use on the 37,000 miles of railway in the United States, not less than 1,250,000 truck and car wheels, under 8,500 locomotives, 5,500 passenger cars, 2,700 baggage and express cars, and 160,000 freight cars.

The available statistics show that passenger cars make an annual mileage of 28,400 miles, or 88 75-100 miles per day of 320 days per annum; the average load borne on each car wheel to be 3 1-3 tuns. With this load the average life of a wheel is 45,000 miles or 1 58-100 years. On trains running at express speeds, the average life does not exceed 10 months' service, while wheels under tender trucks have a life of 18 months. Under freight service in the State of New York, with an annual train mileage of 11,483,123 miles, transporting 75·5 tuns of freight per train, the annual mileage per car was 14,649 miles, each wheel bearing an average load of 1·47 tuns, which gives 3·08 years as the life of a freight wheel, corresponding with the experience of one of the principal roads in the State. But assuming that the average life of car wheels, under all kinds of service, as being five years, the total number of wheels worn out annually in the United States will not be less than 250,000. At an average cost of eighteen dollars per wheel, allowing one-half for their value for the old wheel, the annual loss may be stated at two and a quarter millions of dollars.

POCKET SHEET METAL GAGE.

The difficulty of accurately measuring the thickness of sheet metals is well known to all persons who have occasion to use or deal in them. The edges of metal being often imperfect, ordinary gages are prevented from going on readily. It also usually happens that the extreme edges are thinner than the rest of the sheet and cannot therefore be relied upon to give the thickness correctly. In selecting sheets for many purposes, it is desirable to have a gage to indicate the exact thickness in parts of an inch, and to accomplish this result the gage shown in the cut has been devised, which will show the thickness of a piece of metal up to three tenths of an inch in thousandths of an inch, and at some distance from the edge of the sheet. The piece in form of the letter U has a projecting hub, *a*, on one end.



Through the two ends are tapped holes in one of which is the adjusting screw, B, and in the other the gage screw, C. Attached to the screw, C, is a thimble, D, which fits over the exterior of the hub, *a*. The end of this thimble is beveled, and the beveled edge graduated into twenty-five parts and figured, 0, 5, 10, 15, 20. A line of graduations 40 to the inch is also made upon the outside of the hub, *a*, the line of these divisions running parallel with the center of the screw, C, while the graduations on the thimble are circular The pitch of the screw, C, being 40 to the inch, one revolution of the thimble opens the gage $\frac{1}{40}$ or $\frac{25}{1000}$ of an inch. The divisions on the thimble are then read off for any additional part of a revolution of the thimble and the number of such divisions are added to the turn or turns already made by the thimble allowing $\frac{25}{1000}$ for each graduation on the hub, *a*. For example, suppose the thimble to have made four revolutions and one fifth. It will then be noticed that the beveled edge has passed four of the graduations on the hub, *a*, and opposite the line of graduation will be found on the thimble the line marked 5. Add this number to the amount of the four graduations, which is $\frac{100}{1000}$, and it equals $\frac{105}{1000}$, which is the measurement shown by the gage.

The gage illustrated above, which is full size of implement, will measure the thickness of sheet metal or other material, by thousandths of an inch up to three tenths of an inch at any point within half an inch from the edge and will also answer to measure the diameter of wire. Means of adjustment are provided in case of wear by continued use.

The attention of machinists is called to the usefulness of this gage for convenient and accurate measurement. It is light, small, and suitable to carry in the pocket. Address for further particulars, Brown & Sharpe Manufacturing Company, Providence, R. I.

A CITIZEN of Mechanics Falls, Maine, has a very old coin, a Spanish silver dollar, bearing the date 1179. The figures and lettering are very perfect. On both sides there are several Chinese letters or characters, about twenty-three in number.

The Origin of Porcelain.

An apothecary's assistant at Berlin, John Frederick Bottcher by name, being suspected of alchemy, fled thence to Dresden, where the Elector, believing him possessed of the secrets of the transmutation of base metals, and their conversion into gold, placed him in the laboratory, and under the close surveillance of Tschirnhaus, who was seeking for the Universal Medicine. It was here that the contents of some crucibles, prepared for alchemical purposes, unexpectedly assumed the appearance of Oriental porcelain, which had been introduced into Europe from China, after the voyage of the Portuguese navigators around the Cape of Good Hope, and which was even then much prized by and only in possession of the wealthy. Augustus II. appreciated the importance of the discovery of Bottcher, and removed him to the Castle Albrechtsburg, at Meissen, where, with an officer as a constant attendant, he was provided with every comfort and luxury, and with every facility for his research, till, in 1709, the true white porcelain was produced; and, in the succeeding year, the great manufactory at Meissen was established, with Bottcher as director.

The secret thus discovered was carefully and jealously guarded; strict injunctions, with respect to secrecy, were enjoined upon the workmen. The establishment in the castle was a complete fortress; the portcullis raised neither day nor night, and no stranger allowed to enter, whatever the pretence. The chief inspector and all under him, were sworn to the closest silence, with the punishment of imprisonment for life attached, for divulging aught connected with the manufacture. Every where around the establishment was the warning motto: "*Be Silent unto Death.*"

Despite these injunctions and precautions, and even before Bottcher's death, which occurred in 1719, one of the foremen escaped from the manufactory; and, going to Vienna, was cordially received by Charles VI., and granted the exclusive manufacture for twenty-five years. Thence the process, no longer a secret one, spread over Europe, and the art, relieved from its cramping restrictions—and with the incentive of rivalry among various manufacturers—assumed its proper importance, and made its products available to all classes.

What it Costs to Go Around the World.

Putnam's Monthly for January says the circumnavigation of the earth has become an easy and not a very expensive undertaking. A European journal gives the following estimate, taking Paris as the starting point; we translate the sums into greenbacks:

From	to	First class fare
Paris	Marseilles,	$25⅜
Marseilles	Alexandria,	137⅝
Alexandria	Suez,	20⅜
Suez	Aden,	266⅜
Aden	Point de Galle, Ceylon,	200
From Paris to Ceylon,		$650

From Point de Galle the circumnavigator has choice of two routes. The first and most direct is *via* Japan, as follows:

From	to	First class fare.
Point de Galle	Hong Kong	$200
Hong Kong	San Francisco,	420
San Francisco, *via* Panama and St. Nazaire, to Paris,		517
Ceylon to Paris,		$1137

The other, *via* Australia:

From	to	First-class fare
Point de Galle	Sydney,	$323⅝
Sydney	Panama,	430
Panama	Paris,	342⅜
Ceylon to Paris,		$1096

The time occupied by the two routes is thus given:

From	to	Days.	From	to	Days.
Paris	Ceylon,	25	Paris	Ceylon,	25
Ceylon	Sydney,	24	Ceylon	Hong Kong,	15
Sydney	Paris,	55	Hong Kong	Paris,	64
Total,		104	Total,		104

It is estimated, however, that when the Pacific railroad is completed, the journey around the earth will be reduced to eighty days, traveling time. Not only the intercourse between China and Japan and Europe, but between Australia and Europe, will then find its speediest route across the American continent.

A Better Umbrella Wanted.

A correspondent in one of our exchanges asks the question: Will no inventive genius improve upon the construction of the umbrella? As at present formed this indispensable article is shockingly ill adapted to its purposes. The best part of it, where one would put his head, is occupied by the stick and wires, so that only half the sheltering cover is available. Then the roof is so contrived as to cast the rain that falls upon it either on to the shoulder or into the coat pockets, or down over one's knees and feet. To remedy these evils the stick should be placed out of the center, and a turned-up rim should be made to constitute a gutter, with one shoot or spout only, which can be turned into such a position as to throw the water always to leeward of the pedestrian. If I were an umbrella maker I would endeavor to work out these improvements; as it is I can only enforce them upon the attention of those whom they may concern.

A CONVENTION of white lead manufacturers was held in St. Louis on November 11. The object was to effect a concert of action on matters relating to the trade, and the further object of promoting the interests of Western white lead manufacturers exclusively, reducing the price of white lead, and ridding the markets of adulterated material.

Improvement in Plane Stocks and Irons.

Even when constructed of the best seasoned wood and of such necessary dimensions as to make it heavy and unwieldy, the ordinary plane stock occasionally warps and has to be redressed on the face. The common method, also, of adjusting the bits or irons tends to spring the plane and to destroy the wooden key or wedge. Both these difficulties are intended to be obviated by the improvements shown in the accompanying engravings.

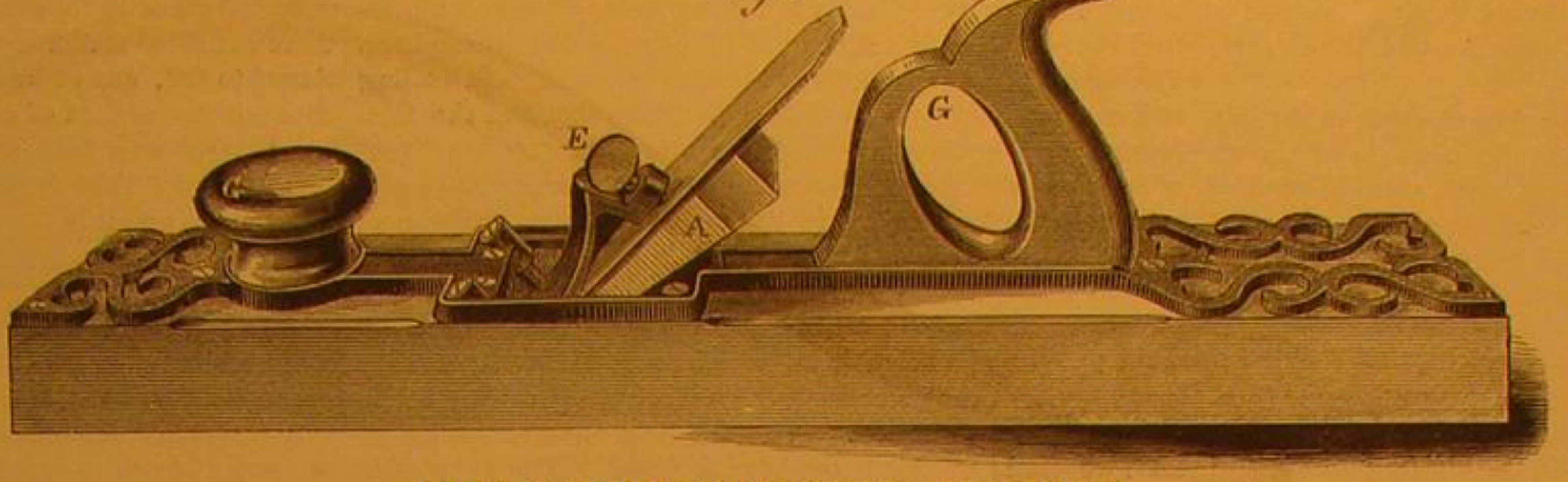
Fig. 1 shows an improved plane, the stock lighter than usual, and stiffened, strengthened, and adjusted, as to weight, by an ornamental malleable iron or brass casting extending its whole length. Fig. 2 is an iron cap similar to that in Fig. 1 but specially adapted to planes as ordinarily used, these being susceptible of receiving this improvement without costly alteration. Fig. 3 is a common plane iron, or bit, with a metallic wedge instead of the wooden wedge, and double or stiffening iron, both of which it supersedes.

The plane—Fig. 1—has a fixed incline, A, secured in the throat of the plane by a common wood screw passing through a slot in the incline so that it may be adjusted as necessary. This has a bearing on the inclined supports of the metallic top, seen plainly at B, Fig. 2. The pointed, downward projections, C, same figure, engage with the upper surface of the wedge, D, Fig. 3, and the thumb screw, E, by turning one way, brings the wedge firmly against the bit near its edge, and by turning in the other direction, after being seated in the plane, presses the wedge, D, against the projections, C, holding both bit and wedge firmly. The recesses, F, Fig. 2, are for the reception of the handle and guide, G, Fig. 1. In the ordinary slotted plane iron the screw, E, turns in one end of a strap that slides in the slot of the bit, the other end being held to the bit by the ordinary flat headed screw.

In the plane represented in Fig. 1 the screw, E, sets against the plane iron or bit, which has no slot in it. In this figure two adjustable screws passing through the metallic capping serve the same purpose as the projections, C, in Fig. 2, acting as fulcrums against the wedge. By this improvement the width of the mouth may be instantly adjusted to suit the different kinds of wood worked or the different demands of the work. The metallic covering of the stock may be removed from a worn out stock and adjusted readily to another block. Practical workmen will readily discover the advantages of this improvement.

Patented through the Scientific American Patent Agency August 25, 1868, by Smith & Carpenter. Other features are covered by a caveat subsequently filed. For further information address F. Smith, 11½ West King street, Lancaster, Pa.

Fig. 1



SMITH & CARPENTER'S PATENT PLANE.

Fig. 2

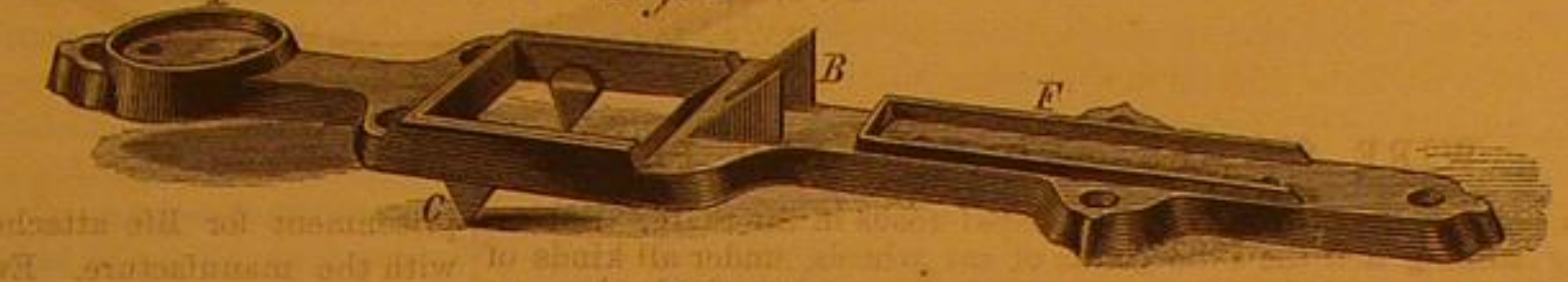
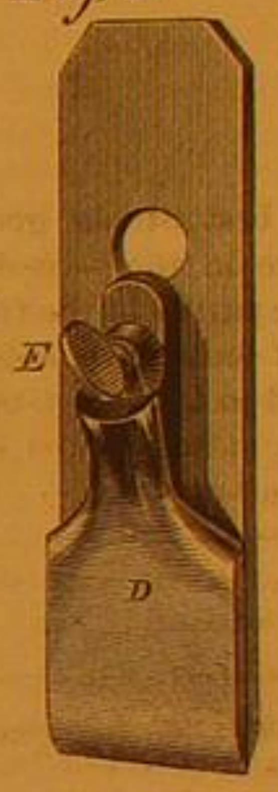


Fig. 3



THE BAROMETER.—ABSTRACT OF A LECTURE BY PROF. GUYOT.

Reported for the Scientific American.

The third lecture of the scientific course before the American Institute, was delivered by the veteran physical geographer, Prof. Guyot, whose labors in this field were eloquently alluded to by Judge Daly, in introducing the lecturer to the large and appreciative audience present on the occasion.

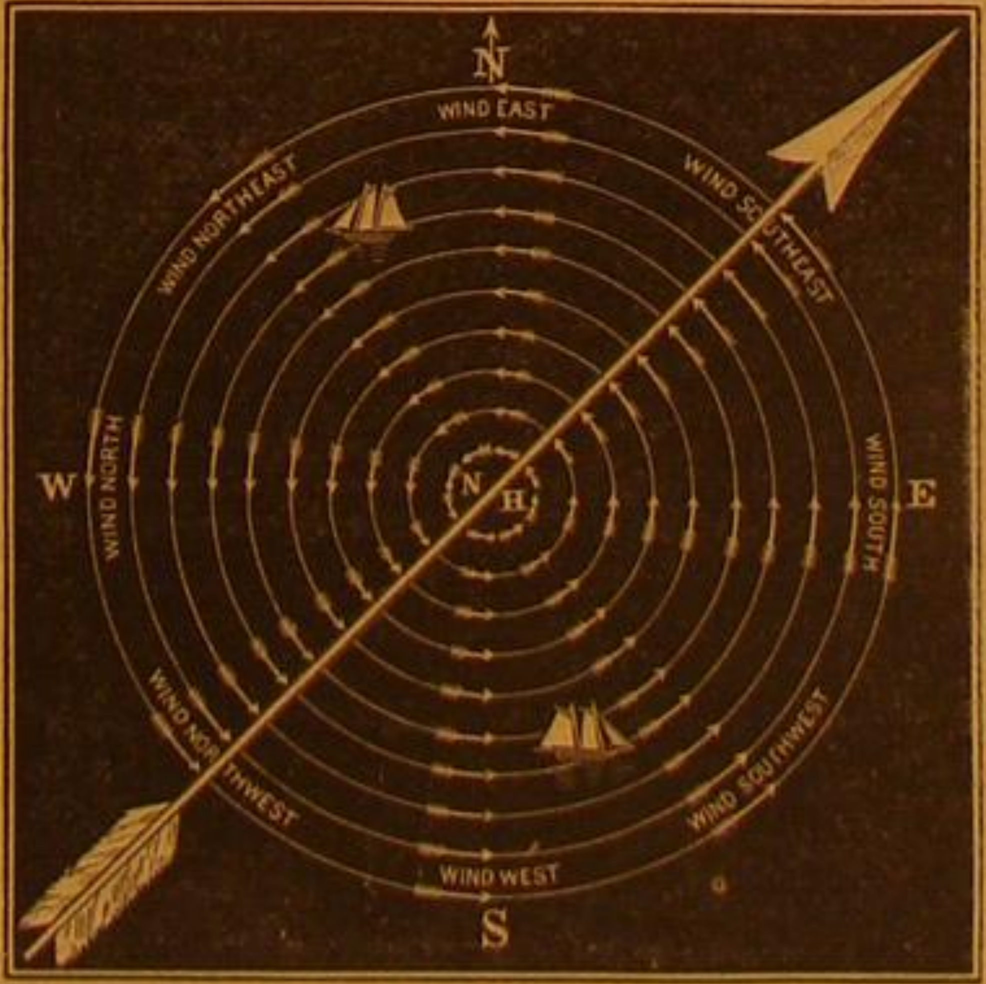
The lecturer introduced his subject by an allusion to the three forms of matter of which the earth is composed, viz., solid, fluid, and gaseous. The aqueous portions of the globe contain all, or nearly all, the lowest types of animal life, the solid land being the home of the higher types, including man, the crowning work of creative power. The gaseous portion of the globe—the atmosphere—is composed chiefly of oxygen and nitrogen; one volume of the former to four of the latter, or 23·82 parts by weight of oxygen to 75·55 parts of nitrogen.

The motive power of animals, as well as much of that used in engines for the propulsion of machinery, is derived from the union of the oxygen contained in the air with other substances. Most of the influences which affect the life and growth of the higher orders of animals and plants, and to which the general name of "climate" has been applied, originate in the atmosphere and depend upon changes in its heat, moisture, and weight. Although the subject of the present discourse pertained strictly to the weight of the atmosphere, it could not be considered independently of some of the phenomena of heat and moisture.

Prof. Guyot next discussed the depth of the atmosphere, and its variations of density for different altitudes. The depth of the atmosphere is estimated at forty-five miles, but the lower four miles of this depth contain more than one-half its entire weight. This point was illustrated by a large and beautiful colored diagram, in which the blue color of the atmosphere was shown gradually shaded out toward its upper limit, and the hights of the loftiest peaks of the Alps, Andes, and Himalayas, contrasted with the entire depth of the ærial ocean. It must not be supposed that a definite upper limit to the atmosphere can be fixed although it can be approximated. A very thin pellicle of air surrounding the globe contains nearly all the organic life upon it. If a globe fifteen feet in diameter should be taken as a representative of the earth, a stratum of any substance taken to represent the layer of air in which organic life exists would be only a small fraction of an inch in thickness.

The lecturer next proceeded to define the word barometer—a measurer of weight. Until the 17th century the air was generally believed to have no weight. Aristotle tried to demonstrate the weight of the atmosphere but failed to do so. Galileo determined it first. He showed that water would only rise in a tube when the pressure of the air was removed from its upper extremity beyond a definite hight. His pupil, Torricelli, following in the footsteps of his illustrious master, conceived the idea of substituting mercury on account of its greater weight for the water column. He filled a tube, closed at one end, with mercury, and, inverting it in a cup containing the same substance, found that the mercury settled to a given point, above and below which it fluctuated as the outside pressure varied.

Prof. Guyot here reproduced the Torricellian vacuum, with a glass tube and a tumbler, and stated that that apparatus was the best barometer that had yet been invented, although some improvements for convenience of transportation, but not affecting the essential principle, had been added to better adapt the instrument for scientific investigation. Scales of different kinds have been devised, but they all have for their object the measurement of the distance between the level of the mercury in the cup and the top of the column in the tube. This being the case, it is always important that the mercury in the cup should be adjusted to a fixed level, the zero of the scale, or that the error arising from its variation from that point, should be allowed for in reducing the observation. Other sources of error arising from differences in temperature, etc., were pointed out. The Torricellian vacuum could not be relied upon as being sufficiently perfect, unless all air had been removed from the mercury by boiling it in the tube before inverting it. The surface of the upper end of the column is convex, owing to the mutual repulsion of the glass and the mercury. The highest point of the convexity, is therefore, not the true reading. A mean between it and the lowest point must be taken. This can, however, be easily corrected by calculation.



The speaker next proceeded to describe various other barometers. The aneroid barometer was described as being an air-tight box with elastic walls, which are compressed when the weight of the atmosphere increases, and expand when the external pressure diminishes. The motion caused by the compression and expansion is multiplied by an ingenious mechanism and marked upon a dial by a hand. Although the instrument is sufficiently accurate for many purposes of observation, it can not be reccommended for scientific investigation. The circumstances which render elasticity constant are subject to frequent disturbance; and a slight blow upon the exterior of an aneroid barometer is sufficient to change its zero, and give rise to grave errors. The instrument, although good for home use, is a bad traveler. Another instrument, invented by a French savant, consists of a hollow angular tube bent like a bow, which straightens or contracts with the varying external pressure, and which, by mechanism similar to the aneroid, marks the variations upon a dial. The same remarks were applicable to this instrument as were made of the aneroid barometer. The siphon barometer is the only one that approaches in reliability the original Torricellian barometer. This form of instrument, instead of having a tube of mercury inverted in a cup of mercury, has the lower end of the tube bent upward in the form of the letter *U*. The external pressure upon the open end of the upturned leg of the tube sustains the column in the leg of the tube, sealed at the upper end, so that the mercury in that branch receives no pressure from the external air. The addition of an ivory float upon the surface of the mercury in the open end of the tube having a thread attached to it, the thread passing over a small wheel attached to a hand upon a dial, and a counterpoise fixed to the end of the thread opposite the float, the whole being inclosed in a case, constitutes the common well-known wheel barometer. Another common form of the barometer is the tube and cup fitted into a wooden case with a vernier scale at the top. These different forms of the instrument were illustrated by diagrams. Two of the diagrams displayed upon the stage, one illustrating the self-registering and printing barometer invented by Prof. Hough of the Albany Observatory, and another the curve of hights from Oct. 5 to Nov. 3 1868, as delineated by that instrument, were not alluded to by the lecturer, probably for want of time. It is much to be regretted that an explanation of this beautiful and intricate device could not have been given. It depends upon the making and breaking of an electric circuit by the rising and falling of the mercury, for the communication of impulses to electro-magnets, which unlock a train of clockwork so devised as to not only to describe a constant curve upon a piece of paper, representing the hight of the column at any time of day and night for many days in succession, but also to print upon pages, which may be subsequently bound, the hights of the column as often as may be desired; thus, making a printed record with great accuracy, and with scarcely any attention being required other than to renew the battery and to substitute new slips of paper as often as they are filled with the record. The tube used is a siphon, and the means by which the above results are accomplished rank among the most ingenious and remarkable of modern in ventions. The value of such an instrument to science can scarcely be overestimated. Neither was any mention made of the barometrograph, illustrated and described on page 149, of the current volume of the SCIENTIFIC AMERICAN, but it could scarcely be expected that more than a mere allusion to these ingenious devices should have been made in a single lecture. Such an allusion, however, was due to these instruments, as a tribute to their great scientific value and the genius displayed in their construction.

The speaker pointed out the fact that in the use of the ordinary wheel barometer errors were liable to occur, owing to the friction upon the float caused by the oxidation of the mercury and from other causes. These errors, and the fact that the public had in general been led to expect too much from them as weather indicators, had tended to make this form of the instrument unpopular. The value of a barometer as a weather indicator depends upon the correctness of the interpretations put upon its indications. It does all that it purports to do, that is, it indicates variations in the weight of the atmosphere. These variations are intimately connected with changes of weather, as they depend upon differences in heat, moisture, and direction of winds; but as the precise nature of the relations existing between these phenomena are in general very imperfectly understood, it follows that observers are by far more numerous than competent interpreters.

The form of instrument best adapted to scientific use is that adopted by the Smithsonian Institute, and hence known as the Smithsonian instrument. It is a mountain and observatory barometer, so called from its use in measuring hights in mountains and for observatory purposes. The lecturer himself had the honor of introducing these instruments into this country on behalf of the Smithsonian Institute. It can be divided into pieces of suitable lengths for easy transportation; has an adjustment for bringing the level of the mercury in the cistern to zero, a vernier scale for reading fractions of an inch, and adjustments which can be made to correct all the errors above enumerated, so that a simple reading can be made as exactly as can be done with the old form of the mountain barometer, without the necessity of subsequently reducing the results of the observations. This instrument is so perfect in its operations that a variation of $\frac{1}{2000}$ of an inch can be read. The lecturer had determined the hights of mountains with it within three feet of their actual hight as determined by angular measurement.

The lecturer next proceeded to show the causes for fluctuation of the mercurial column. These fluctuations may be divided into regular and irregular. The irregular fluctuations increase from the equator toward the poles. At the equator the fluctuations are mostly regular and uniform. The regular fluctuations are monthly, daily, and hourly. The monthly fluctuations are caused by the change in the relations of the position of the earth to the heavenly bodies. The daily fluctuations are caused by atmospheric tides, and the hourly to a variety of causes some of which are yet obscure. These variations are so uniform that Humboldt said of them that it was quite possible at the equator to determine the time of day by the barometer. The monthly variations are greatest in the tropics. The barometer stands lower generally in summer than in winter, the difference depending chiefly upon the greater amount of moisture contained in the air during the summer season, which renders the atmosphere lighter, the gas of water having only about six tenths the weight of air. The speaker dwelt at some length upon this point, but entirely omitted to mention the effect upon the atmosphere, of water existing as water in the air, as it occurs during the fall of rain or when it is suspended in the vesicular condition known as fog.

The irregular fluctuations are caused by changes in the temperature, hygrometric condition, and disturbances of the atmosphere by winds, which, as it were, roll a wave or swell of the ærial fluid before them. Such variations increase toward the poles, so that in our latitude the barometrical column is in a state of almost constant perturbation. These perturbations are so small, as in the ordinary mode of observation to be imperceptible, but they are none the less real.

The lecturer next introduced and explained diagrams illustrative of the variations in the barometrical column corresponding to the direction of winds, both in North America and Europe, and followed these with a diagram, which we reproduce herewith, illustrative of Redfield's theory of storms or cyclones, which he said was now fully established.

The large arrow in the diagram shows the general direction of a storm for the northern hemisphere, but while the storm, as a whole, proceeds from the southwest toward the northeast, it at the same time revolves around a center in the direction of the arrows, or in an opposite direction to the hands of a watch, the wind blowing in any part of the area covered by the storm as indicated by the direction of the arrows in that part of the diagram. As these storms approach, the barometer first rises abruptly then rapidly falls. As the first part of the storm that reaches us at any point to the right of the large arrow is the northeast part, the wind will consequently at first blow from the south east. As the storm advances the wind will blow successively from the south, southwest, west, and northwest, at which time the weather clears up and becomes settled. If at the approach of a storm to any point the wind blows from the northeast or east, that point lies to the left of the line of approach, as shown by the large arrow. The wind will then change, first to the north and from thence to the northwest which will end the storm.

Hundreds of millions of dollars might be saved if sea captains would understand and apply this theory. The position a vessel occupies in relation to the general line of progression, can be determined by the direction from which the wind blows at the point it occupies, and the vessel can then be headed so as to get out of the gale by the shortest route, as shown in the diagram, which explains itself.

Our limited space prevents us from doing full justice to this interesting and practical lecture, which was listened to throughout with profound attention, and frequently applauded, although more than usually protracted.

PHILOSOPHY OF THE TEA-KETTLE--A LECTURE BY PROFESSOR SILLIMAN.

[Reported for the New York Tribune.]

Professor Silliman delivered a lecture on the above subject before the American Institute, Dec. 16, 1868. After the usual introduction Professor Silliman commenced his lecture by narrating briefly the story of Watt's experiments with the tea-kettle in his youth, which first attracted his attention to the study of steam and its application to mechanical works. After some remarks upon the phenomena of heat, while the water in a vessel upon the stand was gradually rising in temperature, by the heat of a Bunsen burner, he said: This vessel which we are heating has now become filled with bubbles. Fishes breathe water because it contains atmospheric air, while it is richer in oxygen than common air. The first phynomenon therefore in seeing that kettle boil is the displacement of the air. Tasting water that has been boiled, after the air has been expelled, and before the air has time to return, it is flat and unpalatable. The tea-kettle is boiling under the pressure of the atmosphere. Every individual carries a tun weight in the pressure of the atmosphere upon his person. Ordinarily we do not feel it; but in walking on the surface of miry clay we feel it, because then the upward pressure on the soles of our feet is removed. The second condition we have to consider, then, in the boiling in the tea-kettle, is that we are boiling the water under the pressure of 15 pounds to the square inch. Boiling is not always necessarily connected with temperature. If the pressure of the atmosphere is taken off, in whole or in part, there may be ebullition without great heat. [Water at 120° was here boiled in the air pumps.] Boiling consists simply of little bubbles of vapor rising and escaping from the surface of the fluid. An egg might be boiled all day in water at 120° without being cooked, because it requires a greater heat to cook it. As these little bubbles rise in the tea-kettle, they strike a colder stratum of water and are condensed, the water failing to fill the vacuum, producing the sound we call the singing of the tea-kettle. The next stage of our process of boiling will be the process of distillation, which consists in the transfer of particles of water out of the liquid state into vapor, then its translation and final recondensation in another place.

The amount of heat passing into the water in the tea-kettle would be measured by the thermometer until it reached 212°. At that point the thermometer would cease to rise, although the heat was still passing as rapidly as before into the water; the surplus being employed in converting the water into steam, which escapes from the vessel. Having heated water in a glass vessel to the boiling point, we remove the fire and cork it up. It continues to boil; and upon pouring cold water upon the surface, it boils still more violently. Why? Because the condensation of the steam removes the pressure, and the water boils more readily, even at a lower temperature. He proceeded to try Count Rumford's experiment of building a hot fire, with a temperature of not less than 2,000° above a vessel of water. The surface of the water boiled, as shown by its condensation upon a cold glass plate laid above it; but the water in the vessel was not heated. It is necessary, therefore, to heat the tea-kettle at the bottom, and not at the top. If we desire to boil substances which will be injured by the temperature of 212°, we may readily boil them at any lower temperature above 100° by removing the pressure of the atmosphere. Taking equal quantities, by weight, of ice at 32°, and boiling water at 212°, the ice was melted by the water, and the temperature of the mixture was 52°. There had disappeared 140° of heat, and this was the latent heat, without which the water would remain ice. Everyone has noticed that the melting of ice in the spring causes a great chill in the atmosphere; for whenever and wherever ice is melted, it absorbs inevitably 140° of heat. On the other hand, the vaporization of water takes up a great deal of heat, which is rendered latent; for steam itself, at the pressure of the atmosphere, has only a temperature of 212°. If we measure the heat thus becoming latent, we shall find that it amounts to about 970°. By adding constantly a given quantity of heat, we shall find that it takes $5\frac{1}{4}$ times as long to convert a given quantity of water into steam as to raise it from 320° to 212°. This latent heat would be enough to heat water, if a solid, red hot. If we add to the pressure of the atmosphere, we shall have a higher temperature of the steam; but the amount of latent heat in the steam will be less, the sum of the latent and the sensible heat being a constant quantity, equal to 1,180° Fahrenheit. The conversion of water into steam will expand it into 1,700 times its former bulk, and this exerts a prodigious amount of mechanical force which is utilized in the steam engine. Heat is nothing but a mode of motion; and the steam engine enables us to make that motion useful in the form of mechanical power. He illustrated the reconversion of motion into heat by rapidly turning a brass tube containing ether and corked up, and holding around it a wooden clamp until sufficient heat was generated to convert the ether into vapor and blow the cork from the tube. Count Rumford, in the latter part of the last century, tried a similar experiment upon a much larger scale. When in the employment of the Bohemian government at Munich, he made those remarkable experiments which have signalized his name in this department of knowledge; for he employed horse power in the boring of cannon held in a vessel of water at the ordinary temperature, noting the time occupied, and the amount of force supplied. In about two hours and twenty minutes he brought this large body of water into a state of ebullition, simply by the mechanical power applied in boring; and he determined by these experiments that in order to raise a pound of water through one degree of Fahrenheit, there must be a different power applied to raise one pound to the hight of 772 feet. This is what is called the mechanical equivalent of heat. Professor Silliman next treated heated water in a closed spherical vessel connected with a column of mercury and a thermometer. When the pressure of the steam had forced the mercury to the height of 33 inches, corresponding to a pressure a little more than that of the atmosphere, the thermometer had risen to 245°. He then opened a tube to allow the steam to escape into a vessel, at first producing a rattling sound in consequence of the condensation of the steam by the water and the falling of the water to fill the space thus left vacant; but very soon the water was raised to the boiling point, and the rattling ceased, and the steam passed noiselessly through the water, and escaped. It is easy to convey heat in the form of steam; and it is now common to convey it in pipes sometimes for long distances to wooden vessels, where it is desired to boil water. Steam is the most wonderful vehicle for transporting heat with which we are acquainted. This hall is heated by steam from a boiler in the celler, giving us 1,000 degrees of heat, the latent heat of the steam becoming sensible as it is condensed in the pipes, and with such astonishing rapidity that it sufficiently warms the atmosphere of the room, furnishing one of the most efficient means of heating which is known. Heating either by hot water or by steam, the relative merits of which I am not now discussing, is by far the most economical, the most efficient, and the most agreeable of all artificial means. Professor Silliman then exhibited a toy steam engine, rated at two-mouse power [laughter], and proceeded to give an explanation of the steam engine as invented by Watt. The first step of improvement was to close the cylinder at the upper end; hitherto it had been open. In the former steam engine the steam had forced up the piston, and upon the condensation of the air in the piston by cold, the atmospherial pressure brought it back again. Watt had introduced other improvements, among which were the injector, the governor, and the cut-off. There has never been in the history of inventions since the world began any machine or apparatus which was so perfect as it left the hands of the inventor, as the steam engine was when it left the hands of Watt. You may stand to-day beside the most stupendous piece of steam engineering in the world, and you will see connected with it no essential change from his invention. It is true that he had no machinery or tools competent to reach the exact results that we can now produce. He had no turning lathes, boring-machines, planing machines, but all was done by a cold chisel, the hammer, the file, etc.; and the marvel is that he produced such results as he did. I have often thought with what delight that great man would stand upon one of our first-class steam frigates, or by one of our first-class pumping engines, such as are used at the reservoirs in Brooklyn and New York, and see the perfection, the finish, and the smoothness of the work, a result possibly solely due the genius of Watt, because without that power we could not have had the apparatus with which to apply it. Professor Silliman next proceeded to illustrate the irregular expansion of water near the freezing point. He filled a vessel with water at 55° and surrounded it with ice and salt to reduce its temperature. A freezing mixture is composed of two solids having an affinity for each other, but which cannot unite without becoming fluid; and in order to become fluid a large amount of latent heat is required, which must be borrowed from the surrounding substances. In the vessel of water he immersed two thermometers, one near the top and the other near the bottom. As the temperature of the water fell, the temperature of the lower thermometer descended to $39\frac{1}{2}$°, and there remained stationary, while the upper thermometer continued to fall, and at last reached the freezing point. Why does not that system of currents keep going on like the boiling of water in a flask, so that the whole shall freeze at the same time? That is just where this wonderful exception takes place, and it is the great delight of a devoted mind to believe that the exception is a part of the original intention of the Great Architect in the formation of the world in adapting it to be inhabited by human beings, because we may readily believe that, except for this irregularity in the expansion of water the world would be uninhabitable. At the temperature of $39\frac{1}{2}$° the very contrary effect takes place, and the water begins to expand, it increases in bulk, and consequently becomes specifically lighter, and, like a cork, floats upon the surface, or immediately beneath it; so that you will have the surface of the water cooled down to 32°, and converted into ice, and yet that freezing does not extend much below the surface. You rarely find in the coldest winter that ice is formed more than two feet thick. If you observe a caldron of molten iron as it cools, does it solidify first on the top? No. Does a mass of lead in a ladle solidify at the top? No; but equally at the bottom. In most cases the solid, which is the result of congelation, is heavier than the fluid in which it is formed and sinks to the bottom, whereas in the case of the water the solid is much lighter than water. We have here another exception that the ice which is formed is lighter than the water and it floats upon it. When we see an iceberg from 100 to 200 feet above the surface of the sea we know that for every foot of elevation above water there are 10 feet of depression beneath the surface; so that what we see is only one eleventh of the whole bulk. Lake Superior has a uniform temperature of about 40°, and beneath the surface in the Winter, in any of our lakes we shall find water at about that temperature. This is an important fact with reference to the inhabitability of our globe; because, you observe, that if water as it solidified continued to shrink and to become heavier, the whole mass would become frozen in a single winter so that no summer would be long enough to melt it, and eternal death would rest upon the surface of the globe. In the freezing mixture Professor Silliman inserted one end of a closed tube, containing vapor, and containing water in a bulb at the upper end, and the condensation of the vapor from the abstraction of the heat by the freezing mixture, in its turn, abstracted the heat from the water in the bulb above so rapidly that it was frozen solid.

He then illustrated the heating of houses by hot water pipes, showing that the heated water would rise, from its being lighter than not heated, and thus a circulation of water never heated above the boiling point, and therefore not liable to burn the atmosphere by charring particles of dust in it, would be constantly maintained. He proceeded to speak of the chemical constituents of water, being two atoms of hydrogen and one of oxygen. These two gases which have never been reduced to liquid form by mechanical power, would readily unite by the magical power of chemical combination, and form that wonderful matter which we call water. The ancients in their philosophy said the earth is composed of four elements, earth, water, air, and fire. We may interpret this under the light of modern science thus: Earth is the solid, water is the liquid, air is the gaseous condition of matter, and fire is the force that converts them all from one condition into the other. We have in water the solid ice, and permanent as granite, so long as the temperature is unchanged. We have in water an inelastic, mobile, transparent fluid. We have in water the perfectly elastic invisible gas which we call steam. Although we cannot by mechanical means compress the gases which constitute water into liquids or solids, yet by their union we can condense them into water, and we can by their union produce the highest degree of artificial heat which it is in the power of man to produce mechanically. Two vessels, one containing hydrogen and the other oxygen gas, were connected with a single tube. The former being turned and lighted produced an ordinary flame (the gas not being pure), but upon turning on the oxygen gas the two produced a much whiter and more brilliant light. Placing in the blaze a mass of cold iron, the water produced by the union of the gases was condensed upon its surface, falling from it in drops. He next placed in the blaze a slender bar of steel, and the heat was so great as to burn the steel, scattering it in a shower of intensely brilliant sparks. These two elements, by their collision, produce an amount of heat, as a mode of motion which is beyond that which we can produce by any other artificial means which is purely mechanical. We can, indeed, by this voltaic current, acting chemically, produce a current of electricity in the focus of which everything which can be melted, melts, and everything that melts volatilizes. That, as I have said, is a mode of motion. It can be converted into motion, and motion in like manner can be converted into heat. We are living upon a ball of matter moving through space with planetary velocity, and if that mechanical motion with which the earth is moving in its orbit could be suddenly arrested the amount of heat which would be equivalent to that mechanical motion would not only be sufficient to melt the whole earth, but to actually volatilize it into the nebulous state again; nay, it would be sufficient to volatilize six worlds as large as that which we occupy. I am prepared to show you some wonderful experiments with the spheroidal condition, but I have not time, and I will close this already too long lecture with a single illustration more.

There is an erroneous idea that steam-boiler explosions are produced by the formation of a certain gas. The only gas is steam, and it is only because there is too much steam. There is often too much steam because there is too little water; and also owing to the fact that when water comes into contact with superheated surfaces of iron it is suddenly converted with great violence into steam, sufficiently powerful to tear the strongest metals. Chemists utterly deny that there is any foundation whatever for the popular notion among mechanics that there is produced, in cases of explosions of steam-boilers, a kind of gas.

The lecture of Professor Silliman was illustrated by a great variety of experiments, many of which were received with much applause.

FACTS CONCERNING THE FINANCIAL CONDITION OF THE SOUTH.

The following facts concerning the financial condition of the South were furnished to us by the manager of a leading journal, published at Mobile, and are doubtless substantially correct.

During the war, and while Confederate currency was abundant, the planters entirely paid up their debts.

For the two years subsequent to the war, but little capital was embarked in trade in the South, and hence but little credit could be extended to the planters, and they were forced to work through, economically, with the little specie currency they quite generally had stored away. That they might live within themselves, the attention of planters was largely directed to the growth of breadstuffs and meats, and more corn, wheat, and bacon were made in the South than ever before.

During this present year a fair crop of cotton has been made, and generally made with provisions and feed of home growth, so that the planter has received but small advances and is not now in debt. From the high price of our staple—cotton—more money will be distributed in the South this year than ever before, not excepting the year of the great crop—1860.

This year's cotton crop will net the planters of the South the immense sum of *two hundred and fifty million dollars.*

The crop of Mobile alone will bring not less than *thirty million dollars* to be distributed from that point.

The entire debt of the South, abroad, and in the North and West, is less than fifty million dollars.

The vast sum of more than *two hundred million dollars* will be loose money in circulation in the Cotton States.

The restoration of political quiet, following the determination of the Presidential election, will cause a confident free use, circulation, and expenditure of all this currency. In the old time the planter in the South used the gains of each year (in fact was generally a year ahead in debt to his factor) in the purchase of more negroes or more lands, and hence had but little or no money to expend for luxuries and the merchandise of trade.

Now there are no negroes to buy.

The principle of small and well cultivated plantations is accepted, and no planter wishes to buy more land.

The gains of the planter will now be invested in the purchase of improved farm implements, household furniture, articles of comfort and luxury, dry goods, clothing, books, sewing machines, pianos, and other musical instruments, etc., etc.

The trade of the South will now be an exceedingly rich one. While the great West is now undergoing hard times incident to the low prices of breadstuffs, the South will be prosperous in the wealth of her staple, now bringing the most profitable prices.

No part of the country to-day offers a richer field for the enterprising merchant and manufacturer than the Cotton States. These views are plain and simple, and will present themselves with force to every shrewd observer and thinking man.

The man who sees this condition of things aright, and takes immediate advantage by placing himself before the people of the South with his business properly advertised, cannot fail to secure a lucrative trade and large returns of profits for his expenditures.

The Great Floating Dock for Bermuda.

This enormous maritime structure is now completed. The following is a concise history and description of the gigantic undertaking:

The British government, being impressed with the ab-absolute necessity of providing dock accommodations for the iron-clad ships and other vessels constituting the North American and West India squadron, determined some time since to build a capacious floating dock of iron for service at Bermuda. When Admiral Sir Alexander Milne commanded on that station he pointed out to the Admiralty this great want. During the past ten years many iron-clads have been added to our fleet; and although most of these have been payed below water line with various compositions, the hulls of most ships after service afloat were exceedingly foul. The iron men of war on the North American and West India stations were no exception, but after a shorter or longer time afloat were more or less covered below water-line with barnacles, weeds, and parasites, thus impeding the speed of the vessel and causing other annoyances.

The want of a dock in the West Indies, in which a ship could be laid up for cleaning the bottom and for necessary repairs, induced the government to construct a monster floating machine at a cost of nearly £250,000. This dock was built by Messrs. Campbell, Johnson & Co. of the Albert Works, Silvertown, from plans patented by Mr. Campbell, and adopted for the Royal dockyard at Bermuda by Colonel Clarke, R. E. the government director of works. This great iron floating structure, the largest in the world, is of the following dimensions: Extreme length, 381 feet; width inside, 83 feet 9 inches; width over all, 123 feet 9 inches; depth, 74 feet 5 inches. The weight of the dook is 8,350 tuns, and it is asserted that a vessel weighing 10,000 tuns or more may be easily lifted, making the total approximate displacement about 19,000 tuns.

The dock is U-shaped, and the section throughout is similar. The iron-clad Bellerophon, and ships of similar and of smaller size, may be easily received into this capacious hollow, and when once the dock is in position ships forming the squadron on the West Indian station will no longer be subject to great and ever-recurring inconvenience. It is built with two skins fore and aft, at a distance of 20 feet apart. The plans show that the space between the skins is divided by a watertight bulk-head, running with the middle line the entire length of the dock, each half being divided into three chambers by like bulk-heads. The three chambers are respectively named "load," "balance" and "air" compartments. The first-nameb chamber is pumped full in eight hours when a ship is about to be docked, and the dock is thus sunk below the level of the horizontal bulk-heads which divide the other two chambers. Water sufficient to sink the structure low enough to admit a vessel entering is forced into the balance chambers by means of valves in the external skin. The next operation is to place and secure the caissons and eject the water from the "load" chamber. Then the dock with the vessel in it rises, the water in the dock being allowed to decrease by opening the sluices in the caissons. The dock is "trimmed" by letting the water out of the "balance" chamber into the structure itself. The inside of the dock is cleared of water by valves in the skin, and it is left to dry. When it becomes necessary to undock the vessel the valves in the external skins of the "balance" chamber are opened in order to fill them, and the culverts in the caissons are also opened, and the dock sunk to a given depth. From keel to gunwale nine main water-tight ribs extend, further dividing the distance between the two skins into eight compartments. Thus there are altogether 48 water-tight divisions. Frames made of strong plates and angle iron strengthen the skins between the main ribs. Four steam engines and pumps on each side—each pump has two suctions, emptying a division of an "air" chamber—are fitted to the dock, and these also fill a division of the "load" chamber. When it becomes necessary to clean, paint, or repair the bottom of the dock it is careened by the weight of water in the load chambers of one side, and the middle line is raised about five feet out of the water. This gigantic structure is a splendid specimen of workmanship; and, although intrinsically ugly, the skillful toil of the artisan for two years is manifest in the *tout ensemble* of the first great floating dock ever put together in England.

Two other vessels of this kind, have, we believe, been built and sent abroad—one to Cadiz and another to Callao—in pieces; but this is the only dock fitted in this country ready for transport in a complete condition.

The question has been asked whether it would not have been judicious to construct an ordinary dock at Bermuda; but when it is remembered that the island itself is only a coral reef, and that no good foundation can be got, the answer is directly given to this query. Then arises a surmise whether such a leviathan machine could successfully encounter bad weather in the high seas. There is no reason to suppose that the dock would founder, because it can be made as tight as a bottle; and should it get in the trough of a heavy sea, end on, the water would enter at one end and flow from the other. It would, in fact, live on the wave like a well corked bottle. The vessels towing it out would have to keep its head to the gale, and avoid collision; then there would be no risk and little danger.

The Bermuda dock has an enormous rudder, and this has lately been increased considerably in area at the after-end by a large number of planks, in order to give more steerage power. Its cutwaters are formed like the bows of a barge, to divide the water, and by that means diminish the resistance, and enable the dock to be more easily towed."—*London Scientific Review.*

Interesting Planetary Discoveries.

The planet Mars is the only object in the whole heavens which is known to exhibit features similar to those of our own earth, and the accumulated explorations and discoveries of astronomers during the last two hundred years have resulted in the construction of a globe representing the characteristics of this planet as astronomers believe them to exist. At a recent meeting of the Astronomical Society of England, a globe of Mars was exhibited, on which lands and seas were depicted as upon an ordinary terrestrial globe. By far the larger portion of these lands and seas were laid down as well known entities, respecting which no more doubt is felt among astronomers than is felt by geographers concerning the oceans of our own globe. An interesting description of this globe appears in *Fraser's Magazine.* To the lands and seas, developed in the planet, are applied the names of those astronomers whose researches have added to our knowledge on the subject. Each pole of Mars, it seems, is capped with ice, which varies in extent according to the progress of the seasons. Around each cap is a polar sea, the northern sea being termed the Schroter Sea; the southern, Phillips Sea. The equatorial regions of Mars are mainly occupied by extensive continents, four in number, and named Dawes Continent, Madley Continent, Secchi Continent, Herschel I (Sir W.) Continent. Between Dawes and Herschel Continents flows a sea shaped like an hour glass, called Kaiser Sea, the large southern ocean out of which it flows being denominated Dawes Ocean. Between Madler and Dawes continents flows Dawes Straits, connecting a large southern ocean and a northern sea, named after Tycho Herschel continent is separated from Secchi continent by Higgins inlet, flowing from a large southern sea, termed Maraldi Sea. In like manner Bessel inlet, flowing out of Airey Sea (a northern sea) separates the Madler and Secchi continents. Dawes Ocean is separated into four large seas, and large tracts of land lie between, but whether they are islands or not is not certain. In Delarue Ocean there is a small island, which presents so bright and glittering an aspect as to suggest the probability of its being usually snow-covered. These seas, separated by lands of doubtful extent, reach from Delarue Ocean to the south pole.

One of the most singular features of Mars is the prevalence of long and winding inlets and bottle-necked seas. These features are wholly distinct from anything on our earth. For instance, Higgins inlet is a long, forked stream, extending for about three thousand miles. Blesse inlet is nearly as long, and Nesmith inlet still more remarkable in its form. On our earth, the oceans are three times as extensive as the continents. On Mars, a very different arrangement prevails. In the first place, there is little disparity between the extent of oceans and continents, and then these are mixed up in the most complex manner. A traveler, by either land or water, can visit almost every quarter of the planet without leaving the element in which he began his journeyings. If he chooses to go by water he could journey for upward of thirty thousand miles, always in sight of land—generally with land on both sides—in such intricate labarynthine fashion are the land and seas of Mars intertwined.—*Boston Journal.*

Vesuvius on the Rampage.

A correspondent of the *Pall Mall Gazette* has been to look at Vesuvius, to see for himself what the eruption of a volcano is like. He finds it sufficiently terrible. He went up the mountain and stood upon the lip of the crater, and peeped into the roaring abyss on one side, taking advantage of a strong wind that was driving all the suffocating steam and vapor to the other. Presently the eruption came:

It does not consist, as the pictures necessarily lead one to suppose, of a continuous shower at all. Still less does it consist of a continuous shower of black ashes shot out from a fire blazing on the top of the mountain; it is rather a series of explosions. But the roar and glare of the great abyss is continuous. You look into the pit, and though you see no actual flame, yet its sides are in a state of constant incandescence; from the mouth of it there roars up incessantly a dense cloud of steam; and in the depths of it below you hear the noise of preparation for the outburst that is next to come. Then you hear a sharper crackel, and then, without further warning, follows a loud explosion, which shoots into the air a torrent of white-hot missiles of every shape and size. So enormous are the forces at work, that not only small pieces of stone and sulphur, such as you might carry away as mementos of your visit, but huge blocks of mineral, each enough to load a railway ballast wagon, and all in a state of perfectly white heat, are tossed up as though they were so many cricket balls. The explosion lasts, perhaps, no longer than a minute; and then there is a cessation of some seconds, with the noise only of internal preparation once more, after which the explosion is repeated.

Printing in Colors. A Step in Advance.

We have before us a copy of a new illustrated weekly, the *Western World*, a popular literary and family paper, published by French & Wheat, 13 Park Row, New York. We give this new enterprise a cordial welcome and predict for it large and increasing public favor. The contributions to the number before us indicate thorough acquaintance on the part of the publishers with the tastes of the American public. The stories are chaste and entertaining, the miscellaneous matter selected with great care and judgment, and the editorial matter of a high order in subject, thought, and style.

But the most striking features of this publication are its illustrations, heading, and border. These are printed in colors by a patented process by which the different colored impressions are given to the paper by a single feeding. The process is still in its infancy, yet, notwithstanding the difficulties which attend the earlier stages of any improvement, the effects produced are novel and striking, approximating very nearly to chromo-lithography. The general appearance of the paper is very pleasing, and this method of printing in colors must be considered a decided step in advance.

OBITUARY.

We regret to announce the death of Prof. Wm. E. Jillson, which occurred at his home in Jamaica Plain, Mass., on the 29th ult. Mr. Jillson will be remembered by inventors and others who had occasion to consult the Patent Office Library, from 1860 to 1865, as its accomplished librarian. In 1865 he resigned this position to accept one in the Boston Public Library, where he remained up to the time of his death. He was considered one of the most accomplished bibliographers in the country.

THE Pittsburgh *Dispatch*, in speaking of some of its more useful exchanges, says:

Another paper, of a very different class, which we always read with interest, is the SCIENTIFIC AMERICAN, the best journal of the kind published. It not only abounds with information, of the most useful kind to inventors and mechanics, but its general articles are always well written and full of interest. The number before us is one of the best of the paper which we have yet read, and shows that the publishers are up to the spirit of the times in the way of progress and improvement.

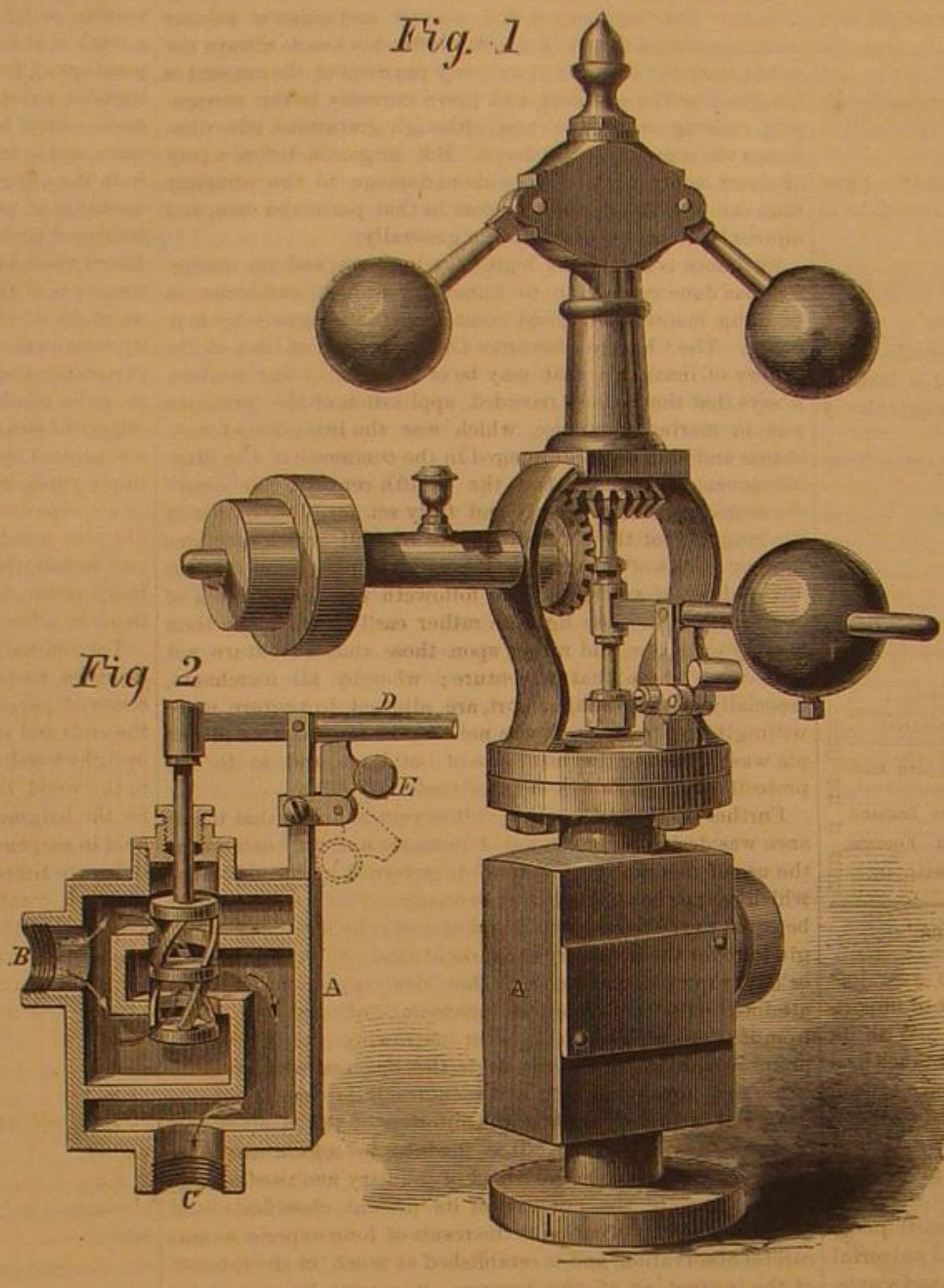
WE are indebted to Messrs. E. R. Jewett & Co., Buffalo, for proof sheets of engravings, designed to illustrate the Patent Office report for 1867. We have so often spoken in praise of these artistic illustrations, that it is unnecessary now to say more than to commend the great fidelity with which these drawings exhibit the real point upon which the claims to a patent are based.

Improvement in Engine Governors.

For all stationary engines the governor is absolutely necessary. So much importance is attached to its proper action that it is not surprising that it has been the subject of numerous patents. The governor, to be effective under all circumstances, should act quickly, if not instantly, when resistant force is suddenly added to, or suddenly thrown off the engine; it should maintain an equable speed under occasional and moderate variations in the force to be overcome, and should entirely close the inlet valve should the belt that drives the governor be thrown off or break. It would seem, from an examination of the governor shown in the engravings that these requisites are fully met in this improvement, and this opinion is borne out by letters from the managers of concerns in which this governor has been used for months.

A brief description of the invention aided by a reference to the engravings, will enable the engineer or mechanic to easily understand its construction and operation. Fig. 1 is a perspective view of the governor with its attachments complete and Fig. 2 a vertical section of the valve chamber and its parts. The valve chamber, A, may be either rectangular, as seen, or of other external form, as may be desired. Interiorly the chamber is divided by a partition of an angular S-form, the horizontal portions of which are connected by vertical walls and by the walls of the valve chamber. The two upper horizontals of the diaphragm are bored to form seats for the valve, which consists of three disks attached to the upright valve stem and connected by wings or ribs, being either straight bars or of a spiral form; the latter preferable, as the movement of the valve or combined disks is similar to that of a piston in a cylinder, and the spiral form of connection insures an even bearing and wear against the sides of the apertures forming the valve seats.

In the sectional engraving the valve is shown open. B being the inlet for the steam, the arrows show the directions the steam will take, when admitted, and its escape through the passage, C, to the steam chest. It will be seen that by the provision of double ports for the valve a much smaller valve than is usually employed can be used, which, of course, is an improvement, as its movement can be much more easily governed. The inventor says that the area of an ordinary governor valve of two inches diameter is 3·1416 square inches and that this area may be obtained by the use of one of his improved valves of only one and a half inches diameter.



BELLIS' PATENT ENGINE GOVERNOR.

The valve stem coupling is connected to the governor stem by the ordinary swivel. In this coupling is a slot to receive the end of a lever, D, carrying an adjustable weight seen in Fig. 1, the fulcrum of the lever being on a stand rising from the valve chamber. It is evident that this weighted lever may be used to give a variety of speeds to the engine, or to adjust the speed to the number of revolutions. It is plainly seen, also, that the weight of this lever, when not counterbalanced by the centrifugal motion of the governor balls, will effectually close the valve and prevent the inlet of steam. Thus, if the governor belt should break, or be suddenly thrown off, the valve would close and the steam be cut off. So, also, when the engine is stopped no steam could reach the steam chest and cylinder through the valve chamber. To keep the valve open when about to start the engine, a weighted catch, E, is used to hold the lever, D, up. Soon, however as the velocity of the governor is sufficient to raise the balls and the lever, the catch is released, and falls by its own weight to the position shown in the dotted lines at E, Fig. 2, leaving the lever ready to act in case of accident.

Patented June 9, 1868, by William Bellis, whom address for additional particulars at Richmond, Ind.

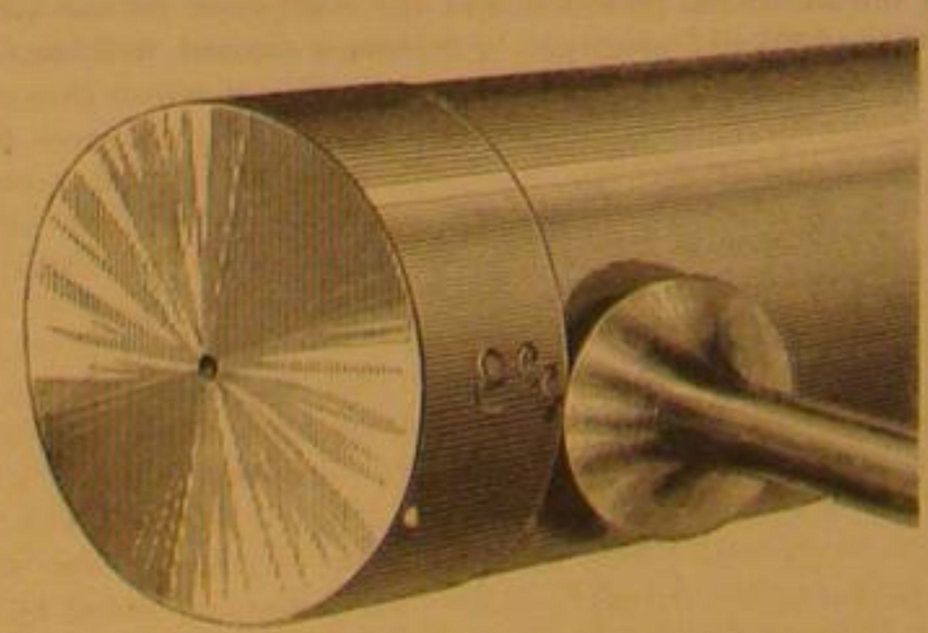
MECHANICAL PRACTICE AT HOME---THE FOOT LATHE.

Foremen of machine shops get their best material for apprentices from the farm. In this statement all managers of shops who have had a lengthy experience will coincide. Why is it? These farmer boys perhaps never saw a machine shop or foundery, yet they betray an aptitude and a liking for the work of the machine shop seldom shown by the city bred boy. To be sure, the lad whose early life has been spent in a manufacturing town or village where the hum of the spindle and the clatter of the loom, or the detonations of the hammer daily assaulted his ears, takes readily to the duties and discipline of the machinist's apprentice; yet frequently the farmer's boy becomes the most intelligent and successful workman. We answer our question by the simple statement that farmers' boys are compelled to practice mechanics in their daily labor. It is not always convenient to stop work and run or ride to the blacksmith's shop whenever any portion of a implement gives out by breakage or wear; and the farmer's boy is compelled to repair the break, often by the use of very inferior tools. He is largely employed in mending, repairing, and making on rainy days and in winter. Even his playthings are more frequently made by himself than bought at the "store." He thus becomes, insensibly perhaps, a mechanic; at least he learns the first lesson of the mechanic's apprentice, the use of tools.

Every farmer should have a shop room fitted up with such tools as are used by the carpenter, joiner, machinist, and blacksmith, or with those that would be valuable in making repairs. Above all, we consider a good foot lathe very desirable. It would be impossible within the limits of a newspaper article to merely notice the advantages of this machine and its varied uses. A good foot lathe costs from sixty to one hundred dollars and the money is well expended in the purchase. Articles of use and ornament made of wood, ivory, and metal may be turned out by the foot lathe convenient for use in the house or on the farm. The practice on the lathe is one of the most fascinating pastimes for a stormy day or an unemployed evening. Apart from its use in making and repairing, the foot lathe is a pleasant companion for the business haunted and brain weary. One who adopts it as a companion of his leisure hours will soon become an adept, and the more he uses and becomes acquainted with his machine the better he will like it. He will be surprised at the number and elegance of the little articles of use and ornament he can produce from the rough material, and at the pleasure that the practice of a mechanical art will afford.

HAND TOOLING---THE BUTTON TOOL.

There is little doubt that the practice of hand-tooling for turning metals is not so extensively practiced in this country as it might be with benefit. The superiority of hand tooling over the absolute action of the fixed tool in the engine lathe,



under some circumstances, is as apparent as is the hand turning of wood over the work performed on the automatic lathe. In our experience as a practical workman we derived great benefit from our knowledge of the use of hand tools. There are various forms of these tools, and they can be made from worn out files or from steel bars, as may be desired. The ordinary triangular file makes a very handy turning tool—in fact it may be ground in three forms, each of which are useful in particular cases. The ordinary flat file is very useful in smoothing or finishing. A square file or square bar, ground at an angle across the corners, is a valuable tool. We show, however, one not so frequently employed as its merits deserve. It is called the "button tool," from the form of the head or cutting portion. (The artist has made the head a graceful bell shape, which is not absolutely necessary). The tool is made by upsetting the end of a steel bar or rod and forming the head in a die. The shape of the head is precisely like that of a common wood screw, and the shank being cylindrical no obstruction to its gradual rotation in the hands of the workman is offered. The tool being fastened in a common chisel handle engages with the work as shown, and while the shank bears upon the rest the hand keeps it against the work and steadily rotates it. In sharpening it the face of the tool is placed against the grindstone and is turned gradually until a perfect edge is secured around the whole circumference. Further description is unnecessary.

CONDENSATION IN STEAM PIPES---LOW PRESSURE.

A correspondent says: "I notice on page 375, last volume, your three line article on steam pressure in the boiler and cylinder being necessarily unlike. How much is the allowance for friction and condensation in the pipes? Please show the probable and actual differences between boiler and piston pressure." Our correspondent misquotes our statement, which was: "Steam pressure in the boiler and steam pressure on the engine piston are not necessarily alike. Allowance must be made for condensation in conveyance by pipes." Our object in stating this self-evident truth was to intimate to engineers and others that in estimating the pressure upon the piston of the engine, as that shown by the gage on the boiler, they may not be correct. Indeed, they are frequently far out of the way. The condensation of the steam in the connecting pipe between boiler and engine is more or less, according to circumstances. If the steam is led through a pipe undefended from the atmosphere, the pipe being fifty or a hundred feet long, as is sometimes the case, it is evident that quite a large percentage of the steam will be condensed, and reach the cylinder in a state of mere vapor, the whole body of steam being lowered in temperature, and its pressure consequently diminished. But if the steam is taken directly from the boiler into the cylinder, as in those portable engines where the engine and boiler are closely connected (the cylinder attached to the top or side of the boiler, and the connecting pipe being only a few inches long), the loss of heat and consequent pressure would be inappreciable, and, therefore, the boiler pressure could be safely taken as an indication of that in the cylinder.

Our correspondent's question as to the amount of condensation and friction is sufficiently answered by the above. As no two circumstances are alike, no unvarying rule can be given; it must be left to the judgment of the experienced engineer or millwright. It is safe, however, to observe the following suggestions, or to approximate to them: Place the engine as near the boiler as possible. Use steam pipe of generous size, with the elbows of much larger transverse area than the straight pipe. If gates are used, let them have large apertures, so as not to "cramp" the steam, and, finally, insulate the steam pipe thoroughly by good non-conducting lagging, or by boxing it with sawdust, tan, or some similar substance. It is well, also, to have a little drip pipe, through which the condensed steam may be drawn off before starting the engine, so as not to depend entirely on the cylinder pet cocks. The working of water in a cylinder is terribly straining.

The Herring Fishery of 1868.

Dr. Louis Feuchtwanger has lately returned from a trip "Down East," and sends us some facts in regard to the eastern herring fishery. He says this season has been one of the most prolific of herrings known for many years, 50,000 herrings being taken at one haul. On the 12th of October 80 hogsheads of herrings were taken at one haul and 30 hogsheads two tides before. Every two hogsheads will yield one barrel of fish oil worth in the market $22·50 per barrel, the oil being used in currying leather and for mixing with other fish and lubricating oils. Beside this product the remains of five hogsheads of fish will produce one tun of pumice or fish guano, the best fertilizer known, and used to mix with inferior guanos and the superphosphates of the various brands, and worth by itself $20 per tun. If mixed with sulphate of soda or even plaster (sulphate of lime) intended for absorbing the ammonia produced by their decomposition, it is not excelled in value by the best Peruvian guano. These facts prove the profitableness of this branch of industry.

The Dunderberg Not a Failure.

The ram, *Dunderberg*, which was sold to the French government a year ago last summer, has withstood batteries of adverse criticism, to which, unlike the more solid compliments of an armed enemy, she was unable to reply. In addition to the attacks made upon her when she was the property of her builder, it was stated, after her sale to the Emperor of the French, that she was a mere tub for sailing qualities, and a mere eggshell for defensive purposes. Time and trial have, however, refuted one of these calumnies, as we learn that the *Rochambeau neé Dunderberg* performs her fourteen measured miles with ease. We are glad to hear that the reputation of her enterprising builder has been sustained.

Scientific American.

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Contents:

(Illustrated articles are marked with an asterisk.)

THE EVENTFUL YEAR OF OUR LORD 1868.

From whatever point of view we consider the year just passed into history, we are struck with the number of important events that have been crowded into its annals. With its political or religious aspects, although they present much food for profitable thought and study, it is not our province to deal. The progress of science, and the remarkable physical phenomena so numerous, and in some instances so appaling, during the twelve short months that have rushed past us, give ample scope for a brief and profitable retrospect.

The year 1868 will henceforth be known as the earthquake year. History has not on its records a period of such universal terrestrial convulsion as the one just left behind us, and scarcely one of greater disaster from this cause. The eruption of Vesuvius, and the excited state of many other volcanos throughout the world, indicate that the mighty forces to which these phenomena are due, are still at work. Whether their energies are in such measure exhausted that no further immediate danger is to be apprehended, is yet undetermined. These terrible visitations are gradually changing the physical aspect of our globe; and from them we can gather some idea of the power of the immense volcanic disturbances, which, ages ago, threw up our vast mountain ranges and engulfed whole continents.

No less grand and impressive have been the celestial phenomena of the year. The great solar eclipse, possessing in some respects features of greater interest than any that has occurred for a long time past, or that will occur for a long time to come, has been not the least of these remarkable occurrences, both on account of its special peculiarities, and the results which have been obtained from organized observation. Add to this the splendid meteoric shower of November, and we may well say that the heaven above and the earth beneath have been prolific of wonders.

The progress in the most mighty undertakings which the world has ever witnessed is no less remarkable. The most gigantic railroad enterprise ever attempted has been pushed this year almost to completion. The Suez canal now almost joins the Mediterranean to the Red Sea, while during the year a movement has been initiated for the construction of a similar work across the Isthmus of Darien, which will unite the two great oceans. A new sub-Atlantic telegraph of greater length than any heretofore attempted, has been made and will soon connect the two continents, to be followed, no doubt, by others of greater magnitude. It has also been the subject of serious contemplation to lay a cable between the Pacific coast and China, and we would probably hazard little in predicting that some even now old men will live to see that work accomplished. Never has the earth seen a period of greater enterprises; never before has civilization made such triumphant advances.

The discoveries and improvements in the sciences and the arts have been numerous and important. To review them and specify them as they demand would fill a volume. A glance at the index of the volume we have just closed will show the great variety of subjects upon which scientific minds are now at work—not in mere speculation, but in actual and accurate experiment. Almost daily, nature responds to some bold inquiry of this kind, and a new truth is born to science.

As this article meets the eye of our numerous friends and readers, the congratulations and kind wishes of friends will be mutually interchanged upon the advent of the new year. That the year 1869 will be as fruitful of progress and as promotive of the welfare of the entire human race, as the eventful year that has passed, is our prayer, while we beg to unite with other friends in wishing each and all a "Happy New Year."

INSURANCE—DUTIES OF COMPANIES AND INSURERS.

The occasional if not frequent litigations between insurance companies and policy holders are calculated to do great injury to both. That company which soonest and quietest adjusts its affairs with a holder of a policy after his loss is always the most popular. The fact of an early payment of the amount is heralded by the recipient, and given currency in the newspapers, making one of the best, although gratuitous, advertisements the company could have. But litigation before a jury or a suit before a referee does more damage to the company than can be offset by their success in that particular case, and injures the business of insurance generally.

Insurance is a perfectly legitimate business, and its institution has done much more to nurse and protect enterprise in building, manufactures, and commerce than is generally supposed. The Chicago *Insurance Chronicle* gives an idea of the history of insurance that may be of interest to our readers. It says that the earliest recorded application of the principle was in marine insurance, which was the invention of merchants and ship owners engaged in the commerce of the Mediterranean, somewhere about the twelfth century. Its object can scarcely be more clearly and fully set forth than it is in the language of the English statute of 1691, which declares that, by means of insurance, "it cometh to pass, upon the loss or perishing of any ship, there followeth not the undoing of any man, but the loss lighteth rather easily upon many than heavily upon few, and rather upon those that adventure not than upon those that adventure; whereby all merchants, especially of the younger sort, are allowed to venture more willingly and freely." It was not long before the same principle was applied to the insurance of buildings, and so to the protection and encouragement of trade.

Further on the writer says; "It is vain to argue that insurance was designed for the use of business, and not business for the use of insurance. Insurance is governed by certain laws, which cannot be violated with impunity. The premium must be equal to the average risk, and exceed it by a sufficient margin to cover the necessary expenses of conducting the business, or bankruptcy is inevitable. This ideal may not be always attained with mathematical precision, but the departures from it will oscillate within ever narrowing limits. If the premiums are calculated too high, the business will decline; if too low, impending ruin will soon teach the insurers their error. It is folly to consider the interests of the insurers and of the insured as distinct. It is madness to regard them as inimical. Insurance is the friend of industry and thrift everywhere. Despite the crudities of its present classification of hazards, that classification is the result of long experience and careful observation, and is established as much in the interest of the insured as of the insurer. It cannot be materially changed without defeating the very objects of insurance. The practical question, therefore, in the case before us is this: If the present rates are prohibitive to the manufacturer, and yet unremunerative to the insurer, what is the remedy? What, in the name of common sense, but this—the co-operation of both in the search for some sufficient safeguard, some measure of protection, that shall reduce the hazard and so reduce the rate? In this search they have each an equal interest. The minimum rate, consistent with safety, is the result which the underwriter seeks, and it is better for the manufacturer to recognize this fact and do all in his power to diminish the hazard, than to seek to reduce the cost of indemnity by means which, if successful, must surely result in the destruction of the indemnity itself."

We would suggest, in addition to the search for a safeguard, honesty in the insured and the insurer. So long as seekers for insurance prefer to overrate the value of their property and pay the additional premium, and the companies, for the sake of that additional premium, or increased amount, will issue a policy on property the real or market value of which they do not understand, or care to ascertain, so long will insurance be simply a contest of sharp practice between insured and insurers, and suits at law will follow losses and a demand for payment. Although both parties are to blame for this state of affairs, a little consideration will show that the *onus* of the blame rests upon the insurer. It is his business to ascertain the value of the property insured. Men generally believe, and honestly too, that what is theirs possesses some peculiar value, and they will estimate their possessions at a higher figure than similar property held by their neighbors. This is natural, and therefore in some measure, excusable. But the insurance agent should use his own judgment, aided by a personal inspection of the property to be insured and the opinions of disinterested but competent parties. And the agent should have a theoretical, if not practical, knowledge of the nature of the business carried on in the buildings for which an insurance is asked. An exhibition of this knowledge would serve as a restraint on the party who desired the insurance, and aid in correcting his mis-statements whether honestly or fradulently made. Instead of employing as an agent or solicitor a person who has merely the gift of fluency of speech and personal presentability, our insurance companies would do well to have agents for each class of their risks who are experts by reason of their familiarity with the nature of the property on which they recommend risks to be taken. Improper representations on either side and consequent controversies in case of loss would thus be avoided.

WILL STEAM IGNITE COMBUSTIBLE SUBSTANCES?

The idea that heating buildings by means of steam pipes completely prevents all danger from fire, we do not believe is correct. When we know that the heat generated by a hydrocarbon in combination with a combustible fiber will produce combustion, as has been so often proved, and that a fibrous material saturated with oil will, if exposed to the sun's rays burst into a flame, it follows that a greater degree of heat, whether produced by steam or any other agency, may produce like results. Experience has proved that a long exposure of wood to a temperature not exceeding that of boiling water, or 212 deg., brings the wood into a condition very favorable to ignition; how much more should it be accepted as a truth that long exposure to pipes conveying steam at a temperature of from 350 deg. to 400 deg., should render the combustible substance liable to ignition. We have on our table specimens of boiler lagging, of pine wood, inclosing the steam space and defended by a sheet iron jacket, thus protecting them from the oxygen of the atmosphere, that are reduced to the condition of porous charcoal, lighting as readily as our old-fashioned tinder merely by the contact of a spark. Every engineer must have noticed in his experience the inflammable condition of the wood through which a steam pipe passed, or on which it rested, if they had remained in contact or contiguity for a period of a few weeks. Every engineer of lengthy experience and close observation also knows that it is possible to ignite combustible or inflammable substances by the direct impact of steam. Cases have been recorded where dry wood was ignited by escaping steam at a distance of not less than thirty yards from the boiler; and we know, personally, where, as an experiment, we lighted oil-saturated cotton waste and dry pine wood by the steam from a boiler at a distance of twelve feet, the boiler pressure being at the time only 95 lbs., temperature, by Regnault 335 deg. The materials burst into flame in a few minutes.

The ordinary way of conducting steam through buildings, factories, shops, etc., from the boiler, is to lead it through a series of parallel pipes, connected by bends or cross pipes at the ends and suspended on iron hooks or brackets attached to upright wooden cleats. These brackets hug the pipes closely to the wood, but they leave spaces between the pipes and wood for the lodgment of the dust from sweepings and the particles held in suspension by the atmosphere of the room. These particles are simply a form of tinder, calculated from their lightness and combustibility to readily ignite. When it is considered that the mere heating of a stick of pine wood, however much seasoned, will compel it to give out an inflammable vapor, it will readily be understood that dry wood and the "fluff" that settle from the atmosphere of a cotton factory or sawing and planing mill are in the best condition for ignition even at low temperatures.

ABOLISHING OF THE FRANKING PRIVILEGE.

We are happy to learn that Senator Ramsay has reported a bill from the Committee on Postoffices, and Post Roads, recommending the abolishing of the franking privilege, and we are glad to see that the senator personally recommends its adoption.

The abuse of the franking privilege has become so general that the revenue of this department is greatly impaired in consequence, and that, too, by our very lawmakers, who should be the most scrupulous in observing the spirit as well as the letter of the statute.

If congressmen would limit their franking operations to their own business there would be less cause of complaint, but some of them allow their friends the use of their signature to frank advertising circulars and pamphlets to a great extent. We have had frequent occasion to call attention to this flagrant abuse before.

If the abolishment of the franking privilege should be extended to the departments it would cost us thousands of dollars on what matter now passes free between us and the Patent Office. But we had rather pay the postage both ways, than have the Government deprived of the large revenue it now is, under the present franking system.

Let the various departments and all congressmen pay their own postage and each bureau charge the same to disbursement account, the same as if paid for stationary, clerk hire, fuel, etc. We hardly expect that our congressmen will pass any bill curtailing their own privileges, but that a reform is needed, no one knowing the abuse of the franking privilege can deny.

SUBMARINE DRILLING AND BLASTING—THE SHELBOURNE SUBMARINE DRILL.

The difficulties of navigating the East River entrance of New York harbor, especially by vessels of considerable draft, occasioned by natural obstructions, have been recognized ever since the settlement of Manhattan Island. About sixteen years ago the hight of the sunken rocks was considerably reduced by the Maillefert process, which consisted of lowering cans of gunpowder on the rock and exploding them by the galvanic battery and connecting wires, the theory being that the superincumbent mass of water formed a resistant or fulcrum against which the explosion might react. But where the rock presented a smooth surface without salient points this method has not proved satisfactory. In consequence the attention of engineers has been directed to the provision of some more adequate means.

The United States Government, having appropriated $85,000 toward the improvement of New York harbor, and General Newton, United States Engineer, having advertised for proposals, the contract for the removal of the Hell Gate obstructions has been awarded to Sidney F. Shelbourne, of New York who, on the 16th of December last, gave an exhibition of his machine, its powers being exerted on blocks of the hard Quincy granite. The principal part of Mr. Shelbourne's machine is a cast iron casing, in form a depressed semi-spheroid, or shallow inverted bowl, seven feet in diameter. It has three solid steel feet or toes by which its stability on the rock is secured. Rising from the upper part of the casting is a conical wrought iron frome, supporting the upper end of the drill shaft by means of two parallel rods entering into sockets in a cast ring at the top of the frame. The drill bar passing up through the centre of the top is furnished at the bottom with a bit, one and a half inches diameter, and having imbedded in its face nineteen diamonds, and rotating at the rate of from 300 to 500 revolutions per minute, advancing at the rate of from one to one and a half inches in the same time.

The feed is caused by a differential gearing which steadily operates to advance the drill into the rock, the debris being washed away by the water forced into contact with the bit through a small rubber hose. The water-tight chamber of the machine contains a pair of engines working at right angles to each other, with a horizontal stroke. As soon as the hole is completely drilled, and also when the drill-shaft is withdrawn from the rock, information of this is given by a magnetic bell which is acted upon by a double wire cord insulated from the water and passing down one of the parallel rods or tubs upon which the crosshead is fixed.

This drill weighs nearly five tons. It will be worked from a wrecking tug with a derrick by means of steam supplied from the boiler of the tug. To prevent this steam being condensed in its passage through the water to the engine it is conveyed in a hose surrounded by another through which the exhausted steam passes.

The rock which will be drilled in the Hell Gate is that known as the bastard granite, and is much softer than either the Quincy or Maine granite, on which the drill has been satisfactorily tested. After a number of holes are drilled over a certain space, a diver will descend and charge them with cartridges of nitro-glycerin, which will be exploded in the usual manner. In connection with the drill another very ingenious and automatic machine will be used to grapple and raise the fragments.

CONCEPTIONS OF THE INFINITE.

Try all we may, we fail to get even the most dim conception of the absolutely infinite—that which has no bound, no measure of comparison. We will cease to make any effort to conceive it as soon as we realize the fact that all our ideas are comparative. Size, color, form, weight, all the qualities in which material things differ from each other, are all judged by comparison with something else. A unit of comparison which answers well as a measure of some object or distance, may be found to be inadequate for the measure of a larger object or distance. To estimate the distances of very remote objects, as the fixed stars, it becomes necessary to take a very large unit of comparison, say the distance light travels in a single second.

Thus it has been estimated that Sirius the "dogstar" is at such a distance from the earth that light requires fourteen years to travel from it to our earth. When we reflect that light travels at the rate of 190,000 miles in a second, we can form a conception of this distance which would be impossible if we made a mile the unit of measurement. But this distance, large as it is, is rapidly increasing. It has been recently computed that Sirius is moving away from the earth at the rate of 144,000 miles per hour. The method by which this motion has been determined leaves no room for doubt as to its reality although it may well be doubted that the rate of recession is anything more than a rough approximation.

These illustrations, although they do not disprove the statement that the human mind cannot conceive infinity, show that the nearest approach to such a conception is in the study of that sublime science, astronomy. No wonder that the devotees of astronomy are the most laborious of all the divisions of the grand army of science. No wonder that they who nightly gaze upon the mightiest of God's works, should have ever been the most unwilling to doubt the existence of a higher creative intelligence. No wonder that this grand study has attracted to itself and appropriated the best talent of every age, and that those who "nightly assault the heavens with the artillery of science," are humbled with the sense of their own weakness as they contemplate the stupendous machinery of the universe.

WHAT IS SCIENCE ?

The primary signification of the word science is knowledge; but as generally accepted it means knowledge reduced to a system. All knowledge is comprised of facts and logical inferences from facts. The basis of all science then is fact, and the prime object to which all scientific research should be directed is the determination of facts. Facts, being the foundation upon which the logical superstructure must be reared, are of the most vital importance. They may not be assumed ; all guesswork is to be strictly shunned.

People are too apt to forget that it is quite possible to reason correctly and ably upon totally false premises. The world is full of books that exemplify our proposition. Old libraries are filled with quaint and labored expositions of almost every subject upon which men can think, valueless now, because they have been found to conflict with facts. It is with feelings of admiration that we roam through a collection of these almost forgotten labors—admiration for the talents which in the light of the nineteenth century, would have made a brilliant display, and which, even in the darkness of medieval times, made a manly and brave struggle to reach truth.

We pride ourselves upon the progress of the times, and we have good reason to do so ; at the same time it is not by any means improbable, that many of our views upon subjects relating to the sciences will be discovered to be fallacious by a future generation, as those of a past age have been by us. It seems to us that there is too much inquiry as to *why* things are and too little as to *how* they are. What is of practical value is how things occur—what are the invariable laws that govern their occurrence. Had Newton set himself to speculating as to why gravitation takes place, rather than to the investigation of the laws which govern the attraction of masses to each other, his labors upon that subject would have been altogether vain and worthless. But his was a mind that applied itself to the investigation of facts. It is true he hazarded some hypotheses, but they were only entertained by him as being what might ultimately be demonstrated by experiment to be true, not made the basis of system. The world has had too much theorizing and is now getting down to the true foundation, the veritable hardpan of all science facts.

REMINISCENCES OF TRAVEL IN SPAIN.

NO. III.

DUCAL PALACES—THE ESCORIAL OF PHILIP THE SECOND.

The public buildings of Madrid are unusually good, and there are many grand ducal palaces fitted and furnished in sumptuous style, the most interesting of which are those of the celebrated Duke of Alva, and Cardinal Ximenes, the latter in some respects the ablest man which Spain has ever produced. Ximenes began his career by entering a Franciscan monastery. During the reign of Ferdinand and Isabella, over whom he exercised a strong influence, his mind more than any other, controlled the policy of the kingdom, and to this day his memory is revered as a saint. The gloomy old palace is a fitting reflex of the rigorous habits of the Cardinal. The palace of the Duke of Medina Celi, facing the Prado, covers an area of 245,000 square feet, and is fitted up with all that taste, skill, and love of display which characterize the wealthy classes of Spain. The Marquis of Salamanca has two elegant palaces ; and until recently his picture gallery was looked upon as containing one of the finest private collections in Europe. Some of our readers will remember the Marquis as having been an active promoter of the Atlantic and Great Western Railway ; and the town of Salamanca, Pa., was named after him. It is reported that he lost heavily by his railway schemes, and that in order to repair the drain made upon his fortunes, he had sold at the recent Paris exhibition many of his valuable pictures, from which he realized upwards of three hundred thousand dollars.

Wealth in Spain, as in most monarchical countries, is very unequally distributed. The grandees are usually very rich in landed estates and other property, while the poor are very poor. In point of squalid poverty, the streets of Madrid are full of picturesque effects. Vice and immorality run through all classes of society, and yield their bitter fruits. The more common outward vice of the lower classes consists in their passion for bull-fights, cock-fights, and lotteries. It is a common thing to witness upon the streets, old men, women, and young children hawking about lottery tickets, from the sale of which they gain a miserable pittance.

Spanish history abounds in great mysterious characters, and we are obliged to confess that there was something strangely fascinating connected with our trip through that romantic country, which we can only explain by the fact that in early life we had read with interest "Don Quixote," Prescott's histories of "Ferdinand and Isabella," "Charles the Fifth," and "Philip the Second ;" also Irving's "Conquest of Grenada" and the "Tales of the Alhambra." The reader can therefore readily imagine with what eagerness we sought out the Audiencia where Ferdinand and Isabella were married ; the old palace where Philip the Second was born ; the little chapel at Seville, where Columbus met Isabella on his return from San Salvador ; the house where he died, and the parochial church where his funeral obsequies were celebrated, also the many exquisite edifices left by the exiled Moors. Perhaps, however, there is no single pile of architecture remaining in Spain so interesting as the Escorial—about two hours' ride by railway from Madrid, and regarded by the Spaniards as the eighth marvel of the world. The Escorial was designed and built by Philip the Second, a cold, haughty, intellectual bigot, who, after burying one youthful queen, went over to England and married "Bloody Mary." Philip does not appear to have been greatly afflicted when Mary died, for history represents him so very anxious to obtain another queen that he could scarcely wait for the six months' official mourning to cease before he sent his ambassador to claim the hand of Elizabeth of Valois, daughter of Catherine de Medicis, then in her sixteenth year, and knowing all the while that his unfortunate son, Don Carlos, had a strong passion for the beautiful princess.

History says that Philip was induced to found the Escorial as an act of gratitude to God, and especially to his patron, St. Lawrence, who inspired the victory of St. Quintin, in 1557. The buildings, which comprise a palace, temple, and monastery, cover 500,000 feet, and cost upwards of four millions of dollars in those times, when it is said that the laborers received but six cents per day for their work. The situation of the Escorial, under the shadow of the Guadarama mountains, is desolate and melancholy in the extreme. The mountains are one mass of bare gray granite, and the wide sweep of country lying in front is a monotony of rocks and stunted trees. Philip was two years in hunting out this situation, and if he had searched for two years more he could scarcely have made a selection more desolate. St. Lawrence suffered martyrdom by being roasted upon a gridiron, and it is thought that Philip had the form of that instrument in his head when he drew the plan, which no doubt was supplemented by a granite boulder in his hat, if one may judge from the immense piles of stone blocks employed in its construction.

The architecture of the Escorial is severely simple, grand and gloomy. Philip built it not for a prince, but for a monk, and wanted for himself only a cell, where he could live and die, in the palace he had built to God ; and certainly, we never before saw so much simplicity and solidity in any other similar structure. The palace was originally very plainly fitted up. Philip's cheerless cell, where he was accustomed to pass a good deal of his time, had four common-looking pictures hung upon the walls, a plain board table, a single chair, and a stool upon which he used to rest his gouty foot, the sacking still showing the stains from the remedies employed to kill the pain. These relics of the monarch are reverently shown, and attest the rigid austerities practiced by him after his retirement to the Escorial.

The treasures of the Escorial are very numerous. There are many fine paintings, statues, and tapestries, curious pieces of furniture, elegant and costly church vestments, beside several thousand saintly relics, highly venerated, among which are ten complete skeletons, more than a hundred heads, and several hundred bones. Philip had a passion for these things.

Just back of the choir of the temple, there is suspended a marble crucifix of life size, done by that famous man Benvenuto Cellini of Florence. He worked upon it, he says, "with the diligence, and love, that so precions an object deserves, and because I know myself to be the first who ever executed crucifixes in marble."

The library is a splendid room two hundred feet in length, and contains many rare and beautiful books, among which is a splendid Old Testament of the eleventh century in letters of gold with exquisite paintings ; also, a tastefully decorated copy of the Koran which is very old. We asked the custodian, what value was put upon the Old Testament, and he replied that a million dollars would not buy it. The fine, sharp portrait of Philip, which hangs in this library, represents a pale, bloodless, careworn man of seventy-two, about to bid adieu to all his grandeur and renown. Such a picture, in such a place, makes it one of the most interesting portraits in existence.

The Monastery was shut to our observation, but we heard the solemn chanting of a few monks who are permitted to occupy its cells and cloisters. Upwards of seventeen hundred mass services are required to be performed every year in the Escorial, and following the custom of her predecessors, the late Queen, when she visited the place, was in the habit of hearing midnight mass at the altar of the pantheon under the temple.

The palace "is tenantless of its heroic dwellers," the courts are deserted, and the mind of the visitor is oppressed by the gloom which hangs heavily over a venerable pile that illustrates better than books, the character of the man who built it.

The palace is now very elegantly furnished—four of the the apartments, afterward fitted up by a subsequent king, in marquetry, with gold and steel door and window trimmings, cost upward of one million dollars. The temple is an enormous structure of massive granite, and beneath the high altar is a gorgeous pantheon fitted up as a burial place for the Spanish kings and queens. Philip died upon a couch within a small side chapel, through the window of which he could survey the splendid follies which he had created ; and his worn-out body was carried down and deposited within a recess of the pantheon. Twenty-one years were employed in the construction of the Escorial, and Philip was accustomed to ride from Madrid on horseback to superintend the work, perching himself on an elevation where he could overlook the situation and development of his costly gridiron.

We spent five hours' hard work in wandering about the vast buildings of the Escorial.

American Institute Lectures.

Dec. 30.—Mr. James Hall, State Geologist, Albany ; "On the Evolution of the North American Continent."

Jan. 6, 1869.—Prof. Horsford, Cambridge, Mass. ; "On the Philosophy of the Oven."

Jan. 13.—Dr. T. Sterry Hunt, Montreal, Canada ; "On Primeval Chemistry."

Jan. 22.—Prof. Doremus, College ot the City of New York ; "On the Photometer."

Jan. 27.—Mr. Waterhouse Hawkins, of London ; "On Comparative Zoology."

Feb. 3.—Prof. Cooke, Harvard College, Mass. ; "On the Spectroscope."

Feb. 10.—Wm. J. McAlpine, Pres. Am. Soc. of C. E. ; "On Modern Engineering."

The Late King of Siam.

The name of the late King of Siam was Phra-Bard Samdetch-Phra-Pharamendr-Maha-Monkut. He was seventy years of age, and had some taste for civilization, having dug canals, built forts, railways, steamboats, founded a printing office at Bangkok, and paid some attention to education. These peculiarities probably came from reading the *Evening Post*, to which he was for many years a subscriber.

The king leaves an extensive family of widows, said to be two thousand in number, to mourn his loss. He spent the last years of his life chiefly in studying Siamese theology, and in photographing his wives.

We have a very high respect for the *Evening Post*, and it is therefore with some hesitation that we disturb its theory respecting the progress made in civilization by Phra-Bard Monkut, of Siam. His late highness was a regular reader of the SCIENTIFIC AMERICAN, and it seems to us very likely that he learned more from its columns about forts, steamboats, railways, canals, and photography, than from the *Post* ; but so far as his knowledge of theology and social science is concerned, we have no doubt that he found the *Post* an able assistant, and we hope our cotemporary will forward a copy of the paper containing the notice to each of the two thousand bereaved widows.

Sensations in a Balloon.

The question "Are you not dizzy in looking down from a balloon?" was answered awhile since by the Boston *Journal* as follows: "Dizziness or giddiness is something entirely unknown in aeronautic traveling, and therein is one of the most surprising facts of ballooning. You look downward with the same steadiness and composure with which you look off from a mountain top. Another strange feature is that the balloon seems to stand perfectly still. Common sense teaches you that you are moving when the distance between you and certain objects is widening, but there is no other indication of the fact, nor is there in rising and falling in the atmosphere. Immersed in the air current, and traveling at the same or nearly the same velocity, the balloon seems relatively becalmed.

This fact, the *Journal* goes on to say, sufficiently explains the utter uselessness of sails and rudder. There is no wind to fill the one, nor fulcrum or resisting force for the other. The only power of a gas balloon is its buoyant force, and thus all inward efforts at propulsion or control, beyond a simple means of rising or falling through a depreciation of the buoyant material or the ballast weight, are manifestly fruitless. Until some other inward motive power than mere buoyancy is devised, no forward step can be made in aerostatics, and the union of any other with the gas balloon is entirely hopeless, since the craft is wholly at the mercy of the element which sustains it. The wind currents, too, are so variable that navigating the air between given points under their control would be quite as much out of the question.

No difficulty is experienced at a less hight than two or three miles, by persons in health, nor is any other decided sensation felt under ordinary circumstances. There may a slight ringing or closing of the ears with some persons in a less altitude, but in the upper regions a deafness is experienced. At the hight of three and a half miles the atmosphere is known to have just half the density it has at the surface, and there is, of course, the corresponding decrease of atmospheric pressure. At the surface, a man of ordinary size is said to sustain an atmospheric pressure of 25,000 pounds, while at the hight named it is reduced one half, the change bringing with it many discomfits. The reduction of atmospheric pressure is felt by the balloon through the expansion of the gas and the distention of its envelope, and thus to rise to great altitude necessitates an expenditure of the gas, as well as of ballast. To guard against a too sudden expansion of the balloon, the open neck at the bottom serves as a sort of safety valve, while it also becomes necessary to let out gas at times through the valve at the top.

Exploration of Central Asia.

At the last meeting of the Royal Geographical Society, London, Sir Roderick Murchison said the attention of the society had been strongly drawn of late toward Central Asia, and particularly to the vast regions which bordered the northeastern and northwestern frontiers of British India. The principal region in the northeast embraced the country lying between Assam and Szechuen, the most westerly province of China. A warm desire was expressed by a committee of the British Association, as well as by the Council of the Geographical Society, that that intervening space of about two hundred and fifty miles only should be explored, in order to ascertain if there be practicable passes through the high mountains and wild tracts which separated the upper waters of the Yangtse-kiang from the Brahmaputra at its great bend near Sudiya. Although as yet no positive effort has been made to solve the important problem, the Indian authorities are making efforts to open a route of traffic along a more southerly line between British Burmah and the great Chinese province of Yunnan, now essentially independent of Chinese rule, and most desirous of establishing a trade with our settlements on the Irawaddy.

Of still more pressing importance, however, than an acquaintance with the regions alluded to, is an exploration of the vast and unexamined tracts on the northwest, far beyond the tributaries of the Upper Indus, or between Peshawur and Jellalabad on the south, and the centers of trade and population at Yarkand and Kashgar. The main object is to define the physical character of the vast elevated plateau called Pamir, or "Roof of the world," from which the Oxus and Zarafshan take their rise, and from which the lofty chains, the Kuen Lun, the Himalaya and Hindoo Koosh radiate. In 1867, Sir Roderick urged the essential importance of such knowledge, to be acquired equally by the Russian and British governments; and he then said that this great table-land or watershed ought to be constituted the neutral ground between the two empires, and to be considered as a broad zone to be forever interposed between eastern Turkestan—toward which Russia has now advanced—and the most northern limits of our Indian possessions.

With a view to taking a first step in this desirable exploration, the Council of the Geographical Society sent out last spring a practiced traveler, Lieutenant Hayward, to traverse this region from Peshawur.

Wooden Railways.

The feasibility of laying wooden railways in districts where the traffic does not require a high rate of speed, and where there is an abundance of hard and durable timber, has been recently made the subject of discussion by our Canada exchanges, and by letter we are informed that the method is proposed for Australia, a kind of timber being found there which is very hard and particularly adapted to the purpose. A. M. F. P. Mackelcan, in a communication to the Perth *Expositor*, gives a favorable opinion as to their utility based upon practical experience.

The cost of such railways being so much less per mile than those of iron, the shortening of distances by deep cutting or filling is obviated. The natural features of the district through which it passes can be complied with. The low rate of speed renders the erecting of very expensive bridges unnecessary, and as light locomotives only are proposed, the wooden rails are sufficiently strong for perfect safety.

In many parts of Canada, movements looking toward the construction of such roads are on foot, and an exchange informs us "that $96,000 have been voted by different interested townships in aid of the Toronto, Grey, and Bruce Railway, and the Toronto City Council has passed a by-law granted $250,000 for the same purpose. These sums, it must be borne in mind, are bonuses in aid of the road."

The *Kingston News* says that among the notices of application to Parliament appearing in the *Official Gazette*, is one relating to a wooden railway from Kingston to Loughborough and adjoining townships. "The projected railway is destined to be realized as a fact, and will prove the adaptability to the wants of the back townships of Canada. The people of Kingston are of course very much interested in the success of an enterprise so well calculated to improve the fortunes of the city, and we feel sure they will do all in their power to promote the passage of the company's charter, and to otherwise aid them in the important work." In many other places these railways are talked about. In his communication above referred to Mr. Mackelcan says:

> "I would like to caution those who may patronize or push forward this new system, against making things too great and too grand, under plea of suiting the future, for in this way the present and the future are both destroyed. That which will help Canada to grow into a thickly peopled, well cultivated, and prosperous country, is a net work of cheap conveyance, created in the country by its own industry and with its own capital, and costing so little as to pay for itself in a few years."

The estimated cost of such roads is from $4,000 to $5,000 per mile, which seems to us to be ample. We are inclined to think much more favorably of these practical ideas than the visionary project of a British American Inter-oceanic Railway, alluded to by us in a former number. We hope the plan may be well tested, and feel quite confident it will ultimately succeed.

GEOGRAPHICAL AND ARCHEOLOGICAL.

Putnam's Monthly, for January, says:

Captain Burton (the discoveror of Lake Tanganyika) has a new book of travels in the press, under the title of "Explorations of the Highlands of Brazil," with a full account of the gold and diamond mines. Also, of canoeing down 1,500 miles of the great river San Francisco, from Sabara to the sea.

THE first complete census of the Cape Colony, South Africa, was taken in March, 1865. The enumeration, which does not include Natal and the Transvaal Republic, shows a total of 181,592 persons of European birth or descent, and 314,789 natives, the latter consisting principally of Hottentots, Kaffers, and Bushmen. From a partial census, made in the year 1855, it appears that an increase in ten years was at the rate of 86 per cent. Unlike other colonies composed of mixed races, the rate of increase was much greater among the native tribes than in the white population. Among the possessions of the colony are 226,000 horses, 250,000 draft oxen, 10,000,000 sheep, and 2,440,000 goats. In the list of productions we find 1,390,000 bushels of wheat, 1,633,000 pounds of tobacco, and 3,237,000 gallons of wine. 75,000 persons are employed in agriculture and 13,000 in manufactures. Two-thirds of the white population and one twentieth of the natives are able to read and write. Including Natal and the Transvaal Republic, thirty-two newspapers are published—ten in the Dutch and twenty-two in the English language.

LIEUTENANT WARREN is continuing his excavations at Jerusalem with equal zeal and labor. He has discovered that the foundation wall of the platform of Mount Moriah, upon which stands the Mosque of Omar, as once stood the Temple of Solomon, was originally 1,000 feet long, and 150 feet high, nearly the length and hight of the Crystal Palace at Sydenham. He traced the enormous masses of stone, which are still visible at the southern end, to a depth of 45 feet below the present surface. Behind this wall there are the remains of vast tunnels, arches, and chambers, which Lieutenant Warren refers to the old Jewish Jerusalem, before the time of Herod.

THREE English gentleman, Messrs. Freshfield, Moore, and Tucker, last summer succeeded in ascending the Elburz, the highest peak of the Caucasus, the altitude of which they ascertained to be 18,526 feet Since geographers have adopted the axis of the Caucasus, from the Black to the Caspian Seas, as the boundary line between Europe and Asia, and the peak of Elburz lies on the European side of this line, it thus becomes the highest mountain in Europe, exceeding Mont Blanc by more than 3,000 feet.

THE committee charged to collect funds for the French expedition to the North Pole, has published a report, stating that the vessels will be in readiness by the commencement of this year. It is intended to despatch the expedition from France in January, if possible, in order that it may reach Behring's Strait by the end of July.

PETERMANN'S "Mittheilungen" in Gotha publishes a map of Lower California, from the exploration made by J. Ross Browne, Gabb, and Loehr. An account of the journey, with interesting geological details, from the pen of Herr Gabb, is added.

Editorial Summary.

AGASSIZ'S EXPLORATIONS IN BRAZIL.—The geographer Petermann says of Agassiz's "Explorations in Brazil": "The history of scientific expeditions has scarcely an example which, in point of brilliancy and aid rendered from all quarters, can be compared to this journey of Agassiz. It is known that since his settlement in Cambridge, he has received such a recognition and support from the Americans, as a man of science has seldom enjoyed, and it now appears from his work on Brazil, that also in South America all classes of the people united to do him honor. Had Humboldt visited Brazil during the last years of his life, his reception could not have been more splendid."

A GOOD story is told of a merchant whose business is located on the eastern side of the Sierra Nevada. Being in want of additions to his stock he purchased goods in San Francisco and ordered them shipped *via* the Central Pacific Railroad to its terminus at the time the goods were shipped, supposing that by the time the goods were ready, the road would have progressed nearly to his location. Such progress was made in the interim, however, that the goods were delivered at a point fifteen miles on, from whence they were carted back to their destination.

TO REMOVE SUBSTANCES FROM THE EYE.—To remove foreign bodies from beneath the eyelid, take hold of the upper eyelid, near its angles, with the index finger and thumb of each hand. Draw it gently forward, and as low down as possible over the lower eyelid, and retain it in this position for about a minute, taking care to prevent the tears from flowing out. When, at the end of this time, you allow the eyelid to resume its place, a flood of tears washes out the foreign body, which will be found adhering to, or near to, the lower eyelid

SMOKE WREATHS.—We are in receipt of several communications in regard to smoke wreaths which we are obliged to pass by. The subject is of little or no practical importance. Such wreaths are caused by friction upon the external portion of a volume of smoke caused by its partial adhesion to the walls of the gun, tube, or aperture through which it is forced. This gives a rolling motion from the center of the volume outward and produces the phenomenon. With this explanation we dismiss the subject.

THE removal of Union College from Schnectady to Albany, N. Y., and making it in connection with the Albany Medical and Law schools, and the Albany Observatory, into a State University is strongly urged. It is asserted that if the citizens of Albany will raise $500,000, the trustees of the College will consent to the arrangement and transfer the entire college apparatus, cabinets, library, etc., and the college endowment, now estimated at one million five hundred thousand dollars.

WE understand that the splendid collection of engineering models, belonging to the late Professor Gillespie, of Union College, Schenectady, has passed by purchase into the possession of that institution. It is probably the finest collection of engineering models and instruments in the United States. The department of engineering is now under the direction of Prof. Staley, a former pupil and assistant of Prof. Gillespie, and a gentleman of singular ability in his profession.

BARON JAMES DE ROTHSCHILD, who died in Paris, November 15, left a fortune estimated by the French papers at $400-000,000. Most of this is in stocks, money, and portable securities; but he had also splendid town and country houses, the latter close to the Bois de Boulogne; and fifty-one other houses in Paris; palaces at Rome, Naples, Florence, and Turin; and more or less property in nearly every great city of Europe.

OLMSTED'S SELF OILER.—In the description accompanying the engraving of the oiling device in the last issue of the SCIENTIFIC AMERICAN, it is stated that it was patented Jan 21. 1868. That is the correct date of the oil cup patent, but the hollow shaft patent was issued as long ago as May 2, 1865.

AN eastern professor states that the meteoric showers of the last two years were occasioned by the tail of a comet which passed in 1866. He estimates the flow as being 200,000 miles per day, and that it has been nearly three years in passing. Truly this is a stupendous tale.

A NEW method of attaching the soles of boots and shoes to the uppers has been patented. Copper wire is used for stitching instead of the ordinary shoe thread. It is claimed that superior strength is gained by this method, with but a trifling increase in the cost of the work.

A KENTUCKIAN writes to the *Northwestern Farmer*, that of a lot of telegraph poles put up in Kentucky, the chestnut rotted first, the cedar gave way next, the locust stood five years longer and are still nearly sound.

A YOUNG writer having asked the Petersburg *Express*, which magazine would give him most speedily the highest position, was advised by the editor to contribute a fiery article to a magazine of powder.

IT is stated that the Czar of Russia has sent two engineers to inspect the Pacific Railroad, with a view to utilizing whatever information they may obtain in the construction of a road from St. Petersburgh to Chinese Tartary.

A SINGLE establishment in Vermont turns out 100,000 slate pencils per day. How many little fingers and young brains they must keep busy.

Applications for Extensions.

The following is a list of pending applications for extensions filed prior to Dec. 1st. The date of the patent, and day of hearing of the application at the Patent Office, are annexed in each each:

Rebecca A. Marcher, executrix of R. I. Marcher, deceased; dated May 22, 1855; Tool for Grooving Moldings. Hearing, Dec. 21, 1868.

John C. Schooley; March 14, 1855; Process of Curing Meats. Dec. 28, 1868.

Birdsill Holly; Feb. 6, 1855; Elliptical Rotary Pumps. Jan. 11, 1869.

Warren Holden; May 1, 1855; Boot and Shoe Stretchers. April 5, 1869.

Geo. W. Hubbard and Wm. E. Conant; Jan. 9, 1855 reissued Sept. 18, 1866; Operating Slide Valves in Direct Action Engines. Dec. 21, 1868.

Jarvis Case; Jan. 16, 1855; reissued Nov. 16, 1858; again reissued April 17, 1866; Seed Planters. Dec. 21, 1868.

Arnton Smith; Jan. 16, 1855; Plow. Dec. 21, 1868.

Ambrose Foster, for himself and the representatives of J. A. Messenger, deceased; Jan. 16, 1855; Building Block. Dec. 21, 1868.

Newell A. Prince; Jan. 23, 1855; Fountain Pen. Dec. 28, 1868.

Russell Jennings; Jan. 30, 1855; reissued Oct. 3, 1865; again reissued Jan. 16, 1866; Auger. Jan. 11, 1869.

Jotham S. Conant; Jan. 16, 1855; Sewing Machine. Dec. 28, 1868.

MANUFACTURING, MINING, AND RAILROAD ITEMS.

An excursion over the first twenty miles of the Lake Superior and Mississippi Railroad took place on the 21st of November, and an inspection by the St. Paul city common council. The inspection was made with the view of obtaining an appropriation of $150,000 from the city. The completion of the road is looked for in 1870.

The northern extension of the North Missouri Railroad now extends seven miles beyond the Iowa State line and is rapidly progressing.

A proposition to build a wooden railway along the Lake Superior range from Portage Lake to the Cliff mine has met with great favor. Several thousand dollars of stock were subscribed in a single day. The full amount required is $300,000.

A large furnace has just been erected in the newly developed iron regions of Roane county, four miles from Kimbrough's Landing, on the Tennessee river. From 150 to 200 men are employed.

The proposed hydrographic survey of Vermont, of which we took notice some time since, has been decided upon and the legislature of that State taken the necessary action.

The receipts of cotton at Shreveport, Louisiana, for the month of October reached 6,637 bales, against 500 bales for the corresponding month last year. The receipts since the 1st of September amounted to 12,962 against 1,210 for the same period of time last year.

We understand that the managers of the New York & New Haven, New Haven, Hartford & Springfield, and the Boston and Albany Railroads, have decided to run daily, after the opening of spring, a fast train between New York and Boston, making only four stoppages, viz., at New Haven, Hartford, Springfield, and Worcester. Time six hours and distance about 230 miles, an average of nearly 40 miles per hour including the four stoppages.

NEW PUBLICATIONS.

Magazines for January.

The Eclectic is embellished with "Tasso reciting his Poem at the Court of Ferrara," and contains "The Phantoms of St. Mark's," "The Hindu View of the late Eclipse," "Madam: de Lafayette," "The Sun's Distance," and other good articles. The Atlantic Monthly is brimfull of good things. The Galaxy ought to be read by everybody. The Radical has several fine articles. Lippincott's Magazine has a choice variety. Baltimore comes into the field with the New Eclectic Magazine, the selections for which exhibit great care; Turnbull & Murdock, publishers. Golden Hours, a monthly magazine for boys and girls, Hitchcock & Malden, Cincinnati; a capital serial, well illustrated.

The Chemical News.

We are informed that the American publishers of this periodical propose to add to the English edition a Supplement, containing notices of the current progress of chemistry and the physical sciences in America. The new feature is inaugurated in the December issue, and will be under the editorial charge of Professor Charles A. Seely. This addition will greatly increase the value of this excellent periodical for American readers.

Sloan's Architectural Review and Builders' Journal.

We are in receipt of this magazine for October, November, and December. These numbers are beautifully illustrated with original designs of churches, dwellings, public buildings, and drawings of carpenters and joiners' work, with details and specifications. We most cordially commend this first class publication to all directly or indirectly connected with building, whether architects, contractors, or workmen. To lovers of art, it will prove a magazine of great interest and value, and is worth double its subscription price, $6, to the general reader. Published by Claxton, Remsen & Haffelfinger, 819 and 821 Market street, Philadelphia.

W. J. Taylor, of Berlin, N. Y., has a Wheeler & Wilson Sewing Machine (No. 289) that has done nearly $5,000 worth of stitching during the past sixteen years, and is now in perfect working order.

Inventions Patented in England by Americans.

[Compiled from the "Journal of the Commissioners of Patents."]

PROVISIONAL PROTECTION FOR SIX MONTHS.

3,395.—Cooling and Barring Soap.—Silas Divine, New York city. Nov. 7, 1868.

3,433.—Breech-loading Fire-arms, and Cartridges for Breech-loading and other Fire-arms.—Gustav Bloem, Dusseldorf, Prussia, and Ernst Scheidt, New York city. Nov. 12, 1868.

3,465.—Propelling Vessels.—A. C. Loud, San Francisco, Cal. Nov. 14, 1868.

3,472.—Railway Wheel.—Geo. G. Lobdell, Wilmington, Del. Nov. 14, 1868.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

Sled Brake.—James Willis, Mifflin, Wis.—The object of this invention is to provide a simple and efficient brake for sleds, and consists in an arrangement of levers and connecting rods to operate an oscillating shaft having lugs to take into the ground.

Axles of Vehicles.—Edward Finn, Berlin, Wis.—The object of this invention is to provide the means of easily and quickly removing or putting on the nuts of axles, and at the same time enabling the same to be firmly held n place.

Millstone Dress.—Benjamin C. Stephens, Houston, Mo.—This invention relates to a new and improved millstone dress, whereby grain may be ground in a uniform and perfect manner.

Car Bake.—D. J. Parmele, San Francisco, Cal.—This invention consists of an improved arrangement of mechanism for instantly throwing a pair of friction wheels, into gear, to the shaft of one of which the brake chain is attached, the other being arranged on the car axle.

Propagating Boxes.—Albert D. Manchester, Westport, Mass.—This invention relates to improvements in boxes or crates for propagating purposes, the object of which is to provide boxes of cheap construction that will facilitate the same and afford a ready means for removing them from the boxes without injuring the roots.

Harrow.—B. T. Martin, Charlotte, Mich.—The nature of my invention relates to improvements in harrows, whereby it is designed to provide an arrangement which will admit of a better adaptation of the same to uneven ground, and whereby, also, it may be adjusted to a condition for leveling uneven ground.

Ink Caster and Case.—J. M. Kennedy, Vicksburg, Miss.—The object of this invention is to provide an article of desk and table furniture containing a number of useful things, all of which relate to clerical operations, that is to say, to the performance of uniting ruling, sealing, dating, and the like.

Knife and Scissors Shapener and Cleaner.—Wm. Miller, Chicopee, Mass.—This invention relates to a new device for sharpening and cleaning table and other knives, and also for sharpening scissors, and it consists in the knife-cleaning apparatus, which is composed of a series of vertical leather or other plates, which are arranged between a spring and a screw, so that they may be pressed together with suitable force.

Treatment of Waste Liquor Produced in the Manufacture of Gelatin by Muriatic Acid.—Frederick Bihn and Wm. Schrader, Frankford, Pa.—The object of this invention is to separate the ingredients of the waste liquor which is produced in those glue factories in which gelatin is made by treating certain bones with diluted muriatic acid; and the process consists in separating the ingredients by the evaporation and subsequent condensation of the muriatic acid, whereby the phosphate of lime remains as a residuum. The invention also consists in treating the waste liquor with sulphuric acid, for the purpose of aiding and facilitating the aforesaid evaporating process.

Car Coupling.—W. G. Bell, Pittsburgh, Pa.—The object of this invention is to provide a simple and effective car coupling, by the employment of a double-headed connecting bolt, pointed at the ends, and arranged to enter the bell-mouthed buffers and separate a pair of spring-actuated clamping jaws, so that the heads will pass beyond the said clamping jaws which close behind the said heads and establish the connection of the cars automatically. The said jaws are adapted to be opened behind when the cars are to be uncoupled.

Operating Head Blocks in Saw Mills.—John F. Cook, Baltimore, Md.—This invention consists in an arrangement of parts whereby either head block may be moved into any desired position on the carriage with comparative ease by one man; also, in a novel mechanism for producing either a simultaneous or independent movement of the knees, as may be desired; also, in a graduated device for regulating the movement of the knees.

Gate Latch.—Benjamin Hendrickson, Huntington, N. Y.—The object of this invention is to provide a means by which farm and other gates may be sustained partially upon the latch post while the gate is closed, and also operated more easily in closing and opening the same.

Plow.—J. L. Stearns, Mahomet, Ill.—The object of this invention is chiefly to provide a riding or sulky plow, so-called, which is adaptable as a gang breaking plow, or a subsoil plow, by merely changing the plows, that is to say, by attaching the proper plows to the sulky.

Plowing Hoe.—Thomas J. Mason, Harmony, Maine.—This invention has for its object to furnish an improved plowing hoe, simple in construction, strong, durable, not liable to get out of order, easily repaired, and which will do its work well and thoroughly, requiring no plow or cultivator to be previously used.

Dressing Glass Reflectors.—Charles Furber, London, England.—This invention relates to improvements in dressing glass reflectors, whereby it is designed to provide an arrangement of the same that will facilitate the inspection of the back part of the head, or other portion of the body while dressing.

Suspending Scissors.—J. H. Kuttner, Hempstead, Texas.—This invention relates to an improvement in the method of suspending scissors in dry goods stores, and in other situations, whereby they are rendered more useful by being made more available than they have hitherto been.

Tool for Cutting Moldings.—D. W. Perry, Wilkesbarre, Pa.—This invention relates to planing machines for cutting moldings, and it consists in the manner in which the bit or cutter is formed, and in the manner of its attachment to the head, whereby many objections to the common method are obviated, and many advantages secured.

Signal Lantern.—John Graham, Grafton, W. Va.—The object of this invention is to provide a simple, cheap, and convenient signal lamp for railroad use.

Toy Pistol.—Thomas E. Marable, Petersburg, Va.—This invention relates to that class of toy guns and pistols, in which the projectile is forced from the barrel by means of an elastic cord, and it consists in providing an adjustable stop which will prevent the ball from accidentally falling out of the barrel, although not interfering with the operation of the toy when the cord, having been drawn back over the notch, is disengaged therefrom by the trigger.

Cultivator.—Clark Alvord, Westford, Wis.—This invention comprises four separate improvements in cultivators, namely: 1st, a new method of attaching the teeth; 2d, a new device for holding them in the ground; 3d, an improved apparatus for cleaning them; and, lastly, a novel construction of the frame, draft pole, and cleaning apparatus, for the purpose of enabling the teeth to be raised or lowered conveniently, and of fixing them in contact with the ground or at any required elevation above it.

Clothes Line Frame.—William H. Acker, Tarrytown, N. Y.—This invention relates to a new and improved frame for the purpose of fastening clothes lines thereto, so that they may be drawn to a proper state of tension when clothes lines are adjusted upon them.

Sanitary Brace.—F. Pinckard, New Orleans, La.—The object of this invention is to force persons to keep their mouths closed, and to breathe through their noses during sleep.

Corn Planter.—John D. Chambers, Carthage, Mo.—This invention consists of an improved arrangement to permit the plows to follow the inequalities of the ground, and to be raised out of the ground, when moving to or from the field; also, certain improvements in the plows, the dropping apparatus, and the framing, designed to provide an efficient machine of cheap construction.

Bedstead Fastening.—William Johnston, Appleton, Wis.—This invention has for its object to furnish an improved bedstead fastening, strong, durable, simple in construction, not liable to get out of order, and which may be easily attached and detached.

Hydrocarbon Burner.—Louis Verstraet, Paris, France.—This invention relates to improvements in the use of petroleum or other mineral oils for fuel for generating steam in steam boilers, and for other purposes. It consists in the peculiar construction and arrangement of furnaces and discharge tubes and oil reservoirs, in the use of air which has been saturated with the vapor of petroleum in the reservoir, in combination with the petroleum in the process of combustion, and in supplying the boiler in part with the water condensed from the vapors evolved in the process of combustion on their passage through the smoke flues of the boiler.

Dresser Copper.—W. H. Boyden, Rockland, R. I.—The object of this invention is to construct a dresser copper for dressing cotton warp, in such a manner that the edges of the copper with which the threads come in contact can be finished smoother than heretofore, and when in use will wear away more slowly; and so that when the parts of the metal in contact with the threads become worn to any extent, so as to endanger the threads, they can, without cutting the threads, and reaming out the copper, be adjusted in a few minutes so as to bring a new surface of metal in contact with the threads; thereby saving a great deal of time and labor and rendering the instrument much more convenient to operate that heretofore.

Conductors' Punch.—J. and G. D. Friese, Baltimore, Md.—The object of this invention is to so improve the common instrument for cutting eyelets in paper, leather, cloth, etc., that the spring that forces the jaws apart will not wear out or get out of order so soon, while the piece punched out of the paper, leather, etc., will be more certainly and effectually removed from the tooth or cutter.

Harrow.—O. W. Edmonds, Bluffdale, Ill.—This invention consists in connecting two rotating harrows to a supporting beam or frame by adjustable connections, whereby they may be changed in reference to the distance from each other, and in providing a spring or springs in connection with the shafts of the harrows and the supporting frame, whereby the inclination o the harrows with reference to the surface of the ground may be governed, as also the duration of their rotation.

Shutter and Blind Fastening.—W. B. Farrar, Greensboro, N. C.—This device relates to that class of locks or fastenings which are applied inside of a building to secure the bolt by which the shutter bar is confined; and it consists in a lock so constructed and operating that such bolt cannot be removed by a person outside of the building, while it can be fastened at any time from the outside without the necessity of going within.

Preparing Cod Fish.—Elisha Crowell, New York city.—The object of this invention is to so prepare cod or other fish that it shall be divested of everything not edible, which unnecessarily adds to its weight and bulk, and shall be reduced to the most convenient form for handling and transportation, while at the same time it is sufficiently protected from the action of the air.

Coal Chute.—H. Merriman, Bloomington, Ill.—This invention relates to a new and useful improvement in coal chutes used for loading and discharging coal into boats, cars, or vehicles of any kind, whereby the operation of discharging coal is greatly facilitated.

Horseshoe.—Robert G. Jameson and Wm. H. Chamberlain, Bristol, N.H.—This invention relates to a new and improved method of constructing horseshoes, whereby they are rendered much more useful than horseshoes made in the ordinary manner, and it consists in forming a curved bar with the calks formed on it, and attaching it to the shoe.

Compression Cock.—G. E. Boissilier, St. Louis, Mo.—This invention relates to improvements in cocks for discharging liquids or fluids, and it consists in operating a socket valve within the shell of the cock by revolving the stem.

Machine for Quartering Apples.—Clark E. Billings, Warren, Vt.—This invention relates to an improved machine for quartering apples in the process of preparing them for drying, cooking, or other purposes, and the invention consists in pressing the apple into horizontal knives by a plunger operated by a spring lever.

Bridle.—John McKibben, Lima, Ohio.—This invention relates to a new and improved bridle, difficult to explain without an engraving.

Sewing Machine Attachment.—James Wensley, New Brunswick, N. J.—The object of this invention is to provide an improved adjustable guide for sewing machines, and also an improved adjustable presser.

Method of Imprinting the Grain of Wood on Paper or other Substances.—Johann Bongardt, New York city.—This invention relates to a new process for producing on paper or other material a beautiful imitation of the various grained woods, and it consists in so treating the planed surface of a piece of grained wood that it can itself be used as a block for copying its grain with great accuracy upon the paper. In this manner the most exquisite imitation wood paper hangings, and even imitation veneers, can be produced at a trifling expense.

Machine for Forging and Shaping Rivets, Screw Blanks, etc.—Francis Watkins, Birmingham, England.—This invention relates to a new machine for heading rivets, screw blanks, and other bars, when the same are prepared in pieces of the required length. The machine is so made that two sets of heading devices are in constant operation, a head being formed alternately on each machine, so that the power required for one machine is utilized to operate two. The invention consists chiefly in the use of two rotating disks, mounted at the ends of a shaft, on which shaft is also placed and keyed a ratchet or feed wheel, worked by a hooked rod which is pin-jointed to a lever acted on by a cam on another shaft. In the periphery of each of the disks or the carriers are placed dies for receiving the shanks or necks of the rivets, bolts, screw blanks, or other articles to be headed. Inside of these dies are "tippers" or sliding bolts for holding the blanks to their work, and for discharging the same when finished. These tippers perform their work by means of their inner ends being cranked and resting in the grooves of a stationary cam, one such cam being arranged within each rotating disk. The tippers are made of two pieces screwed together, so that they may be adapted to hold blanks of various lengths to the header The two sides of the machine are alike, but the dies in the disks are arranged so that blanks are headed alternately on one and on the other side.

Fluting Machine.—Wm. D. Corrister New York city.—This invention relates to a new fluting machine in which the upper one of a pair of hollow corrugated rollers is hung in an up-and-down adjustable frame, which can be set by means of a vertical screw, while the required degree of pressure is produced by means of a spring coiled around the screw.

Apparatus for Unloading and Stacking Hay.—W. D. Brooks, Bethany, Pa.—This invention consists chiefly in a novel manner of operating the truck from which the fork or load is suspended, said truck running on a flexible track, which is fastened at one end, and which works around a swiveled pulley that is higher than the fastened end of the track, so that the latter is thereby lower at the fastened end, and causes the truck to move automatically toward the same. But when it is desired to make the truck move toward the pulley, the flexible track is slackened, and a cord fastened to the truck is pulled, so as to cause the track to be higher at the fastened end.

Machine for Punching and Shaping Screw Nuts, etc.—Francis Watkins, Birmingham, England.—This invention consists chiefly in operating both the cutting as well as the punching tools of two machines from one single shaft. On the main shaft of the machine is a driving wheel, which gears into a spur wheel and thereby drives another shaft, on which are keyed two cams, actuating two slides which carry compound punches; the solid punches carried by one slide working within the ring punches carried by the other. The machine is double acting, and there are similar tools at each end of each slide. The slide which carries the ring punches actuates two other slides, opposite its two ends, by means of rods fixed to the first slides and passing through the others. The rods have adjustable nuts upon them and allow a certain amount of independent motion in the end slides which also carry ring punches similar to those carried by the slide which actuates them. Dies or forming boxes in which the articles to be made are formed, are secured to the frame of the machine by means of bolts or otherwise.

Refrigerators.—S. Wheat, Middletown, N. Y., and D. B. Wheat, New York city.—This invention has for its object to furnish an improved refrigerator which shall be simple in construction and effective in operation, preserving the provisions or other substances placed in it for a longer time, and with a less supply of ice than is possible when the refrigerator is constructed in the ordinary manner.

Combined Band Cutter and Feeder.—P. G. Biggs, H. Granger, H. A. Butler, Macon city, Mo.—This invention has for its object to furnish an improved machine by means of which the bands of the bundles or sheaves of grain may be cut and fed automatically to the threshing machine with a spreading movement, so as to enter the said threshing machine in proper position for being threshed.

Seed Planter.—Isaac Rexford, Malone, N. Y.—This invention has for its object to furnish an improved seed planter, simple in construction, effective and convenient in operation, doing its work accurately and well, and which may be easily adjusted to plant various kinds of seed.

Bridle Bits.—William S. Robbins, New Bedford, Mass.—The object of this invention is to provide a bit for a horse bridle, in such a manner as to form a safety bit at all times in addition to an ordinary bit.

Automatic Stop for Mining Cars.—James Tamblyn, Virginia city, Nevada.—The object of this invention is to a simple automatic stop to prevent mining cars from running into the shaft before the "cage" is up at the mouth or top of the shaft to receive the car.

Spade.—Michael Connolly, Newark, N. J.—This invention relates to a new and improved spade, and it consists in a peculiar construction of the same, whereby the earth may be dug considerably deeper than with an ordinary spade, and with less labor.

Scoop.—Thomas B. Davis, New York city.—This invention relates to a new and improved mode of constructing sheet-metal scoops in one piece of metal, whereby they may be manufactured at a less cost and in a superior manner to those ordinarily made.

Harvesters.—Mason Gibbs, Homer, Mich.—This invention relates to a new and useful combination of a reel and rake for harvesters.

Plowshare.—George W. Cooper, Ogeechee, Ga.—This invention relates to a new mode of constructing plowshares, and also to a new manner of a curing the same to the foot. The plowshare is made of cast iron, and by its peculiar shape and construction, it can be made without a land side plate. The fastening device is a U-shaped bolt, passing with one arm through the share and foot, and with the other arm through the share into the foot, so that by means of one bolt and nut, the effect of two bolts and nuts, without their disadvantages, is produced.

Clothes Boiler.—Daniel Kellogg, Ypsilanti, Mich.—The nature of this invention relates to the cleansing of clothes by circulating boiling water through them.

Horse Brushes.—W. W. McKay, Ossian, Iowa.—This invention relates to improvements in horse brushes, whereby it is designed to provide a rotating brush, to which motion may be readily communicated by hand, and so arranged as to admit of the substitution of one brush or comb for another readily.

Preserving Wood.—Nicholas C. Szerelmey has taken an English patent for preserving wood, as follows: A solution is made of 10 lbs. of powdered potassa and 40 lbs. of powdered lime in 50 gallons of boiling water, and another of 150 gallons of cold water and 40 lbs. of sulphuric acid. These two liquids mixed together form what is called compound No. 1. Next, 50 gallons of crude petroleum, 40 lbs. of asphaltum, 30 lbs. of powdered lime, and 20 lbs. of zopissa are boiled together, and mixed with a pint of sulphuric acid to form compound No. 2. The timber to be preserved is immersed in compound No. 1 for a quarter of an hour, and then dried for a day or two, and afterward it is, by the aid of a tar brush, coated on all sides by compound No. 2.

Welding Iron.—William Bridges Adams, the well known English engineer, has taken out a patent in England for welding iron, the chief points of which are, that he first makes the surfaces to be joined perfectly true, clean, and close fitting, by planing or otherwise, and then heats them by the aid of jets of gas and air supplied under pressure. Mr. Adams proposes, by the aid of this process, to form guns and other articles by welding together halves or segments which have been prepared by rolling. This specification is well worthy of the attention of those interested in welding.

Dressing Millstones.—Robert Young, of Glasgow, Scotland, has taken out an English patent for machinery for leveling and dressing millstones by the aid of diamond or other suitable cutters, which have a rectilineal motion only given to them.

Building Blocks.—Louis Mumenhoff, of St. Mary's Axe, has taken out an English patent, as a communication from Nicolaus Schroder, of Creuznach, Rhenish Prussia, for compositions for forming blocks to be used for building purposes. One of the mixtures proposed consists of 100 cwt. of coal ashes or coke slag, 16 cwt. of hydraulic cement or lime, and 1 cwt. of Portland cement. The materials are to be worked together in a pug mill, and then rammed into molds. The blocks formed harden in the air, and they may also be further hardened by treating them with waterglass.

Preserving Wood.—Wm. R. Lake, as the agent of Segismund Beer, of New York city, has taken out an English patent for a method of preserving wood by treating it with a boiling solution of borax, the object being to remove the perishable matters without injuring the woody substance. The wood may, if desired, be impregnated with tar or other substances after the above treatment.

Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; beside, as sometimes happens, we may prefer to address correspondents by mail.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisemets at $1 00 a line, under the head of "Business and Personal."

☞ *All reference to back numbers should be by volume and page.*

William Mason, of Oregon.—Thirty-nine dollars received of Wells, Fargo & Co., October 8, 1868., said to have been sent by the above. No advices accompany the money; what is it for?

T. J. M., of Ontario.—Neither Babbitt metal or any composition of metals for bearings will so well suit your case as boxes made of hard maple. These can be adapted to the shaft by the use of oil and plumbago. This composition will give a surface for shaft journals fully equal to that of the best anti-friction metals. It will not soon wear out, and will offer less resistance to friction than any other substance with which we are acquainted. In fact, the value of wood as a substitute of metal in mechanical operations and constructions seems, to us, to be very much underrated. An article in a previous number entitled "Mechanical Skill Shown Without Mechanical Appliances" gives some facts that show the adaptability of wood and its use in machinery.

N. H. D., of Mich.—A hollow iron bar containing the same amount of metal as a solid one, and of the same extreme length would resist a greater strain, if suspended by its ends and the weight applied between, than the solid bar. But a solid bar would resist a greater strain of tension or twisting, or of rupture by being drawn longitudinally apart, than a hollow one of the same diameter, as in evident by comparing a one inch bar of wrought iron and a gas pipe of similar diameter.

H. R. P., of Mass.—A pan of water set upon a hot stove will sometimes commence and continue rocking for a while; why is it? Ans. —The heat generates vapor of water, or steam at the bottom which in expanding between the stratum of water and the bottom of the pan, reacts upon it and sets it to rocking, provided the bottom is not perfectly flat. The sudden expansion of the cold metal of the pan might also be supposed to account for the fact; *vide* the old experiment of a hot bar of iron laid across two edges of cold metal described in text-books on physics. The matter you claim as a discovery, we cannot notice unless you transmit to us the evidence that you are the discoverer, and the methods by which you demonstrate the fact.

J. C. S., of Mass., writes us to ascertain the chemical process by which cotton is separated from wool, which he says is well known to manufacturers in this country and in Europe. Will any of our correspondents give us the information?

A. G. C., of——To make iron combine with sulphur you should first heat the iron. It may be successfully done, however, by projecting into a red hot crucible, little by little, a mixture of sulphur and iron filings, maintaining all the while a high temperature. When all has been put in the crucible it should be covered and the mass heated until it fuses.

R. B., of N. J.—There are patent signals which would be very useful to notify passengers when approaching stations, and it is the fault of railroad companies that such signals are not in use.

G. C. of Ohio.—A State court has no jurisdiction in patent causes where the trial in for infringement, but if a fraud has been practiced upon you, you can commence suit in a state court.

R. A., of Pa.—If a party has been using your invention, the very fact of such use is good evidence of its utility, and would assist you in maintaining a claim for damages.

C. and P., of Ky.—It is a frequent occurrence to receive electric sparks from large belts running at high speed. Those you described had probably no connection with the meteoric shower occurring at the time.

H. B. C., of Pa., writes us that iron turnings in Pittsburgh are worth from fifteen to eighteen dollars per gross tun, delivered at the iron mills for manufacture.

C., of Mass.—The concave lens of an opera glass, only produces sufficient divergence in the rays conveyed by the convex lens that distinct vision is produced. Being placed within the focal distance of the convex lens, no inversion takes place.

B. F. K., of N. Y.—Soapstone is found at Grafton, Athens, Westfield, and Marlborough, Vt., and in many other places, in N. H., Mass., N. C., Md., and Va. It can be made into slate pencils by sawing.

Official List of Patents.

Issued by the United States Patent Office.

FOR THE WEEK ENDING DECEMBER 15, 1868.

Reported Officially for the Scientific American.

SCHEDULE OF PATENT OFFICE FEES:

On filing each caveat	$10
On filing each application for a Patent (seventeen years)	$15
On issuing each original Patent	$20
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
On filing a Disclaimer	$10
On filing application for Design (three and a half years)	$10
On filing application for Design (seven years)	$15
On filing application for design (fourteen years)	$30

In addition to which there are some small revenue-stamp taxes. Residents of Canada and Nova Scotia pay $500 on application.

Patents and Patent Claims.—*The number of patents issued weekly having become so great, with a probability of a continual increase, has decided us to publish, in future, other and more interesting matter in place of the Claims. The Claims have occupied from three to four pages a week, and are believed to be of interest to only a comparative few of our readers. The publication of the names of patentees, and title of their inventions, will be continued; and, also, as heretofore, a brief description of the most important inventions. We have made such arrangements that we are not only prepared to furnish copies of Claims, but full Specifications at the annexed prices:*

For copy of Claim of any Patent issued within 30 years $1

A sketch from the model or drawing, relating to such portion of a machine as the Claim covers, from $1
upward, but usually at the price above named.

The full Specification of any patent issued since Nov. 20, 1866, at which time the Patent Office commenced printing them .... $1·25

Official Copies of Drawings of any patent issued since 1836, we can supply at a reasonable cost, the price depending upon the amount of labor involved and the number of views.

Full information, as to price of drawings, in each case, may be had by addressing

MUNN & CO.,
Patent Solicitors, No. 37 *Park Row, New York.*

84,851.—Slide for Hanging Upright Saws.—Ashbel P. Barlow, St. John, Canada.
84,852.—Side Scraper for Wells.—Elias Beach, Titusville, Pa.
84,853.—Oil Injector for Steam and other Enginery.—Robert Brayton, Fremont, Ohio.
84,854.—Instrument for Acupuncturaticn.—Anson R. Brown, M. D., Albion, Mich.
84,855.—Mode of Preserving Bait for Fishing.—Edward E. Burnham (assignor to himself and George Brown), Gloucester, Mass.
84,856.—Roofing Composition.—Bork Capron, LeeCenter, N.Y.
84,857.—Harvester Rake.—R. Carkhuff (assignor to himself and T. H. Wilson), Lewisburgh, Pa.
84,858.—Churn.—James Carleton, Walla Walla, Washington Territory.
84,859.—Fire Shield.—John C. Clarke, La Grange, Mich.
84,860.—Hair Cutting Shears.—L. D. Craig, Nevada City, Cal.
84,861.—Heel for Boots and Shoes.—Albert O. Crane, Boston, Mass.
84,862.—Boot Jack.—Joseph Darden, Washington, D. C.
84,863.—Brick Machine.—James C. Dean, Chicago, Ill.
84,864.—Gasket Packing for Steam and other Enginery.—Byron Densmore, New York city.
84,865.—Game of Colors.—Charles H. Douglas, Hartford, Conn.
84,866.—Process of Screening Charcoal.—J. S. Evans, Irondale, Mo.
84,867.—Compound for Destroying Insects.—Wm. R. Fairbairn, Ridotte township, Ill.
84,868.—Method of Attaching Knobs to their Spindles.—Wm. A. Fenn, Wolcott, N. Y.
84,869.—Blank Book.—Herman Fischer, Chicago, Ill.
84,870.—Machine for Distributing Fertilizers.—John F Fisher, Greencastle, Pa., assignor to himself and Daniel Breed, Washington, D.C.
84,871.—Shoemakers' Bench.—David Fisk, and J. M. Blodgett, Clyde, N. Y.
84,872.—Loom.—Wm. T. Flinn (assignor to Barton H. Jencks), Bridesburgh, Pa.
84,873.—Belaying Cleat.—Charler S.H.Foster, Deer Isle, Me.
84,874.—Mentsrual Receiver.—Theodore A. Gamage, Boston, Mass.
84,875.—Pipe Coupling.—Hachadoor P. Garbadian, Philadeldelphia, Pa.
84,876.—Corn Husker.—J. Irving Gordon, Sing Sing, N. Y. Antedated Dec. 11, 1868.
84,877.—Tile eor Floors, Sidewalks, Etc.—John Gray, San Francisco, Cal.
84,878.—Mode of Fastening India-Rubber Tires on Carriage Wheels.—J. Ashton Greene, Brooklyn, N.Y.
84,879.—Sulky Harrow.—E. W. Hewitt, Pacatonia, Ill.
84,880.—Spirit Level.—Collins F. Hill, Hamilton, Ohio. Antedated Dec. 8, 1868.
84,881.—Metallic Lath.—Isaac V. Holmes, New York city.
84,882.—Manufacture of Fans.—Edmund S. Hunt, Weymouth, Mass.
84,883.—Rock Drill.—Michael Keefer, Millstone Point, Md.
84,884.—Dovetailing Machine.—Charles F. Kuhnle, Washington, D. C.
84,885.—Fishing Tackle.—J. D. Leach, and Sabin Hutchings, Penobscot, Me.
84,886.—Revolving Pile Hook.—J. D. Leach, and Sabin Hutchings, Penobscot, Me.
83,887.—Harvester.—Samuel K. Lighter and Joseph Curtis, Hamilton, Ohio. Antedated Dec. 3, 1868.
84,888.—Apparatus for Cooling Liquids on Draft.—Joseph Link, United States Army.
84,889.—Gas Heater.—David H. Lowe, Boston, Mass.
84,890.—Cover for Fuel Magazine in Base Burning Stoves.—Egbert Macy (assignor to John H. Keyser), New York city.
84,891.—Seal-Bolt for Railway Cars.—Peter H. Mann, and Griffith P. Terry, Albany, N. Y., assignors to Andrew B. Uline, and G. G Kidder.
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84,898.—Waiter Machine.—Daniel F. Myers, New York city.
84,899.—Fastening for Corsets.—Peter H. Niles and Frank W. Marston, Boston, Mass. Antedated Dec. 2, 1868.
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84,911.—Cultivator and Plow.—Samuel F. Seely, Whitford, Mich. Antedated Dec. 11, 1868.
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84,914.—Automatic Stop Cock for Gas Burners.—George E. Smith, San Francisco, Call.
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84,916.—Saw Grinder.—Elias Strange, Elias W. Strange, and Emerson C. Strange, Taunton, Mass.
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84,990.—Bell Pull.—Sterling Bonsall, and Louis Hillebrand, Philadelphia, Pa.
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84,997.—Fire Alarm.—Jesse Coulson, Oskaloosa, Iowa.
84,998.—Bag Tie.—David Dick, and Oliver W. Preston, Jr., Corning, N. Y. Antedated December 9, 1868.
84,999.—Horse Hay Rake.—A. T. Dunbar, Alba, Pa.
85,000.—Steam Generator.—Francis B. Dunn, New York city.
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85,003.—Soldering Machine.—Valentine Fath, Philip Fath, and Julius Frielingdorf, St. Louis, Mo.
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85,006.—Slow Closing Valve for Water Closets.—Charles Harrison, New York city.
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85,010.—Pulverizer, Leveler, and Marker.—Lewis Jones, Funk's Grove, Ill.
85,011.—Combined Corn Crib and Threshing Floor.—Joseph R. Jordan, and James Campbell, West Alexandria, Ohio.
85,012.—Apparatus for Tightening Belts.—James M. King, Quincy, Minn.
85,013.—Harness Pad Dress.—George W. Lawbaugh, Genesco, Ill.
85,014.—Portable and Stationary Lantern.—Lemuel W. Leary, Norfolk, Va.
85,015.—Mode of Preparing Carbonated and Caustic Alkalies, etc.—Karl Lieber, Charlottenburg, near Berlin, Prussia, assignor to E. J. Keferstein, Washington, D. C.
85,016.—Curtain Fixture.—Albert Lovie, Philadelphia, Pa., assignor to Charles F. Steinbach.
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85,018.—Material for the Manufacture of Boxes, Picture Frames, Buttons, Insulators, Inkstands, and other Articles.—John Mudge Merrick, Jr., Boston, Mass., assignor to New England Vulcanite Hide Company.
85,019.—Spading Machine.—Loring Moody, Malden, Mass.
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85,822.—Machine for Grinding Glass Fruit Jars.—Michael Neckermann, Pittsburg, Pa.
85,023.—Portable Wardrobe.—Gerrit Niermann, Cincinnati, Ohio.
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85,025.—Wagon Brake.—D. J. Owen, Springville, Pa.
85,026.—Churn.—S. R. Owen, Stewartsville, Mo.
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85,029.—Fountain Lamp.—M. Samuels, New York city.
85,030.—Mode of Shaving and Polishing Skins.—Christian Schmitz, Philadelphia, Pa.
85,031.—Wash Boiler.—Edward Seeley, Scranton, Pa.
85,032.—Repairing Whips.—C. R. Shelton, New Haven, Ct.
85,033.—Farm Gate.—Daniel Shockey, Waynesborough, Pa.
85,034.—Car Brake.—L. S. Sisson, West Edmeston, N. Y. Antedated December 5, 1868.
85,035.—Corn Sheller.—J. P. Smith, Hummelstown, Pa.
85,036.—Neck-Tie.—W. S. Smoot, Washington, D. C.
85,037.—Machine for making Paper Collars.—Charles Spofford, and Charles H. Montague, Boston, Mass.
85,038.—Plate for Artificial Teeth.—Leander R. Streeter, Chelsea, Mass.
85,039.—Draft Equalizer.—Richard Walker, and George Trumbull, Batavia, N. Y.
85,040.—Shuttle for Sewing Machines.—Albin Warth, Stapleton, N. Y., assignor to himself and Eberhard Faber.
85,041.—Hat Conformator.—E. Z. Webster, Norwich, Conn.
85,042.—Burning Kiln.—Gustav A. Wedekind, and Helmuth Dueberg, New York city.
85,043.—Riddle for Grain Separators.—George A. Wells, Oskaloosa, Iowa.
85,044.—Harvester Rake.—Cyrenus Wheeler, Jr., Auburn, N. Y.
85,045.—Harvester.—William N. Whiteley, Springfield, Ohio.
85,046.—Chill for Casting Car Wheels.—William Wilmington, Toledo, Ohio.
85,047.—Lamp Chimney.—S. R. Wilmot, Bridgeport, Conn.
85,048.—Sluice Gate.—John S. Wilson, Harveysburg, Ohio.

REISSUES.

49,069.—Manufacture of Paper Stock.—Dated August 1, 1865; reissue 3,228.—Henry Betts, Norwalk, Conn.
64,492.—Sash Stop.—Dated May 7, 1867; reissue 3,229.—Charles Clapp (assignee of Calvin Cole), Ithaca, N. Y.
83,770.—Material for the Manufacture of Boxes and other Articles.—Dated November 3, 1868; reissue 3,230.—Maurice Fitzgibbons, New York city.
73,823.—Die Press.—Dated January 28, 1868; reissue 3,231.—John Mays, and Eliphalet W. Bliss, Brooklyn, N. Y.
74,168.—Life-Preserving Apparatus.—Dated February 4, 1868; reissue 3,232.—John B. Stoner, Leopold Mendelson, and Theodore Crommelin, New York city, assignees of John B. Stoner.
65,268.—Machine for Rubbing and Mixing Paints, Chemicals, Fertilizers, etc.—Dated May 28, 1867; reissue 3,233.—Robert Poole, Baltimore, Md.
30,509.—Bell Attachment.—Dated October 23, 1860; reissue 3,234.—A. E. Taylor, New Britain, Conn.
39,439.—Brush.—Dated August 4, 1863; reissue 3,235.—John L. Whiting, Boston, Mass.

DESIGNS.

3,291.—Cabinet Organ Case.—Franz Doerschuck, New Haven, Conn.
3,292.—Fork or Spoon Handle.—Henry H. Hayden, New York city, assignor to Holmes, Booth, and Haydens, Waterbury, Conn.
3,293 to 3,295.—Floor Cloth Pattern.—Charles T. Meyer, Bergen, N. J., assignor to Edward C. Sampson. Three patents.
3,296.—Figure.—Carl Muller (assignor to Nicholas Muller), New York city.

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Vol. XX.—No. 2. (NEW SERIES.) | NEW YORK, JANUARY 9, 1869 | $3 per Annum (IN ADVANCE.)

Improved Floating Water Power.

Tide mills and those driven by other water currents are not unusual, but the level of the wheel shaft being fixed, either low water or high water is prejudicial to the full action of the mill. The device shown in the accompanying engraving, being sustained always on the surface of the current, and the connections of the power with the machinery being self-adjustable or automatic, the hight of the water can have no effect on the performance of the waterwheel.

The contrivance consists of two scows or floats connected by cross-bars or timbers, so that they are in parallel lines, and having suspended between them one or more water-wheels of the kind known as undershot. The ends of the floats, or scows, facing the current are wedge-shaped to present little resistance to the current and to divert the stream into the space between the two floats. Projecting also from the bows at the water surface, is a V-shaped guard for defending the wheel from floating timber, ice, etc., or a boom may be used projecting from the shore, as an additional means of defence, when the state of the stream requires it. A gate conforming to the circumference of the wheel, being a segment of a circle, is used also as a guard and to regulate the amount of water impinging on the buckets and consequently the speed of the wheel, as also to entirely stop the wheel by cutting off the stream from the buckets. The main or wheel shaft carries on the shore end a bevel gear that drives a similar gear, from the shaft of which power is carried, by means of pulleys and belts or shafting, to the mill standing upon the bank. The receiving pulley and shaft is hung in a frame, one end of which is hinged or pivoted to the shore side float, or scow, and the other to the mill building. Thus, whether the water be high or low, the belt is always kept "taut," and the machinery driven the same, under all circumstances. Chains or ropes at the ends of the floating scow nearest the shore, and the pivoted frame, hold the floats rigidly in position.

SHEPARD'S PATENT CURRENT MILL.

The wheel may be made with ordinary fixed radial buckets, or the buckets may be pivoted to open and close by their own weight, as those in the engraving, thus offering less back resistance to the water in rising. By lengthening the boats two or more wheels may be used, or a series of floats may be constructed across the stream having their wheels suitably connected, thus multiplying the power indefinitely. It will be seen that the immense expense of constructing dams, and the large damages from flowing lands to form a pond or reservoir are avoided by this plan. It is evidently a valuable device in many localities where sudden rises of water or frequent changes in the condition of the stream prevent a reliable and steady water power.

Patented June 2, 1868, by Albert B. Shepard, who may be addressed for additional particulars at Sand Bank, Oswego County, N. Y.

GLASS STAINING---THE MANUFACTURE OF ILLUMINATED CHURCH WINDOWS.

Although each of half a dozen of the largest cities in America boasts one or more establishments for the manufacture and architectural application of stained glass, by far the finest and best work of all is done, as might be readily supposed, in New York city. There are on Manhattan Island four factories, beside one in Brooklyn, and as the various processes are little understood, save by the mechanical experts and operatives themselves, most of whom observe a profound secrecy, or affect a great degree of mystery about their art, it is thought that a popular account of them may prove interesting to the general public.

By far the greater part of the stained glass made (more than 90 per cent), is used for the decoration of ecclesiastical edifices, and, as a natural consequence, nearly all the designs illustrated are of a scriptural character. Occasionally, though not often, a "memorial window" will be erected in a college or school. A small proportion of colored glass is not unfrequently employed in the ornamentation of some public hall, lecture room, or theater: a little bit of bright fresh color is sometimes given by it to the parlors of a private house; it is even at times degraded to add an additional, and alas, unnecessary attractiveness to the tempting rooms of a gambling hall or a gin palace, but as before stated, the churches claim more than nine tenths of all the work in colored glass.

A rapid description of all the manipulations to which a sheet of common plate or window glass is subjected, and the manner of constructing a window, will run as follows:

The artist first sketches out his idea in pencil on ordinary drawing paper, and elaborates it until the design is complete; he then prepares a large sheet of pasteboard on which he draws the human and other figures of the exact size they are to be in the completed work; the various colors and their gradations are then decided on, and their exact arrangement determined, so that the designer can now tell exactly how many pieces of glass he will require of each color, and how many of each of the several various sizes and shapes. This important preliminary work being accomplished, the brittle substance itself now for the first time is taken in hand.

The material used is for the most part the common window glass of American or New Jersey make, which is purchased in large sheets made especially for the purpose. A very small proportion of glass of the finer colors, the very best rubies, blues, purples, and greens are imported, but by far the larger portion are colored by the American workmen.

The clear uncolored glass is cut with a common glazier's diamond, although the multitude of pieces required and their varied and fanciful shapes make this a seemingly interminable job. This may be readily imagined when we state that one single window of Trinity Church, in New Haven, contains more than ten thousand separate pieces, every one of which was cut and colored singly.

When the requisite number of diamonds, circles, squares, octagons, crescents, and other shapes are cut, according to the number called for by the full size pattern, they are next taken to the painting room, where the color is laid on. This part of the work is very simple, merely consisting in covering, with a common flat brush, one side of each fragment of glass with a thin, even coating of the proper color. These paints are all mineral, as they have to be exposed to an intense heat for many hours, in order that the coloring material may sink into the surface of the glass—be, in fact, so fused with its very substance that it becomes actually a part of the glass, and can no more be separated from it than can the medallion head from the surface of a coin.

The glass stainers' reds and yellows are produced from pure silver prepared with antimony; the blues are made from cobalt; another red comes from oxide of iron; white, from block tin; black, from manganese; green, from copperas; purple is only yielded by pure gold itself. These are all what are known as "enamels," or surface colors, and are not melted through the entire substance of the material. These various mineral substances are reduced to powder by grinding. A "flux" is then prepared from a mixture of red lead, flint glass, and borax, which are melted together in crucibles. To this "flux" the desired color is then added, and the mass is then reduced to a paint, which is laid on with a brush, as before described. While the color is drying on the many-shaped bits of crystal we can take a look at the "kiln," in which they are soon to take a cooking, by the side of which the strongest heat that ever over roasted a turkey and spoiled a thanksgiving dinner would be but as the cooling atmosphere of the latest patent arctic refrigerator. This kiln is merely a brick oven, about five feet by four in dimensions. In the inside of it is a series of shelves made of iron plates half an inch in thickness, and forty-eight inches long by thirty-six inches broad.

These shelves are placed one over another, about an inch apart, from the bottom of the kiln to its top. They are so arranged that the fire can have free access to them all on both top and bottom, and so suffuse them and their contents all in the same steady, fervent heat. On these shelves the painted glass, now dry, is piled in layers twelve or fifteen deep until all the shelves have received their complement, and the oven is full. The heavy iron doors are then closed, and the baking begins. An intensely hot fire is kindled in the fire-box, and in a short time the iron plates and all the many-colored pieces of glass are red hot. The temperature is maintained for eight hours, at the end of which time the fire is drawn, and the glass is left to cool. This cooling is very slow, requiring forty-eight hours, in order that the glass, which otherwise would be as brittle as ice of the same thickness, may be annealed or toughened. When removed from the kiln it is found that the "flux" (being itself in great measure composed of glass), in which is incorporated the color, has melted, and the surface of the previously clear glass plate having also slightly melted, the two have fused together, so that there is now, in fact, a sheet of plain glass having on one surface a thin "veneer," so to speak, of glass of another color, which is so firmly adherent, as to be absolutely inseparable, save at the expense of fracture.

The cooked and colored glasses are now removed to the room of the workman whose business it is to join them together in the proper design. To do this he has a large horizontal table, on which he proceeds to *build up* the proposed window, working by the water color or pencil pattern before him. Beginning at what is to be the bottom of the picture, he lays the lower border of the design, fastening the pieces together by means of flat leaden rods, made for the purpose. These rods are a sort of narrow strip of very soft lead, with a deep groove along each of its sides. Into this groove is placed the edge of a piece of glass of the proper color, and the edge of the groove are bent down so as to hold the glass in a secure grip. A second slip of glass, of another color is then fastened into the opposite groove, and so the "building up" continues, the workman slowly adding piece after piece to his mosaic pattern till the whole is finished. The leaden framework, or sash, is then most carefully covered with a cement of oil, putty, and red lead, which renders it weather tight, and proof against both rain and wind. The window having been then properly framed by the carpenter the work is done.

Glass stainers use two sorts of "ruby" and "blue" glass; in one sort known as "flashed" glass, the color is blown or superimposed on a plain surface, thus making a sort of "veneer," as before described. This peculiar arrangement makes it possible to produce very elegant and beautiful effects by cutting down through the color and exposing the transparent glass beneath, precisely in the same manner that cameos are cut. In the other kind of colored glass, technically called "pot-metal," the coloring material is diffused homogeneously through the entire substance, so that a fracture shows color all through it. For certain uses this sort of material has also its special advantages.

Some very beautiful work is also accomplished in glass, of the sort known as "acid work." This is where the patterns show in delicate white of a semi-transparent hue—the patterns which are mostly chosen from flowers or dainty lace work, appearing as though done in pearl or frost-work. This is commonly known as ground glass. This kind of work is used where heavy plate glass is desired for windows or doors.

The leading agent in the process is hydro-fluoric acid, which works quietly, after this fashion. The plate of glass is laid on a table, and the pattern stretched on it—all parts of the plate except the design are now covered with a thick coating of coach varnish mixed with asphaltum—a ledge or rim of wax, half an inch or so high, is raised round the edge of the plate to dam up the liquid from escaping, and hydro-fluoric acid with three parts of water is poured on to cover the plate about an inch deep. This acid attacks all parts of the glass not protected by the varnish, on which it has no effect, and at the end of an hour, when the liquid is poured off, it is found to have "bitten in" or destroyed the surface of the glass in the shape of the design to a slight but perfectly appreciable depth To have the pattern show white and pearly on a clear surface it is of course only requisite to work in "reverse" or to cover the design with varnish and let the acid "bite in" the border, leaving the pattern raised. Some very elegant doors of this sort are now being finished for the new Park Bank, and for the office of Brown Brothers & Co.

To give an idea of the value added in this art to mere raw materials, by skill and labor, let us mention one piece of work at the establishment of Mr. Henry Sharp, to whose kindness we owe much information about this kind of work which is usually kept sacred from the public eye. In the show room is a piece of common window glass, perhaps sixteen by twenty inches in size, worth originally about twenty-five cents. The paints with which it has been treated would cost about five dollars more, which would be the value of the raw materials. Upon this glass was prepared a specimen work, intended for the great Paris Exbibition, but which never got there as its companion piece was destroyed in a fire. The design was "Jephthah's daughter parting from her companions," and it was so equisitely drawn and colored, and so exqcisitely finished, that the maker has been offered $400 for it, which he refused.

Many fine works are now in progress at the establishment above referred to. Mrs. Samuel Colt, of Hartford, has a memorial window containing a double design; one "Joseph Dispensing Corn," to the memory of the late Samuel Colt, her husband; the other, to three of her children, is "Christ as the Good Shepherd."

Mr. Parrott (whose name is known rather in connection with war than peace) has building a fine chancel window, of a geometrical and mosaic pattern, for a church at Cold Spring, N. Y. Beside these there are windows for the Catholic Cathedral, Portland, Me.; Episcopal Church, Hartford, Conn, Episcopal Church, Benicia, Cal.; Episcopal Church, corner Fifth avenue and Forty-fifth street, New York; St. Peter's Presbyterian Church, Rochester, N. Y.; Episcopal Church, Bay Ridge, L. I.; Episcopal Church, Bush's Mills, N. Y.; Episcopal Church, Geneva, N. Y.; Episcopal Church, Newport, R. I.; Episcopal Church, North Salem, N. Y.; Congregational Church, Tankhannock, Pa.; Catholic Institute, Altoona, Pa.; Wesleyan Female College, Cincinnati, Ohio. Beside these are many single memorial windows, all of which are at present in process of building, about twenty men being employed in the work. The demand for windows of stained glass is largely on the increase since first-class work has been made in this country, as the above partial list will show.

Some little idea of the cost can be gained from the knowledge that the glasswork for the Colt Memorial Church will cost $7,000, the chancel window alone calling for $2,000—the great chancel window of Trinity Chapel, corner of Twenty-fifth street and Fifth avenue, New York, costing $5,000, etc., etc. In fact, so excellent is the New York city glass work reckoned, and so great is the demand for it, that the facilities for its manufacture have been more than doubled in the last two years.—*N. Y. Times.*

The British Association.—The accounts of the local committee ror conducting the Norwich meeting of the British Association for the Advancement of Science have just been made up, and show a balance of £332, to be applied as follows: £50 for the purchase of elementary scientific books for the Norwich Free Public Library, the selection to be left to the Rev. Hinds Howell; £100 to be granted to three trustees for the purchase of meteorological instruments for Norwich; and the balance to be granted to the Norfolk and Norwich Museum unconditionally. The next meeting of the Association will be held at Exeter.

Influences of the Different Trades and Professions as Causes of Consumption.

(From the Atlantic Monthly.)

This question is of *vital* importance to every young person about to choose a profession or trade as the business of life. It is worthy of the maturest thought of every parent and every philanthropic employer; for upon the proper choice of a trade or profession will depend much of the future weal or woe of the youth just commencing life. At present there seems often to be, while making the choice, a woeful amount of ignorance of the common rules of health.

We may consider the question in two lights; namely, first, as it regards perfectly healthy youth; and, second, as it has reference to one that is either in ill health or who from physical organization or hereditary tendencies is liable to suffer from consumption.

And, *first*, it is undoubtedly true that a man may take any of the various trades or professions, and if he only do not neglect the rules of health, he may practice without injury any of these arts even to advanced life. Nevertheless, there are some which, from their very nature, or their necessarily accompanying circumstancs, are less healthful than others. Among these may be named all those practiced in places in which fine dust is floating in the air, whatever that dust may be Especially deleterious is the trade of machinist, in working at which quantities of fine steel dust are set flying; or the knife and scissors grinder's trade, in which, in addition to the steel, a cloud of emery dust is drawn in with almost every breath. It is true that some of these various dusts do not produce real tuberculous disease, but they all tend to clog up the finer air-cells of the lungs, and are liable to cause cough, emaciation, and death, at times with tubercular complications.

Next, perhaps, in order come all those trades that cramp the chest, and prevent free expansion of the lungs, and incline the patient to bend forward, thus permanently diminishing the caliber of the chest, compressing the delicate structure of the lungs, causing obstruction therein, with subsequent disease and death. Prominent among these trades stand such as that of shoemaker for men and that of seamstress for women. These are essentially sedentary in their nature, and have most strongly marked tendencies of the nature alluded to. But they likewise lead to the various forms of dyspepsia, to irregularities of the digestive and of other of the more delicate functions of the body. These latter complaints are too often found, when we unravel the history of cases of consumption, to be the precursors for months previously of the dreaded affection of the lungs. The whole internal arrangements of many large establishments for "slop" work, where perhaps from fifty to a hundred young women or men are collected in large unventilated rooms, are simply an outrage upon common decency, and infamous with regard to arrangement for the health of the employés. How general it is we know not, but not infrequently we have been informed by patients that at times, for example, no water closets can be found on the premises, or, if found, they are in a deplorable state. Hence constipation and indigestion come to add their weight to the deleterious influences of the trade itself

Less constantly confining to the chest, but as employments analogous to the last mentioned trades in effect, we may name those of clerk and student. Both tend to induce inaction of the entire body and a curving forward of the chest; and although neither of these professions *necessarily* produces disease, and although it is possible for the student and clerk to avoid the evils that are impending, they very frequently do not avoid them, either from their own gross ignorance of hygienic laws, or from the cupidity of the employer, which prevents them from properly attending to the same. Those employed are at times compelled to work in houses totally unfit for human beings to inhabit, while at other times love of gain deprives them of the requsite time for the taking of food.

Such cruelty on the part of employers, we admit, is rare. Moreover, we are inclined to think that there are but few who willfully sin in this manner. They have ample means, and money with them is resolvable into human labor. In modern scientific language, of "the correlation of forces," they virtually say, "With the force of so much money we ought to get a corresponding degree of human force applied to the purposes required." Under this idea, the health of those employed is considered of but secondary importance. We confess that we think there are few even of our worthiest employers who have the perfect health of those employed seriously at heart: and this is not derogatory to them; for it is simply human nature, and will continue as long as our present mode of conducting business is continued. When a true Christian co-operation is introduced into all the channels of business, then, and not till then, will those employés see to it that everything is done to prevent detriment to their lives during their hours of toil.

Another evil tendency of certain trades is to require sudden transitions from heat to cold and wet to dry, the long continuance in cold, damp cellars or warerooms half underground, which, even in the heat of midsummer, though deliciously cool to the transient customer, are most deadly in their influences upon those permanently employed therein. Of such employments is that of the molder, with his constant wet about him, and the beer bottler's, who lives most of the time in damp, dark cellars; and analogous to these cellars in their influence on human health are the cool, damp underground rooms of dry goods dealers, in all our streets of business. These each and all tend to produce consumption, and are therefore nuisances as at present managed; for anything is a nuisance that tends to destroy human life. We have had to warn not a few clerks of the risk they were running in staying in such places. If they fly from them early, they may be saved. If they continue after health is once seriously impaired, they are doomed. Such places ought to be forbidden by law, and, when a proper public sentiment arises, this will be done.

We have thus far considered the influence of these various kinds of business upon persons in perfect health; and we may merely add, that, if there be danger to those in health, it will be madness on the part of those having hereditary tendencies to tubercular disease, or who are actually diseased, to enter them, or into any of an analogous kind. Strange as it may seem, we find often an utter neglect of these rules, and pursuits in life are commenced without a thought of the effect on future health.

History of Hats and Hatting.

One of the most practical and readable technical works we have seen is "A Treatise on Hat-making and Felting," by John Thompson, a practical hatter, published by Henry Carey Baird, Industrial Publisher, 406 Walnut street, Philadelphia. It contains in a condensed form all the information requisite to a full knowledge of materials and the manipulations necessary to manufacture them into hats; also the application of machinery to hat-making. The following sketch of the history of hats and hat-making extracted from its pages, will be found of general interest:

The word hat is of Saxon derivation, being the name of a well-known piece of dress worn upon the head by both sexes, but principally by the men, as a covering from the hot sun of summer, the cold of winter, a defence from the blows of battle, or for fashion. Being the most conspicuous article of dress, and surmounting all the rest, it has often been ornamented with showy plumes and jewels, and with bands of gold, silver, etc. It is generally distinguished from a cap by its having a brim, which a cap has not, although there are exceptions even to this rule of distinction, for there are hats that have no brims, and there are also caps that are provided with a margin. Those hats that are made of fur or wool have all been felted, and felt, strictly speaking, is a fabric manufactured by matting the fibers together, without the preliminary operation of either spinning or of weaving.

We find but little of hat-making recorded in history, and anything relating to hats is extremely meager, although their partial use may be traced back to the time of ancient Greece amongst the Dorian tribes, probably as early as the age of Homer, when they were worn, although only by the better class of citizens when on a distant journey. The same custom prevailed among the Athenians, as is evident from some of the equestrian figures in the Elgin marbles.

The Romans used a bonnet or cap at their sacrifices and festivals, but on a journey the hat with a brim was adopted. In the middle ages the bonnet or cap with a front was in use among the laity, while the ecclesiastics wore hoods, or cowls.

Pope Innocent, in the thirteenth century, allowed the cardinals the use of scarlet hats, and about the year 1440, the use of hats by persons on a journey appears to have been introduced into France, and soon after became common in that country, whence probably it spread to the other European States.

When Charles VII. of France made his triumphant entry into Rouen in 1440, he wore a felted hat.

Hatters of the present day most generously ascribe the honor of the invention of felting, and of its prospective introduction to that of hat-making, to the old renowned Monk St. Clement, who when marching at the head of his pilgrim army, obtained some sheep's wool to put between the soles of his feet and the sandals that he wore, which of course became matted into a solid piece. The old gentleman, philosophizing upon this circumstance, promulgated the idea of its future usefulness, and thus it is said arose the systematic art of felting and of hat-making.

However all this may be, still the invention of felted fabrics for the use of man may have been, as some assert, very ancient and of quite uncertain origin. The simplicity of its make, as compared with that of woven cloth, shows all speculative assertions to be rather uncertain.

However obscure the origin may be, we learn that the first authentic account of hatters appeared in the middle ages, in Nuremburg in 1360, in France in 1380, in Bavaria in 1401, and in London in 1510.

The hatting trade of the United States of America is noticed first in the representations made by the London Board of Trade to the House of Commons, in the year 1732, in which they refer to the complaints of the London hatters, regarding the extent to which their particular manufacture was being carried at that time in New York and in the New England States.

A look at the fashions and mode of dressing in ancient times causes amusement. So capricious is the fancy of man that nothing is immutable, all is change, and hats have been of all conceivable shapes and colors, and dressed with the most fanciful decorations, plumes, jewels, silk-loops, rosettes, badges, gold and silver bands and loops, etc., etc.

The crowns and brims having been in all possible styles from the earliest period, it would appear that nothing is left for the present and all coming time, but the revival of what has already been, even to the fantastical peaked crown that rose half a yard above the wearer's head

In the fifteenth century, hats in Great Britain were called vanities, and were all imported, costing twenty, thirty, and forty English shillings apiece, which were large sums of money at that early period.

The most extreme broad brims were worn about the year 1700, shortly after which the three-cornered cocked hat came in, and about this time feathers ceased to be worn, the lingering remains being left for the badge of servitude to the gentleman's attendant. Metal bands and loops were only regarded as proper for naval and military men of honor.

It is a singular historical fact that the elegant soft hat of the Spaniard has remained the same from the earliest period to the present day, while among all other civilized nation a transformation in the style of that article has taken place. Comfort in the wear seems to have given place at all times to fancy and the demands of fashion.

Queen Elizabeth's patent grant to the hatters of London is still recognized in England, and the 23d of November is the hatters' annual festival, that being St. Clement's day, the patron of the trade.

A Remarkable Stone—Supposed Enormous Black Diamond.

Mr S. L. Young, of New Boston, Ill., writes us a description of a remarkable stone found by a soldier during the late war, back of Atlanta, Ga., during the siege of that city, and now in the possession of a gentleman residing in New Boston. He says:

It is a stone of most curious formation, being seven eighths of an inch long, two and a half in circumference, weighs two ounces, and has evidently been broken at one end. The other end has eight facets; the sides are prismoid or dodecahedra. It is shining black, partly covered with a crust of a brownish color. There are places on it that have a very brilliant natural polish; it resists the action of the hardest file, reducing it to smoothness in a very short time, and burnishing the file as completely as the finest emery stone would, and in much shorter space of time. Nitro-muriatic acid (aqua regia) has no action upon it. It has been immersed in the acid for ten days without producing the least effect. It will cut glass with the facility of the glazier's diamond. The end, where broken, presents a laminated appearance; not flakey, but as though it had split.

A number of lapidaries have examined it and pronounce it of value, some of great value; a Jew sutler, who examined it, offered at once over one thousand dollars for it; but the gentleman who owns it, thinking from his eagerness that it might be worth very much more, refused his offer, and still retains possession of it; though I understand he has had a number of better offers since, which he also refused.

After a careful examination of it I have very little hesitation in pronouncing it a black diamond worth many thousands of dollars. I am a practical jeweler, and have had considerable experience with valuable stones; and have given this one a critical examination, and subjected it to all the tests at hand. Believing it to be worthy the consideration of more scientific men, I have concluded to furnish a description of the stone for the perusal of the many readers of your excellent journal, and will take pleasure in giving any further information in my power to any one who may choose to address me on the subject.

Should our correspondent's views in regard to this stone prove correct, and it certainly seems as though they may, this will be a lucky "find" for the possessor of the stone in question, should it be without defects.

Practical Utility of Mathematical Science.

The following extract from *Mc Hugh's Philosophy of Teaching*, may serve to set right those who have been led to believe that the utility of mathematics beyond the knowledge of arithmetic is questionable:

The use of the mathematical science is as little understood by many as the sciences themselves. This is quite natural, for according to the current belief, arithmetic is the science of numbers; what, then, is the use of any other? Schoolboys think that when they thumb over their arithmetic they are fit for any business. All our writers on arithmetic define it "the scicnce of numbers;" we do not blame boys for believing what they have been taught by their highest authority. Arithmetic is not the science of numbers. This is a bold utterance; let us see if it be true: A merchant performs all his calculations by arithmetic; a banker, broker, collector of taxes, etc., count by arithmetic: here we stop. Arithmetic (without giving a definition) goes not one step outside commercial life. This must be strange to Eddy and Tommy.

Look at our country, 3,000,000 square miles—how do we know? By arithmetic? Arithmetic has no more to do with this calculation than it has with shoemaking. Here is my farm from which I want thirty-seven acres cut off parallel to the State road—how is it done? Arithmetic has no more to do with it than baking. Here is a site for a public building; but ere the mason commences, he must get a plan from an architect. Arithmetic has no more to do with architecture than with churning.

Barrels are measured by conic sections; the calculations of architecture, engineering, marine investigations, the machine shop, altitude of mountains, level and curve of railroads, etc., are each and all wrought out by abstruse mathematical investigations, of which arithmetic forms the A B C, or introduction. How difficult for Eddy to understand what science is!

Any young man, having ambition to excel, possessing energy, industry, tact, and talent, can learn the essential parts of these in a few years with the aid of a good teacher; then he is a theorist. He must go to the machinist, engineer, or architect—to the workshop, office, or the sea: after years of practice, he is a master. How difficult for some parents to understand the necessity of these sciences for their children—anything beyond the rudiments; how difficult to introduce any system in many of our schools, particularly in rural districts, where it is most needed; how difficult for teachers who have capacity to introduce any thing beyond the ordinary course—that of forty years ago—those stern and abstruse sciences, by which the Egyptian discovered the boundaries of his farm when old Nile's flood had passed from its cloudless valley; by which Archimedes saved Syracuse, and rendered it famous as his neglected tomb. It is difficult to understand how an engineer will open a tunnel on each side of a hill, set laborers to work, and meet without any guess in the right line within.

If Ann Jones makes an experiment in baking, and fail, it is a small matter; but if an engineer make an experiment at a tunnel or suspension bridge, and fail, it would be a serious and expensive affair. Hence we see the use of mathematical science, and the necessity of our high-minded youth bracing themselves for the noble and glorious world of beauty before them—the field of mathematical investigation. For independent minds who can bridle self—a thing very desirable and sometimes difficult—it is the only stepping stone to greatness.

Here is a machine shop; look at all the wheels, belts, pulleys, lathes, etc.; how were they placed? Arithmetic has no more to do with the calculations of this shop than with sawing wood! The ship *Atlantic* is in port bound for Liverpool—how will the captain steer her thither? Arithmetic has no more to do with marine calculations than with fishing. Our year contains 365 days and over—how was this discovered? See the curve on the railroad—outer curve elevated; see that suspension bridge, tunnel, steeple, hight of the Andes—how were these things built or found out? See these barrels filled with liquid for market, how are they measured, for measured they must be? Eddy says by arithmetic. He is mistaken.

We see a man in any business outside of commerce, he follows mathematical laws, seldom of his own study. Such men generally have books containing a well-digested code of laws, in the shape of rules, drawn up by some eminent mathematical scholar, of whom, or of whose study, the workman takes no account.

Hence the difficulty of finding a man successful in anything to which he has not been bred—the impossibility of finding that Yankee who does everything. Had Archimedes left his geometrical diagrams in his study, the Romans would have been masters of Syracuse sooner. Geometry, not arithmetic, saved the city. Had Newton and his peers left their mathematical investigations and turned the energies of their mighty minds to parrots and lapdogs, parks and castles, our mechanical works would be few, clumsy, and defective. We, swains, see one of these men sauntering by the roadside, incapable of enjoying the comforts of life from the abstruse nature of their studies, and we look on them as fools; yet their works may overturn some of the existing modes of life, and give a new direction to the energies of mankind. Archimedes drew mathematical figures on his body, which had been anointed with oil, when forced by his friends to go to the theater—so says Plutarch; he could not find enjoyment there. Our books of arithmetic contain very crude rules, requiring the sciences of geometry and algebra combined to teach them successfully.

Thirty-five Years of Progress in Art and Science.

We have before us the address delivered by Hon. J. D. Caton, late Chief Justice of Illinois, on the occasion of the laying of the corner stone of the new State House at Springfield, Ill. The orator, in speaking of the early judges of that State, says:

As these men traversed the great prairies on horseback, going the circuit rounds, probably not one of them foresaw how soon railroads would change the mode of travel, and that soon their successors would accomplish in an hour the distance which occupied them a day. Could they have anticipated all that has come to pass, we may well doubt whether they would willingly have changed the close companionship, the genial feeling, and I may add, the jolly times which they enjoyed, for the colder atmosphere and more selfish habits which seem to have grown up under the influence of modern improvements. Who now seeks to pay another's bill, or offers his friend a passage ticket? If the promotion of human happiness be the greatest attainable good, and worthy of our most anxious care, we may pause a moment in our admiration of the great things lately done among us. Who shall say that there is more genuine happiness, more cordial good feeling more brotherly love, now than then? But if the sigh of regret is forced from us, that many bright and pleasant scenes of the past can never be repeated, we may not disparage that which has added so much to the greatness and the wealth of the present of our State and Nation, and promises so much more for the future. We who have witnessed all, can hardly appreciate the wonderful truths. If it seems extravagant to assert it, a moment's reflection will convince us that the world has made more actual progress within the last fifty years, during our existence as a State; yes, I will say within the last thirty-five years, since first I became one of her citizens, than in all previous time since Adam was driven from the garden of Eden.

First, I will refer to the means of locomotion and transportation. Until the introduction of railroads, what improvement had been made in these since the earliest dawn of civilization—at least since the horse was domesticated and the wheel had been invented? The Queen of Sheba could visit Solomon in as great state, and with as much ease, comfort, and expedition, as Elizabeth could visit Kenilworth, or even Victoria could visit Balmoral; Jackson had no better means for going from the Hermitage to the capital than had Cæsar for visiting the provinces; Napoleon transported his great armies in the same way that Alexander moved his into Asia. Only in our day has it become possible, as has been often demonstrated, to move a great army, with all its *impedimenta*, a thousand miles in two days, which would have required, only the preceding generation, as those of three thousand years ago, many months to accomplish, at a great expense of treasure and human suffering. Thirty years ago the same means were used to cross the ocean which Columbus used to reach America; then our national representative went to St. James by the same agency which Paul used to reach Ephesus and Athens; now every sea and ocean is traversed by steamers which court the contrary winds, and lay their course from continent to continent with scarcely the variation of a single point.

Within the same period gas has been adopted for the production of artificial light. Since the time when lamps were first lighted, till the time when I sat upon the bench in yonder state house, by the dim glimmer of a few tapers, but the least imaginable improvement had been made in artificial illumination. How great the contrast since the introduction of gas; one burner of which gives twenty times the light of our best candles, and if a brighter—a more conquering light is still desired, we have but to apply to Drummond, when the darkness is dispelled almost as by a mid-day sun.

I might allude to many other great inventions and discoveries of the present age, for the advancement of human thought and enterprise, but time permits a reference to but one, the most wonderful and mysterious of all. The magnetic telegraph presents the means for transmitting information at great distances, with a celerity which, before our day, was only practicable within the compass of the human voice. Till within the last twenty years we were provided with no more speedy means to send information, to a distance of one mile or a thousand miles, than were the Pharaohs or the Kings of Israel, the Incas of Peru, or the Montezumas of Mexico. Now the time is quite inappreciable which is required to send information the greatest distances, and even beyond the broad Atlantic. Had it been proposed to Jackson to send a message from the Hermitage to the capital with the speed of the wind, he would have listened to it with incredulity: then what would he have said to the proposition of Morse, to outstrip the velocity of the meteor with his message to Washington.

I cannot resist the temptation to barely mention one other great invention, which, if of less value as mere business matter, is scarcely less wonderful, and surely gives as much joy to the human heart; I allude to the sunlight pictures, which now fill every palace and every cabin with the faithful portrait of loved ones absent and present, who shall thus be handed down from generation to generation. I am sure I do not stand here alone to regret that this sublime art was not invented in time to perpetuate the lineaments of faces much loved, but gone, alas, too soon.

Am I not right, then, in saying that the world has made more progress in the last thirty-five years than in all the ages that have gone before? Surely we are now in the La Chine Rapids of time, which hurry us along with a giddy velocity, amid scenes so changing that we can only glance at their most prominent features. It is folly to say that we should have a care lest we strike some hidden rocks by which the channel may be beset, lying not far beneath the surging surface.

Supposed Traces of Man in the Paleozoic Age.

The Buffalo *Courier* has the following:

"There are now on exhibition at the rooms of the Society of Natural Sciences, in this city, two of the most remarkable discoveries recorded in the annals of science. One is the fossil imprint of the foot of a man, or rather the cast of such an imprint. It was discovered by a workman, in a colliery in western Pennsylvania, in the shale overlying a run of coal and underlying two other veins which were being worked by the company. The spot where it was found was nearly a mile from the pit's mouth, and some three hundred feet from the surface. The rock in which it was imbedded belongs to the paleozoic age, and the imprint, if such it be, was made millions of years before the present geological era commenced. It is the cast of the left foot of a man of ordinary size, and is perfectly defined. The foot was evidently protected by a sandal or mocassin; the heel, the arch, and the ball of the foot, and the slight depression made by the toes are perfect, and whether produced by the foot of a man or a freak of Dame Nature, the cast is as perfectly defined as if it were the work of a sculptor.

"By a curious coincidence, the society, a few days before this donation, received the second specimen from the Rev. Samuel Cowles, of Gowanda. It is a large slab of sandstone, on which, stamped in the solid rock, can be seen the imprint of horses' hoofs, as perfectly preserved as though they were formed but yesterday upon the muddy bank of a sluggish stream. There are at least a dozen of these impressions, varying in size from the track of the full-grown horse to that of a young colt. They point in different directions, as though the animals were leisurely walking about and cropping the luxuriant grasses of that tropical period, some of them being partially obliterated by the more perfect form of a fresher imprint.

"Mr. Cowles has sent a similar specimen to the professors of Yale and other colleges, and we look with interest for the theories of these high authorities respecting the nature and character of the tracks, by what formed, and the condition of the earth at the date of their formation. If the theories of the discoveries be correct, the result will be to entirely overthrow the present received geological system, and to further complicate that terrible question, the effort to solve which has caused learned men so many soul-disturbing doubts and fears, and which brought Hugh Miller to so tragical an end, that is, whether the geological and scriptural records of the world's creation are reconcilable?

"The fossil foot-print was presented to the society by John Magee, now in Europe. We advise all who take an interest in geology to inspect for themselves these curious specimens, which affects that science so momentously."

The Mines of Nevada.

From Browne's United States Government Report of the mineral resources of the West, recently issued, we glean the following facts. The official statements of ten companies working mines in Nevada give the amount of bullion produced by each during 1867, viz.—

Hale and Norcross....	$1,097,297·45....	owns	400 feet of mine
Savage..............	3,737,100·12....	owns	800 feet of mine
Crown Point..........	920,717·96....	owns	600 feet of mine
Yellow Jacket........	1,729,276·91....	owns	1200 feet of mine
Gould & Curry......	614,620·51....	owns	1200 feet of mine
Chollar Potosi........	2,668,885·36....	owns	2800 feet of mine
Empire M. & M......	278,607·17....	owns	75 feet of mine
Imperial.............	1,106,465·50....	owns	184 feet of mine
Kentuck.............	1,140,741·94....	owns	feet of mine
Overman............	192,318·17....	owns	1200 feet of mine
Total............	$13,486,061·00		

The average cost of mining the ores, including "dead work," was about $9 per tun, and the average cost of their reduction was $16 per tun, from the pulp assays it was shown that only about 64 per cent of the gold and silver which the ores contained was saved, proving a loss of near $5,000,000 from the workings of the ten companies above named. The average yield of the ores from the mines of these companies did not exceed $50 per tun, and as the cost of mining and milling the ores was $25 per tun, only about one-half the yield was profit, This can be taken as an average result, except richer ores cost no more to mine reduce and mill, therefore pay a larger per cent of profit.

The completion of the overland railroads, the discovery of coal at several accessible points, and the improved modes of working the ores, with the great reduction in cost and general expenses of carrying on mining enterprises must secure such results in the future as have only been anticipated in the past.

Most of the ores will be reduced by the smelting process, and all metals run into bars, at or near the mine, and these bars containing gold, silver, copper, lead, antimony, etc., must be taken to assay establishments for separation; and in many cases the precious metals will be all profit, the other metals being of sufficient value to pay all expenses.

Capitalists are now turning their attention to mining enterprises and single investments of $10,000 to $25,000 show thd confidence they have in this line of business. With good mines, good management, and ample capital no one need fear the result. This branch of American industry should be encouraged in a substantial way, and it cannot fail to be remunerative.

The Bulk of the World's Gold.

The New York *Mercantile Journal* in discussing the folly of attempting to conduct the future business of the world upon a gold basis makes the following statements:

All gold that exists in the United States to-day, could be placed in a square box of less than fifteen feet in length, width and depth.

A room one hundred feet long, one hundred feet wide, and ten feet high, would hold eight times the total amount of gold in the known world.

The "Golden Calf," worshiped by the would-be statesmen of our day, who desire an accumulation of coin to the extent of $250,000,000 in our National Treasury, as a basis upon which to resume specie payments, if melted down would not fill a square box measuring nine feet each way.

How puerile then, to clog the wheels of finance and commerce by a blind subserviency to the ridiculous tenets of the dark ages. Coal and iron are infinitely more valuable to commerce than this boasted metal.

Plugging Screw and Brad Holes on Finished Work.

A correspondent of the *Coachmakers' Journal* says:

In plugging screw holes we glue the edge of the plug; put no glue in the hole. By this means, the surplus glue is left on the surface, and if the plug does not hit the screw it will seldom show. We set the heads of brads well in, then pass a sponge of hot water over them, filling the holes with hot water. This brings the wood more to its natural position, and closes, by degrees, over the head of the brad. When dry, sandpaper off and paint, and the putty will not hit the head of the brad; if it does, it will surely show bad. The brad must have a chance to expand when exposed to the heat of the sun, and not hit the putty; if it does it will force the putty out. We have had no trouble with brad heads or plugs since we adopted this practice.

Improved Two-Wheeled Velocipede.

The *furore* created by the introduction of the velocipede in Paris has extended to this country, and in our principal cities the demand for this elegant and graceful vehicle is so great that quite a number of extensive establishments are being devoted to its production, yet the demand cannot be supplied. For ease of motion and grace of action the velocipede ranks with the skate, with this advantage, however, that the former may be used at all seasons, instead of being restricted to periods of freezing temperature.

Like every other machine which we have copied from other peoples, this has been materially improved by American mechanics. One of the most perfect of these machines we have seen is that represented in the engraving. It is very strong, light, easily operated, and under the most perfect control. The foot-rests, or stirrups, are so weighted and hung to the cranks that they always present the surface to the foot, so that in mounting, or after removing the foot temporarily, no time is lost in adjusting the foot. The brake is always ready for action when descending grades or reducing speed, it being operated by the hands through the medium of the steering bar. To effect this the bar rotates in sockets, and has connected with it a strong line or gut, secured at the other end to the brake lever. By simply turning or rolling the steering bar the line is wound around it just as is the chain of a rail-car brake. The steering post of this improved machine rakes well aft, so that the bar is within easy reach of the hands, enabling the rider to keep his arms in a natural and easy position and his body erect. In addition, the saddle, or seat of this machine is movable from front to rear or *vice versa*, so that one velocipede may be adapted to the size of the rider without shifting the crank pins, the saddle being held in place by a simple thumb screw.

With those who live in the cities and require a daily exercise, exhilarating, pleasant, healthful, and free from expense; with those who reside in the country and have long distances to traverse daily in reaching the scene of their labors, or with those who have leisure and wealth at their command, but love such exercises as afford an opportunity for the display of grace, agility, and skill, the velocipede will soon become as great a favorite in this country as it is already in France and England.

To learn how to manage the velocipede requires no more skill, courage, or patience than to acquire the art of skating, perhaps even less, and when the art is once learned, as it may easily be in a few days, it provides a means of locomotion and a source of enjoyment as much more available and delightful than the art of skating as the number of the days in the year is greater than the few bright mornings when only you can find a smooth, glassy, and well-frozen skating ground.

A school for beginners has been established at No. 3 William street, New York. All orders for machines or requests for further information should be addressed to G. H. Mercer & Monod as above.

THE MONOD IMPROVED VELOCIPEDE.

Remarkable Transformation in Reptiles.

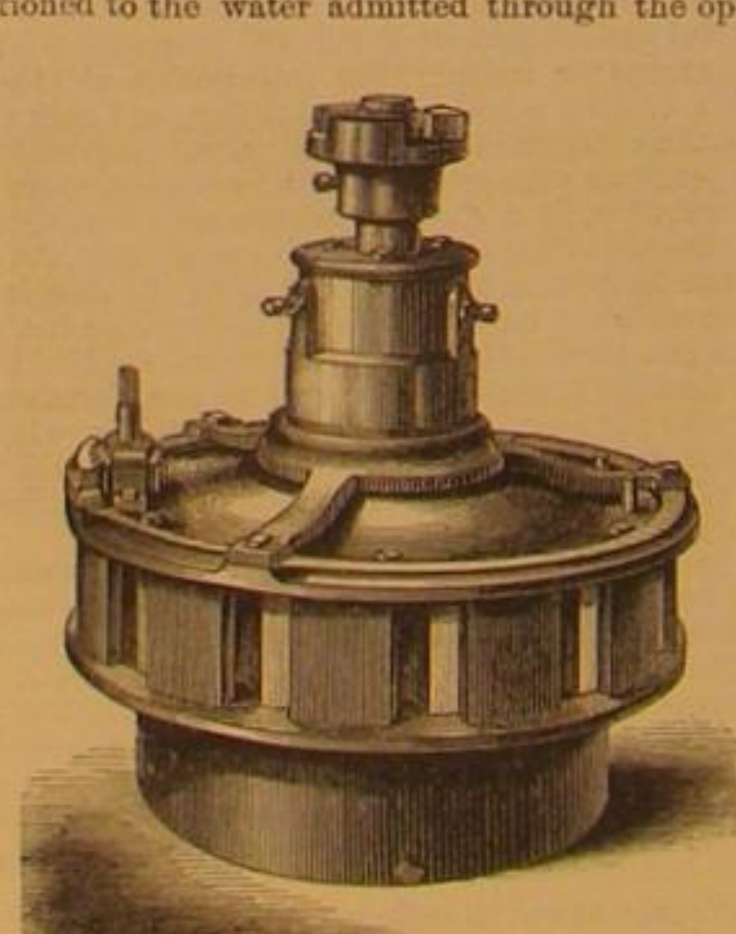
In the November number of the American Journal of Science, Professor O. C. Marsh of Yale College, has given an interesting account of the metamorphosis of some peculiar reptiles which he obtained in the Rocky Mountains during the past summer. The animals were caught in Lake Como, a small brackish sheet of water near the Pacific railroad, and about seven thousand feet above the sea. They are known in that region as the "fish with legs," and by naturalists have hitherto been placed in the genus siredon, and considered closely related to the axolotl from the table-lands of Mexico.

On bringing the specimens to the warmer climate of New Haven, one of them began to undergo a remarkable change. Dark spots appeared on the sides and finally extended over the rest of the body. The fins on the back and tail and the external gills gradually disappeared, and the animal came frequently to the surface of the water for air. The body also diminished in size; the head changed in form; and the eyes became more prominent. The mouth and tongue became much larger, and the teeth changed in position. During these alterations the animal made frequent efforts to leave the water and at last escaped as a true salamander, representing a different genus and even family of reptiles from that of its original condition. Subsequently several other specimens underwent the same metamorphosis, during which various experiments showed that the rapidity of the change was greatly affected by variations in light and temperature, the individuals most favored in these respects having passed through the entire transformation in about three weeks.

Whether this species ever changed in Lake Como and in other similar elevated regions is uncertain; but that it breeds in the siredon state, like the Mexican axolotl, there can be little doubt. This unexpected metamorphosis renders it extremely probable that all siredons are merely young salamanders which have been prevented by peculiar physical condition from attaining their full development—a new and interesting point for the supporters of Darwin.

BURNHAM'S IMPROVED TURBINE WATER WHEEL.

The turbine wheel is worthily and rapidly replacing the old fashioned breast, overshot, and undershot wheels, both for its economy of space and cost and its utilization of power. It is but little affected by "back water," and runs under circumstances very adverse to the economical and profitable employment of wheels of other descriptions. But, as generally constructed, the turbine lacks in the quality of delivering the same proportional amount of power under relative circumstances, as, while it may develop its full power with a full head and free gate, it does not give a proportionate amount when the quantity of water is reduced by a partial closing of the gate. In some wheels this is occasioned by a diversion of the direction of the current or a change in the relative angle of the stream and the face of the bucket, and in others by a check in the velocity of the water admitted to the wheel; in either case destroying the proportions between the position of the gate, and consequent admission of the water, and the amount of power developed by the wheel. The one represented in the engraving, however, delivers a power exactly proportioned to the water admitted through the openings in the register gate. If the latter be one-fourth open the wheel delivers one-fourth of its whole power; if, with one half, it moves with one-half its power.



The case is one casting, with the waterways and chutes formed by cores. Outside of this is the register gate, entirely surrounding the case, and having apertures corresponding to those in the case, for admitting water to the wheel. This gate can be moved by means of a hand wheel, pinion, and segment, sufficiently to cover the inlets or ports in the case, when the water will be entirely shut off. The bottom of the case contains a spider or bridge, that holds the box or step for the wheel shaft, and the top is covered with a cap, the top of which holds the box, that steadies the shaft. A concave hub, its largest diameter uppermost, is keyed to the shaft, and to its outside the buckets that form the wheel are bolted. The buckets are straight or vertical, for about half their length, or as far as the hub is concave, then curved to suit the velocity of the water. The water, whether the gate is entirely open or partially closed, strikes the buckets at right angles, acting first by concussion; it is then forced downward by the concavity of the hub, and acts by its weight on the lower or curved parts of the buckets, escaping, when it leaves the wheel, with a velocity corresponding to that of the wheel.

The patentee says this wheel, costing from thirty to fifty per cent less than any other wheel of the same finish, will yield an equal power; it is simply constructed and durable; has less leakage and friction, and occupies less space than any other wheel of the same power; will give a greater per centage of the power from the same quantity of water, and works well in back water, beside other advantages obvious to millwrights.

Patented February 22, 1859, and March 3, 1868, by N. F. Burnham, who may be addressed at York, Penn., for further information.

The Mastodon and Mammoth Period.

Dr. J. F. Boynton delivered a lecture upon the above subject at Cooper Institute on the evening of 21st Dec. in which, referring briefly to the subject matter of his preceeding lecture, he said that when we arrive at the tertiary formation we come to the period of warm-blooded animals. Among those have been found animals of the marsupial department of animated nature, like to the kangaroo. The marsupial race have a second embryous state; the young remaining in the female pouch till they are old enough to take care of themselves, like other animals, shortly after they are born. He next came to the ornithorhynchus species, with a beak like a duck. The lecturer here described the peculiarity of this bird and its connection, anatomically speaking, with birds and reptiles. The creatures first suckle like animals, then they become more bird like. They can be domesticated for a time, but if they ever get their freedom to go where they like, the animal never returns. Referring to the orders of life at the present time, he would now refer to his diagrams. There were animals which walked upright and others that walked horizontally. On the diagram he pointed out the tertiary period of animals in which the orders of life were not nearly so numerous as in the preceding ages—the Devonian and others. The first figure presented on the chart was the turtle. These animals when they are hatched from the eggs are a perfect type of the older animals. Remains of turtles have been found of such size, that when they were in this life they must have weighed a tun. The next presented was an animal that can be tamed and made familiar in the houses of the people. This was the horned lizard, a hideous, but a very harmless animal. The animal, not more than three or four inches in length, sits like a squirrel cracking nuts. The next animal presented was the parasite of the tertiary formation, a very small animal, known as the louse, found on mice. The next was the "wicked flea, that no man pursues, but is always pursued by the ladies." This animal lives on the surface of animals and is generably very troub lesome. There is another animal that infests the brain, liver, lungs and flesh. This is the internal worm. Speaking of the hog disease, these are the animals that attack and disease the hogs—a disease of which we have heard a good deal, but which is not dangerous, should the flesh be properly roasted, fried or boiled. The germ of these animals lies in the flesh of the hog. Say in a square inch of ham there are no less than two hundred and fifty thousand of these germs, so that if a man eat four square inches of ham infested with this germ, he will have swallowed one million of this trichnea or hog worm. If the meat infected by the trichnea is saved meat, like dried ham that may be eaten raw, then the person eating of it will have swallowed the living germ, and the disease in that person may become apparent and very destructive. The next representation on the chart was a waterspout, which it was supposed had overthrown whole districts, cutting down trees and destroying animals, the remains of which are yet to be found. Having closed his history of the tertiary period, he now came to the ostrich—the largest of all the bird species—the bird, who, when "she lifteth herself on high," as Job says, "she scorneth the horse and his rider." In the island of Madagascar were known birds very much larger than the ostrich of the present day whose egg was thirteen and a half inches in length and four inches in diameter. He came next to animals that live on the surface of the sea, like whales and others. This species in the full grown state, are but embryonic of a higher state of life. The various animals, ranging from the lower order to the higher order were then described by representations on the chart and by the interesting descriptions of the lecturer, touching upon them in their order—the opossum of Virginia, the kangaroo of New Holland and others of the same species. After these came the armadillo, filling up a gap between the lower orders of animals and those of a higher state. The latter were represented in the later portion of the tertiary age. The lecturer then referred to another species of the tertiary age—animals called the tapirs, of Southern Asia and South America, though these animals, apparently alike in the two distant countries, were not altogether of a similar species. Cuvier reconstructed many of the animals that have passed away—reconstructed them by putting together the jaw bones and shoulder blades. This was all that was requisite to an anatomist in natural history. As an architect could tell by finding the capital or base of a Corinthian pillar that the ruin before him was formerly of Corinthian architecture, so could the naturalist tell from a few bones to what species defunct animals belonged.

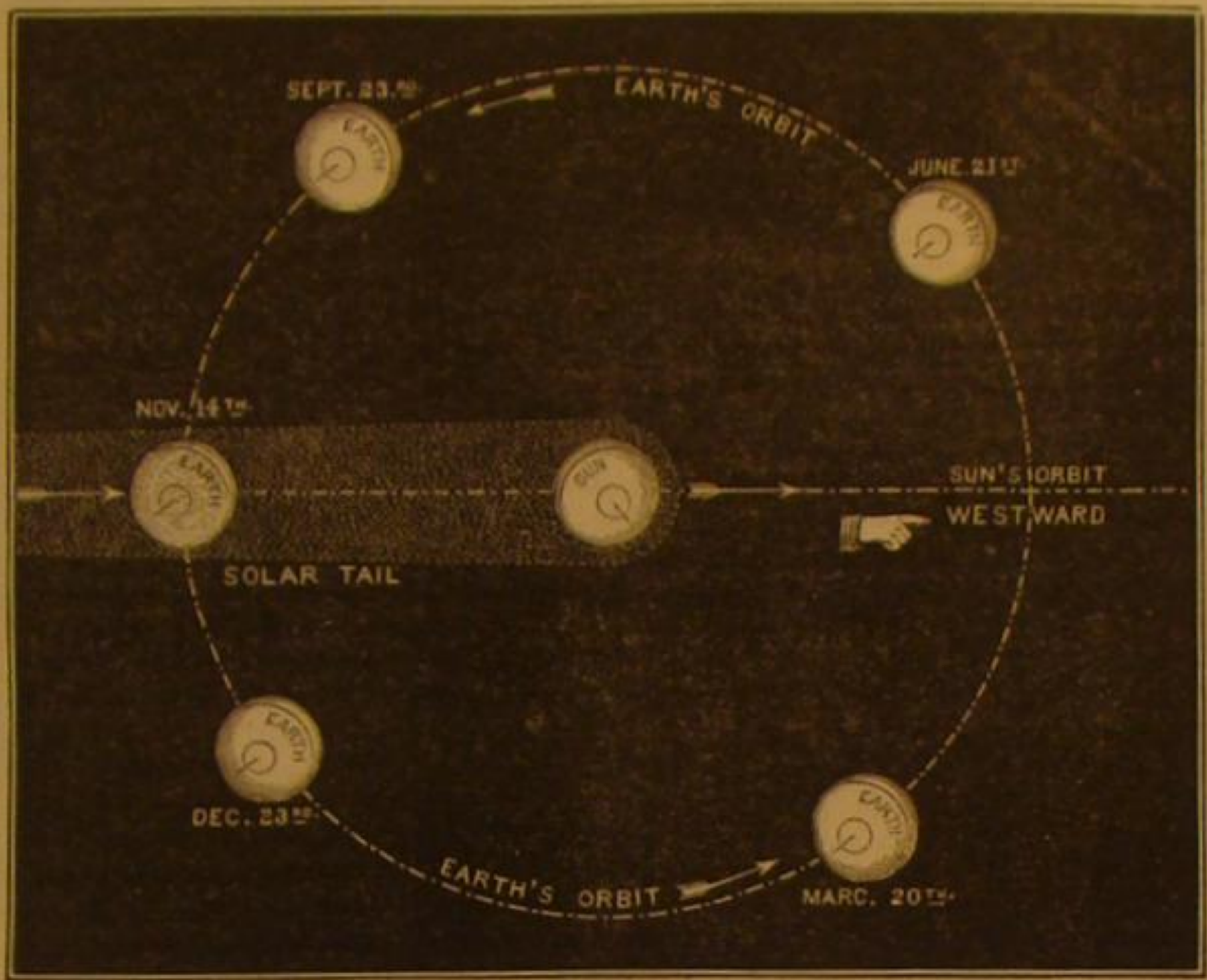
The next animal represented was the rhinoceros, which bore some resemblance to the larger reptile of another age. The reptile of which the rhinoceros was a certain type had also a horn. This was one of the larger reptiles. The lecturer then presented on his chart the cow, the lion, and finally man, the great and crowning work of the creation. On the chart were presented excellent life-like busts of the two candidates at the late election for the Presidency—Seymour and General Grant. After them came the White House, the goal to which they had, on different tracks, been aiming at, and after this came the Capitol. These representations were very fine and elicited the plaudits of the audience. The lecturer then closed and the audience then separated.

Correspondence.

The Editors are not responsible for the Opinions expressed by their Correspondents.

The Origin of the Meteors.

MESSRS. EDITORS:—With your permission I will give you the outline of a theory upon the origin of meteors. I think I can show clearly and indisputably, the three following astronomic facts, namely: That the sun's orbit is westward; that that the sun has a long meteoric tail streaming many millions of miles behind it; and that the earth actually passes through the tail of the sun on the 14th of every November. These three most important facts will be better understood and more thoroughly demonstrated by the annexed diagram, which represents that, in March, the north pole of the sun is seen inclining toward the earth. (This is known to observers, who see the spots upon the sun's disk describing a curve convex to the south.) In June, its north pole is inclined to the left, and the spots are seen moving in straight lines, and inclining upward. In September the south pole of the sun is inclined toward the earth, and his spots are again seen to curve, but now concave to the south. In December his north pole is inclined to our right, and his spots are again seen to move in straight lines, but now inclining downward.



These facts are well known to all practical astronomers; and many astronomic writers represent the same by diagrams in their text-books; they will not, therefore, be denied or disputed.

It is also well known to all astronomers that there is seen at certain seasons of the year "a faint light, hardly distinguishable from ordinary twilight." Astronomic writers tell us "that it has the form of a pyramid;" of course they mean on both sides of the sun, because they immediately represent it by diagram on two sides of the sun, and say that "its major axis is at right angles with the axis of the sun." Hence the popular astronomic opinion or belief is, that said light (that is, the "zodiacal light") is on both sides, or rather, that it surrounds the equator of the sun; and while some have supposed it to be a "solar atmosphere," and others a "nebulous vapor," I feel inclined to dispute the point, and say that is neither.

I hold that "the zodiacal light" is ever only on one side of the sun, and I feel quite prepared to prove the fact by the clearest and most incontestible evidence. Could the zodiacal light be seen evening and morning of the same day, then our astronomic friends would have somewhat to base their opinions upon; but, as the said light can only be seen after sundown at certain seasons of the year, and just before sunrise at certain other seasons, it is certain that the said light is not on two sides of, nor all around the equator of the sun.

This light, then, is, I say, a longitudinal appendage, or tail, if you will, resembling that of a comet, not nebulous or vapory, though apparently so, but purely meteoric, and similar to if not identically the same as that of the comet, which is no doubt meteoric.

If the zodiacal light surrounded the equator of the sun, it could be seen, less or more, almost every morning and evening of the year; but it is not, nor can it so be seen. It is seen only in the months of April and May after sunset, and in October and November before sunrise. Consequently it is only on one side of the sun, and that too on his hinder side, if I may be allowed the expression.

The length of the zodiacal light, as given by astronomers, is from 40 to 90 degrees, and estimating the length of this light in miles, we find by comparing it with the solar distance of Venus, that it cannot be much less than 130,000,000 miles. Its length is no doubt always about the same, but owing to the change of position of the earth, as it moves in its orbit around the sun, the zodiacal light apparently changes its position, appearing shorter or longer accordingly. Supposing 90 deg., then, to be the length of this solar tail, and about 46 deg. the astronomic distance of Venus from the sun; if 46 degress gives 68,000,000 miles (which is Venus' distance from the sun), then 95,000,000 (i. e., the distance of the earth), will represent the earth when seen from any planet at right angles with the sun and earth, at about 63 deg., leaving a balance in favor of the length of the sun's tail of no less than 27 deg., or about 37,000,000 miles, at the lowest calculation.

Supposing the above to be positively true, it seems clear that the earth in moving around the sun must some time or other either pass through or by this tail; and meteorites from it (for it is a composite of nothing else, if the furnacal cinders and cratoric vomitings constantly and continuously thrown out by the ever-flaming sun are to be recognized as such), must fall upon the earth in great abundance at that particular point of her orbit; and that the earth comes to that particular point on the 14th of November, let the reader see and satisfy himself by a reference to the diagram.

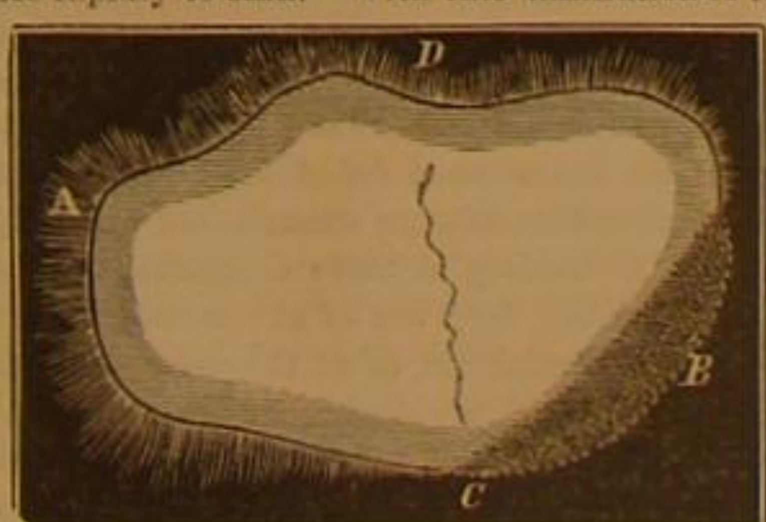
In conclusion, I believe that the sun has entered on his cometary career; that he is now positively a comet on a large scale; and that the last grand end of his illuminative existence will be spent in winding up his longitudinal orbits round some other sun or suns. (Let interested scientists speak out.)

JOHN HEPBURN.

Gloucester, N. J.

Expansion of Ice.

MESSRS. EDITORS:—In your paper of Nov. 11, (Vol. 19, No. 29) pages 313 and 314, in the article on the "Expansion of Ice," after reciting the experiments of Dr. Tyndall, and those that take a different view, you remark that you "are inclined to the opinion that ice does expand as the temperature diminishes." I think that view cannot be sustained. My opinion may not be correct, but it is based upon fifteen years of experience in this northern latitude. At the temperature of 39 deg. Fah. water is at its greatest density; diminish the temperature to 32 deg. and it becomes crystallized, during the process of crystallization it expands nearly one sixth part in volume. After it becomes solid it is governed by the same laws of expansion and contraction as other solids in all fluctuations of temperature below 32 deg. During the winter season in this region ice forms frequently to the depth of thirty-six inches on our lakes, bays, and rivers. In the fall when it has formed to the depth of a few inches and before it becomes covered with snow to protect it from sudden changes of temperature, its movements on a sheet of water from a quarter to a mile in width are very perceptible. Ice from eight to ten inches in thickness seems to be necessary to produce the results I have more particularly observed. Let the following diagram represent a lake of any size, say one mile in length, and suppose that it is covered with ice one foot thick and not covered with snow. Now we will suppose that we are having clear cold weather, as we frequently do have in December, and the thermometer indicates 25 deg. or 30 deg. at sundown, at which it commences rapidly to sink. With this diminution of temperature the ice on the lake commences to rumble like a distant train of cars, and not unfrequently like the firing of artillery. If we examine the ice an hour or two after sundown, we will find that the ice is fractured in various directions and the cracks are open showing that it is contracted. Should the temperature continue to go down until the next morning this contraction continues until the cracks will be two or three inches in width, or would have been if the exposed water had not become frozen. If the minimum temperature should remain uniform for several hours, and very cold, these cracks become filled quite solid. Next morning the sun comes out warm. The temperature comes up rapidly from ten or fifteen degrees below zero to the freezing point. The lake commences to rumble again, and now we have a demonstration of power in proportion to the size of the lake and the thickness of the ice. We will suppose the shore of the lake is bounded by perpendicular cliffs at A, and that at the opposite end, at B, there is a sand beach. Now supposing that the cracks formed by contraction have become firmly frozen, it is plain proposition, that if there is any expansion that the ice must give way in the direction of the weakest point, which would be up the inclined beach of B. This is exactly what occurs, and the movement or sliding of the ice up the beach at B will be in proportion to the size of the lake. At the northeast of Mille Lac, Minnesota, in December 1858, the movement was at the rate of eighteen to twenty inches per day for several days in succession. That lake is about fifteen miles long by seven or eight wide, and is elevated about six hundred feet above Lake Superior, and the north end being situated like the coast at B in the accompanying engraving. The expansion on the whole distance would show itself on that point. If the ice is twelve inches thick, and the sand is frozen twelve inches deep near the water, away it goes up the incline, slowly but permanently enlarging the area of the lake, or forming considerable sand hills around the borders. If the shore consists of boulders and gravel, shoreward they must go and be piled up like an inclosing wall. These walls are frequently several feet in hight and have been attributed by some to human hands.



Not unfrequently the ice gives way across the middle of a lake in the direction of C D. If the point C D should offer less resistance than the shore, B, there will be no movement at B, but the crack will open every contraction, freeze, and thus become crushed with every expansion.

It strikes me it would be no difficult matter to measure the amount of expansion and contraction for every degree of change of temperature.

G. R. S.

Superior, Wis.

A Voice from St. Louis about Watches.

MESSRS. EDITORS:—A correspondent of the SCIENTIFIC AMERICAN, writing from Michigan, says he has had fifteen years' experience as a watchmaker, and yet is puzzled about a very simple matter connected with his business. I have worked on watches and clocks a period of fifty years, and have no objection to tell a thing or two which it seems all watchmakers don't know.

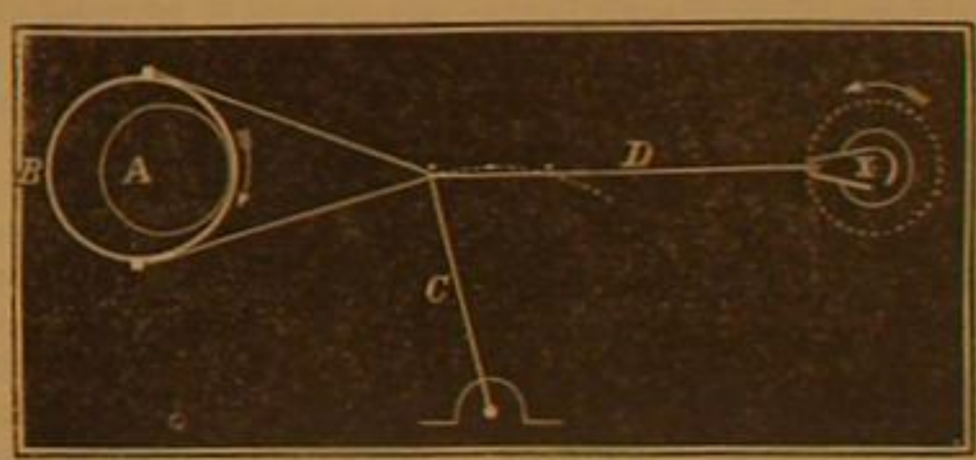
I could not help smiling when I read D. E. C.'s statement. My time has been greatly devoted to the causes of the stoppage of watches and the remedies for it. The taking to pieces and putting up again is a matter of great importance, and few who profess to be watchmakers know how to do it properly. Your Michigan correspondent says, "the lower center bearing under the canon pinion corroded or rusted" in from three to eight weeks after cleaning and oiling. Let the gentleman adopt this plan: When he cleans the watch, be particular to take the center wheel off, clean it thoroughly; if the pivot is scratched, polish it; then make a little hollow in the top hole; put good fresh oil (Ezra Kelly's) on it, and the pivot will not corrode or rust within two or three years. As to the other pivots in the watch, they should all be thoroughly cleaned, old oil cleaned out; then, if no dust gets in and no accident happens to the watch, it will run for years.

This statement may prove of interest to the "many watchmakers in the fog."

St. Louis, Mo. E. U. HUGUNIN.

Eccentric with Crank Combined.

MESSRS. EDITORS.—The enclosed diagram represents the eccentric and rods for moving the valves in a beam engine on the steamer *Keweenaw*, a moving palace on our river, and which I think is akin to John Allen's on page 20, Vol. XIX, and which Aberdeen, on page 69 same volume says won't work.



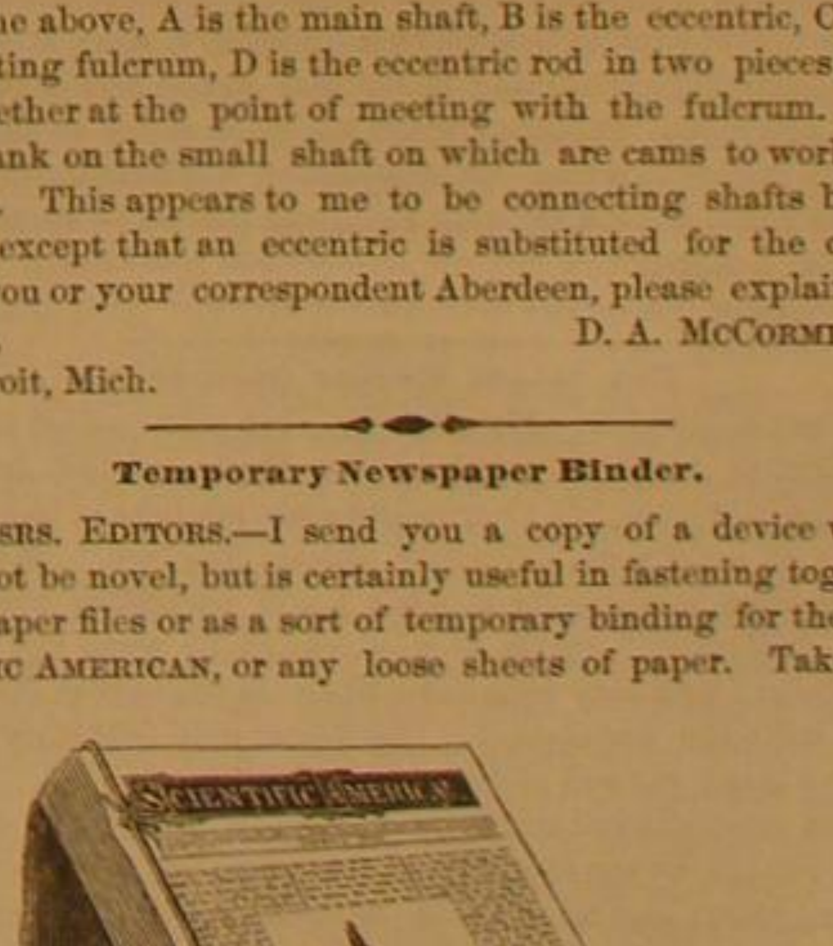
In the above, A is the main shaft, B is the eccentric, C is an oscillating fulcrum, D is the eccentric rod in two pieces jointed together at the point of meeting with the fulcrum. X is the crank on the small shaft on which are cams to work the valves. This appears to me to be connecting shafts by pitmans, except that an eccentric is substituted for the crank. Will you or your correspondent Aberdeen, please explain and oblige,

D. A. MCCORMICK.

Detroit, Mich.

Temporary Newspaper Binder.

MESSRS. EDITORS.—I send you a copy of a device which may not be novel, but is certainly useful in fastening together newspaper files or as a sort of temporary binding for the SCIENTIFIC AMERICAN, or any loose sheets of paper. Take two



pieces of light wire long enough to reach across the paper once, and three or four pieces of stout thread; place one wire under the paper as far from the edge as you choose to bind it put the threads around the lower wire up through the paper, and tie them over the other wire on top and the deed is done.

A. JOHN.

[Temporary covers of stiff pasteboard, we think, might be added, having holes for the reception of the thread or twine.

the wires being placed on the outside of the covers. Of course, it is understood that the successive papers are to be threaded (by means of a coarse needle or awl) one by one.—Eds.

Steam Boiler Explosions.

Messrs. Editors:—There have been various theories and opinions advanced in explanation of steam boiler explosions. Some of these may be sufficient to account for some explosions, but none of them account for all the explosions that have taken place. The only one that I ever read accounting for all was written by a lady (Miss Fanny Purves, of Philadelphia), and that stated that it was nothing more than over pressure; and she counseled, as a preventative, the use of pure tough iron in plates sufficiently thick to bear this over pressure. A question here arises—What causes this over pressure? Is it the indefinite expansion of steam, under a continuous increase of temperature? Such is held to be the case by some, but that is not sufficient, because there is a limit to that theory. Perkins has shown by experiment, that if you take an iron vessel and fill it with water, and heat it to a red heat, and then open a hole, no steam will escape while the vessel and water are at this high heat; but that as soon as the temperature goes down, the steam will escape with great force. We know that when water runs out of the tea-kettle on a hot stove, it will dance about in globules, generating no steam. This is termed the spheroidal state of water, but the intrinsic philosophy of this spheroidal condition is not fully understood. There appears to be a balance between expansion and contraction, or, attraction and repulsion, governed by some law not philosophically understood; and it appears to me that it is this condition of the water in the boiler that causes those terrific explosions that frequently occur. It is well known that when steam in the boiler acquires a high pressure, its augmentation of heat and pressure follows rapidly; and it will not take many minutes to put the water up to the spheroidal heat. The boiler will have to bear an undue strain before the water attains its spheroidal heat; and if it leaves it, will no doubt be impaired more or less, but will nevertheless hold in the spheroidal water; because in this condition it makes no steam, and consequently exerts no pressure. Now while in this condition, the great danger is pending, and of this the engineer is admonished by the following symptoms: The steam whistle when worked will squeak, and suck, and fret; the safety valve will chatter and work asthmatically, if you will allow me the term; and the only remedy that I can see is for all surrounding persons to flee the wrath to come. For as soon as the temperature goes down to the point at which the water gives up its spheroidal condition, and assumes that of high steam, there will be a sudden augmentation of steam and pressure greater than it was when it assumed the spheroidal form, and then follows that terrific explosion we too frequently hear of. I could cite a number of cases of boiler explosions corroborating this view of the matter. The opening of the safety valve by outside force lets in cold air by suction; for in the spheroidal condition of the water the boiler will suck, or inhale, instead of pressing outward or exhaling. And so with the steam whistle, it will wheeze, and suck, and fret, and chatter, giving warning that an unusual condition of things exists inside the boiler.

When we shall learn the electrical condition of the water in its spheroidal condition we may devise some means to avert the calamitous consequences of its changes in steam boilers; for in all the explosions that I have investigated, I found that anomalous condition of the safety valves, steam whistles, and gage cocks.

Professor Hare, of the University College at Philadelphia, made some experiments many years ago upon the quiescent condition of water in a red hot vessel; but could not arrive at any well-established conclusions. And now, since it is only a step from high steam to spheroidal water, and a back step from spheroidal water to higher steam, it seems to be a thing of too easy occurrence for destructive explosions, especially where small boilers are used for great powers—especially the tubular boilers. John Wise.

Lancaster, Pa.

The Steam Engine Indicator.

Messrs. Editors:—My attention has been called to a communication in your paper, on the above subject, from Mr. Charles T. Porter, which criticises some remarks of mine in the series of articles on, "Testing Steam Engines." Mr. Porter refers more particularly to what I said regarding the "Richards Indicator;" which is also called by some the "Porter Indicator," probably from some business connection Mr. P. has had with the instrument. His letter was evidently written after a hasty perusal of but a portion of my paper.

The experimental engineer is as much dependent upon his instruments, as the astronomer, the microscopist, or any other investigator; and no one can be more ready than myself to acknowledge the superiority of the instrument in question. Whether or not it gives more correct indications than the old style need not be discussed. At any rate the new instrument is far more convenient and largely reduces the labor in deciphering the diagrams. People will therefore give it the preference. I have shown in my paper that the indicator is the only instrument that it is practicable to use, in a majority of cases, to test the power of the steam engine, and have pointed out a defect common to both kinds of indicators; viz., that the instrument is tardy in recording the changes of pressure. The cause of this I explained, on page 308, in these words—"The moving parts must have weight and friction, and some force is necessarily required to overcome the latter and put the mass in motion," and these words are repeated, substantially, on page 322. Mr. Porter, probably through haste in reading the papers, has entirely omitted in his communication the subject of friction, and discusses only the inertia of the moving parts. Without reviewing his article critically, it is sufficient to observe that the discrepancies in the length of the ordinates show the force exerted to put the mass in motion and overcome the friction, and not the development of force into power, so the argument about the square of the velocity in no way applies to the case. But this point is of small importance, for the error due to weight of parts is in every case nearly balanced by the oscillations on both sides of the true line, and friction only prevents its being fully so. Friction, then, is the chief cause of the discrepancies. If the friction of the moving parts and pencil of the instrument be one pound per square inch, the piston will compress the spring one pound by the scale before the pencil will move at all, so that, during any change of pressure, the indicated line is separated from the true line a distance equal to the friction pressure. The friction of a good indicator is small but it is always something. If it be only one fourth of that of a good steam engine, working without a load—say one half of a pound to the square inch—this discrepancy repeated on the top and bottom of an indicator diagram would be ten per cent of a mean pressure of ten pounds or five per cent of a mean pressure of twenty pounds. However small the friction, it is absolutely impossible for the instrument to be exactly accurate, and experiment shows that the combined friction and inertia of the moving parts increase the discrepancies at high speeds. Notwithstanding this, the indicator is the best instrument we can use for the purpose, in ordinary practical trials. My only object in pointing out its faults was to show under what circumstances it can be depended upon. The particular example, illustrated on page 341, was selected because the difference is so extreme that it can be seen by the eye without measurement. Ordinarily the difference would be much less, as is there explained. [The last word of the explanatory note on page 341, should be "less," not "up" as the types have it.]

Whether or not my explanations are correct makes no difference. The question at issue is simply one of fact. If Mr. P. will spend fifteen minutes in trying the matter he will be satisfied. Honest differences of opinion tend to improvement, and are therefore commendable, but permit me to suggest that common courtesy between members of the same profession should require that statements of the results of actual experiments should not be denied too positively until disproved by the results of similar experiments made by persons of equal experience.

Messrs. Editors.—On page 355, last volume, I am requested by "Engineer" "to state what we shall call the result we get by the indicator when we throw off all resistance and run the engine by itself alone?"

In answer to this I will say that had the gentleman read further, he would have found in my article on page 341, same volume, the answer to his question and a full discussion of the subject. He will there ascertain that the so-called friction diagram shows the friction due to the weight of the moving parts, which is constant at all loads, added to a large friction in the stuffing boxes which is reduced when the engine is loaded, and that it fails entirely to show the friction due to the load itself. Charles E. Emery.

New York city.

The Steam Engine Indicator.

Messrs Editors:—Since my letter was written which you have courteously printed in a late number, the diagrams on which Mr. Emery founds his judgment have appeared in your columns. We are shown two pairs of diagrams, one pair taken when the steam was admitted to the cylinder through five eighths, and the other when it was cut off at one fifth, of the stroke. The latter show a greater mean pressure than the former by 28·6 per cent, but we are assured that the power actually exerted by the engine was the same in each case, and that this "enormous difference" is wholly an error, arising from a defect of the indicator, a defect inherent and unavoidable, which has, therefore, always existed, but has only just been found out. On looking at these diagrams, we observe that, when the steam had been cut of at one-fifth of the stroke, the pressure at the termination, or at the point where the exhaust was opened, was considerably higher than it was at the same point when the steam had been permitted to follow through five-eighths of the stroke. Now everybody acquainted with this subject knows that the indicator never shows anything of this kind, but that, in all cases, if steam is admitted to the cylinder of a high-pressure, and is cut off early, a lower terminal pressure is shown than when steam of a low initial pressure is allowed to follow nearly to the end of the stroke, to do the same work. It is obvious that, instead of the resistance having been the same in the two cases, as represented, doubtless innocently enough, the engine was in fact exerting in the latter case 28·6 per cent. more power than in the former. The article shows sufficiently that a serious defect exists somewhere, but not in the indicator. Chas. T. Porter.

Rainfall—Steam Indicators.

Messrs. Editors:—I notice in the Scientific American, Vol. XIX, page 346, an article on the annual rainfall in different portions of the earth, in which is the statement that "The amount of water contained in a given amount of air, is, all other things being equal, proportioned to its temperature." It has been ascertained that the amount of water contained in the air varies directly with the temperature, but not proportional. As the temperature of the air increases, its capacity for holding water increases, but in a much greater proportion, and at high temperatures a variation of one degree will increase its capacity several fold more than the same variation would at a low temperature. This is the cause of the large rainfalls in the tropics. For several weeks sometimes there is no rain, the temperature increases very much, and the air, to get saturated, absorbs nearly all the moisture, thus producing a drought. This continues until there is a fall in the temperature, when the water is liberated in very large quantities causing the heavy rains.

I have been deeply interested in your articles on the best modes of testing steam engines, but more especially on the use of the indicator. In my short experience I have found that the Richards indicator is very much valued by some engineers, and I have seen various kinds used, among them patent instruments for preventing or reducing the travel of the pencil above, with its attendant reaction below, what should be the recorded pressure of the steam on its first admission into the cylinder, but I have never found one that is so well suited to general use as the Richards. I have seen figures, taken by it from the engines of Penn & Mandslay, in steam launches, which run at the rate of from 400 to 420 revolutions per minute, and they have been invariably good and well defined. John H. Rickard.

Clifton Springs, N. Y.

[Our correspondent mistakes our meaning if he supposes we asserted the amount of water air contains is proportional to its temperature, all other things being equal. We said "proportioned," *vide* "Silliman's Physics," page 651, and Webster's Dictionary last definition of the verb "proportion."—Eds.

Setting up of Steam Engines.

Messrs. Editors.—Allow me to make a few suggestions for your valuable consideration. I am by trade a machinist and have been a constant reader of your very excellent paper for a long time. Among my fellow craftsmen are many who can build, in the most thorough manner, any part of any engine made, but if called upon to set it up would not know how to do it; still some of these very men understand the principles of a high or low pressure engine and can give good explanation of the same. Of course much of this information is got from such works as King's, Bourne's, Murray's, etc., but I have never yet seen any work that explained how to line up and set for running an engine. Now, if you could, through the columns of your valuable paper, give the proper methods of setting up engines—stationary and marine—commencing with the common horizontal, showing or explaining the proper attachments to a boiler, etc., I think it would meet the wants of a large number of mechanics and increase the subscribers of the Scientific American. Also explain the governor and how to give the proper speed etc.; also the size of feed pipes, steam, and blow-off pipes. If you should deign to notice this letter and should give some notes on the steam engine, give us no algebraic signs, but plain figures, such as most all mechanics can understand; by so doing you will receive the thanks of at least that portion of hard fisted mechanics which I represent. H. M.

Charlestown, Mass.

[Our correspondent cherishes a delusion altogether too common, but one which we had supposed was confined to those who had no practical acquaintance with the building of steam engines; and that is that it is possible to derive this practical knowledge from books. The general principles of the action and construction of steam engines, a description of the details of any particular engine aided by drawings, and the relative proportion of parts may be given in this manner; but it would be as useless to attempt to give written instructions how to line up, and set up, and put in working order an engine *in situ* as to attempt to make an apprentice a good filer by that means. The books our correspondent refers to are among the best on the subject, but they are intended only as aids to a practical education. We have frequently given advice and directions in particular cases which were more or less applicable to other cases, and sometimes we have given the proportions of parts; but to descend to the minutiæ and to give exact rules to govern all cases is impossible. The setting up of boilers is a matter that may be thus illustrated with advantage. An article on that subject may be found in No. 9, of Vol. XVII, Scientific American.—Eds.

Low Steel—The Requirements of Ax Manufacturers.

Messrs. Editors:—I have been very much interested in the articles that have appeared in your valuable paper from time to time on the manufacturing of steel. But it seems to me that the makers of steel in this country have not got the right idea of what is needed for the manufacture of axes. I have worked in one of the largest ax establishments in this country for fourteen years, and during that time the company have tried most of the kinds of steel made in this country, and have been obliged to reject them all; not because the steel was not good steel, but because it was not suitable for axes. And here is where American steel manufacturers make a great mistake in not making a lower tempered steel. When axes were forged by hand they were made very thick, and steel of a higher temper could be used; but now the consumer will not use them unless made very thin; and consequently the steel used must be of good tenacity to have them keep from breaking in frosty weather when they are most used. Long experience has convinced me that high-tempered steel, such as is used where a fine edge is only required, is not suitable for axes as they are now made. We have found this to be true of both English and American steel; and the English manufacturers have sent steel here which was condemned as poor, when the truth was it was too high tempered. But it worked well in tools where it was not so hard punished as it is in axes.

Now why cannot American steel manufacturers make low tempered tenacious steel as well as the English? There is a large demand for such kind of steel, as there is a large quantity used in this country; and the duty on English steel is so high that it is very desirable to have it made where the duty could be saved. It would make a difference of thirty dollars per day with the company that I work for if they could use the

American steel instead of the English. It will be at once seen that it is not prejudice that stands in the way, for interest and everything else is in favor of the American steel. And this ax company, as well as several others, have come to the conclusion that it is cheaper in the end to use the English steel, until the American manufacturers make steel that is suitable for their use. And I cannot see any reason why they cannot do it now as well as at any other time, if they rightly understood what was wanted. C. M.

East Douglass, Mass.

The Open Polar Sea.

MESSRS. EDITORS:—Having given some consideration to the Polar Sea for some years past, I read with some interest the article on page 281, last volume SCIENTIFIC AMERICAN. Inasmuch as there have been numerous theories respecting the open sea by some, and as its existence is wholly denied by others, I wish to make a few suggestions. It is rather difficult to indorse the idea that it is caused by the Gulf Stream as there indicated; for whether that stream be produced by the escape of the pent up waters of the Gulf, or the discharge of the river Amazon, or both combined, it would seem evident that the warm waters being at the surface would continue there, and keep an open communication to the pole, affording a passage to navigation.

That the Polar Sea is open hardly admits of a doubt; I should rather doubt how it could be otherwise. I believe it is conceded by all that the equatorial waters are raised several miles higher than the polar waters (that is their distance from the center of a true sphere), owing to the centrifugal force given by the rotation of the earth, and the action of the trade winds blowing constantly toward the equator. Now if this be so, the effect must be mostly at and near the surface; and if the surface waters are driven to the equator, their predecessors must be constantly giving place. And how can they escape except toward the bottom of the ocean, where the centrifugal force is less? If the pole is open, it must be kept so by water from a warmer region in submarine currents. And if from the equator, where tides rise highest (unsupported by local causes), may we not suppose that the pressure would produce some rising tide at the pole as a natural tendency of water striving for a level.

Braceville, Ohio. CALVIN STOWE.

[We fail to see how a uniform centrifugal force would have any tendency to produce currents in the ocean. Although it is plain that centrifugal force varies from the equator to the poles, it remains constant in any degree of latitude north or south. Water raised to any hight at the equator by this force would, if no other force acted upon it, remain there; the force which raised it being sufficient to keep it there. The other causes mentioned have plausibility.—EDS.

Professor Dussauce and M. Piesse.

MESSRS. EDITORS:—In the number of your journal for December 9, page 379, I noticed that your contributor, S. Piesse, L. C. S., asserts that, after buying "The Guide for the Perfumer," he was much chagrined to find it a reprint of his own book. This is a very grave assertion, coming from a man of M. Piesse's standing.

I have published several works, and have always been careful to give credit to whom credit was due; and if in this book M. Piesse has not been mentioned, it is for the very simple reason that I owe him nothing. "The Guide for the Perfumer," as its title page indicates, is a translation from the French books of Messrs. Debay and Lunel. If these chemists have borrowed from M. Piesse, I cannot be held responsible for it; and I cannot see why M. Piesse brings his reclamations three thousand miles across the Atlantic, where he could so readily take them to Paris where the authors reside; and M. Piesse, who has made a speciality of chemistry, applied to perfumery, cannot be without a knowledge of these works. Certain it is, Messrs. Editors, that a comparison of my book with those of Messrs. Debay and Lunel, will clearly demonstrate that neither the American author nor publisher has done injustice to M. Piesse. Trusting that you will give me the opportunity of publicly repelling this attack upon my character as an author, I remain yours, respectfully, H. DUSSAUCE.

New Lebanon, N. Y.

I have examined with considerable care the respective works of Professor Dussauce and M. Piesse, above referred to, and it seems that the difference in contents, arrangement, and general treatment of subjects is so great, that it would be difficult to find two books on the same subject much more unlike. In no respect do they seem to me to bear a resemblance to each other except in a limited number of the formulæ.

HENRY CAREY BAIRD,
Publisher of "The Guide for the Perfumer."

Philadelphia, Pa.

The Ice Wall About the Polar Sea.

MESSRS. EDITORS:—Are not the well-known walls of ice about the open Polar Sea necessarily formed from the motion given to the water of the ocean, by the centrifugal force generated from the daily revolution of the earth on its axis, and will not Mr. Hayes, or any other explorer, find those walls, from whatever direction he may attempt to reach the sea?

To explain: The motion of the earth at the equator produces a centrifugal force on the water of the ocean, which is to a great extent balanced by the power of gravitation. Consequently, at or near the equator, there is very little tide—say a foot or two. Half way from the equator to either pole, gravitation is at an acute angle of about forty-five degrees with centrifugal force. The tide, therefore, increases gradually in depth as far north as the Bristol Channel and the Bay of Fundy, and as far south as the Straits of Magellan, where the tide rises about thirty-six feet on the eastern side. At the poles, however, the centrifugal force is not counteracted by gravitation; the latter being at right angles with it. The weight of water in the ocean produces a side pressure, amounting to half a pound for each foot of depth. Of course, this water must be continually forced by the side pressure under the ice to the region of the poles, and there being acted on by centrifugal force, and effected by gravitation only so far as it is at right angles with it, the same water must rush outwards to the borders of the Polar Sea to form the well known barriers of ice. These barriers, therefore, appear to be a necessity, and must be found in all directions by those attempting to reach the Polar Sea in vessels.

Considering the expense of each new expedition, and the scientific interest of the subject, it would gratify many interested to have your views, or those of some of your able correspondents, through the columns of the SCIENTIFIC AMERICAN. HENRY N. STONE.

Boston, Mass.

Storing Power---Sand.

MESSRS. EDITORS.—In SCIENTIFIC AMERICAN, No. 24, Vol. XIX, your correspondent, "G," says: Give us a plan to bottle up power;" also, "Elevating water, is objectionable from its scarcity, great evaporation, and expense of reservoirs," and thinks concentration of air might possibly be "it."

No, sir! Too costly apparatus required, exceeding water works in this respect; will do very well for transportation of power through pipes, but not for storing it. Sand, sir, sand is what you want. Or gravel, dry dirt, finely broken stone, etc. Grain would answer very well, if always on hand in sufficient quantities, but would gradually wear out by friction, causing loss of weight. Water, wind, or other available or intermittent power can "elevate" sand as well as water. If it is scarce, there are substitutes. It does not evaporate and need not lose by leakage. Keep it dry and it will not freeze up the reservoir, nor machinery. Being heavier than water, would take up less room and would not be damp and disagreeable like water. By strengthening the supports, the loft or garret of a warehouse, mill, or factory can be used as a reservoir at little expense; or any natural elevation no matter how high, can be used, with a shed for protection against rain and snow. Elevators cost less than pumps and pipes; bins cost less than tanks. Equally as simple as the elevator may be the machinery for utilizing the power given by the sand in returning to its original level; may be an overshot wheel or elevator reversed. The whole can be made with but small expense for materials and would require but little skill to make or attend to it. It could neither burn nor drown people, nor explode; the "heft" of the sand being the only thing to provide for. It could be located wherever most convenient and with a sufficient altitude or head would require no great bulk of sand to run ordinary machinery, as an auxilliary power or regulator between gales even if not between freshets. Sand, I say sand!

W. L. DAVIS.

Louisville, Ky.

Meteorites---Old Theory the Best.

MESSRS. EDITORS:—A correspondent gives, page 353, a theory of meteorites founded on the assertion that the sun carries a tail of meteorites behind him, and that the earth on the 14th of November crosses this tail, by passing through the sun's path. That the sun, with all the planets, is moving through the heavens around the cluster of stars called the Pleiades, and at present in the direction of Hercules, is well established; but that the sun leaves a long tail or train behind him, is not only improbable, but sure not to be so. If such a tail in its path were the true cause of the meteorites, the sun must have two tails and two paths at least; as there is another date, August 10, where the earth passes through another orbit of meteorites, as is well known.

The old explanation of the veteran astronomer, Olbers, is perfectly sufficient to explain all periodical and non-periodical meteorites nightly seen in the heavens. It is founded on Kepler's old saying, that there are more comets and meteoric masses, revolving in the planetary space around one sun, than fishes in the ocean. Le Verrier, who proved by calculation the existence of an exterior planet before it was seen, has also proved in a similar way the existence of several belts where meteoric masses are more numerous, and which move in a certain circle, or rather ellipse, around the sun, in the same way as the asteroids (to the number of more than one hundred thus far discovered) but much smaller, and infinitely more numerous. Two of these belts intersect the earth's orbit at that place where she passes on the 10th of August and 14th of November, of each year. There are many more meteorites moving in the plan of the ecliptic, and more or less parallel to the earth; and among these the earth has, according to Olbers, in the course of ages, hollowed out for itself a kind of empty rut, attracting all within the reach of its gravitation. But as from time to time, by the periodical inequalities in its orbit, and the numberless perturbations to which it is subjected, it moves not exactly in the old rut, it will attract other meteoric masses, which thus far have escaped its attractive power. The moon, as she extends her course in a circle around the earth more than fifty of the earth's radii in diameter, will, of course, have a large share of the meteors it meets; coming so much further from the mean track of the rut, she also may send to us by her attraction some of the meteors she fails to attract to herself; all this explaining the nightly irregular meteors. Such a number of dark masses moving about in space may intercept a small portion of the light of certain stars, and thus explain some of the irregular periodicities observed in their degree of luminosity.

Allow me to observe here, that it always has struck me, when examining the moon by a powerful telescope, that she looks very much as if numerous masses had fallen on a soft, yielding surface, making a depression in the center, and turning up elevated circular edges around it. Some of these so-called volcanos may perhaps in reality have such a cosmical origin.

I close with the remark that the existence of the meteoric belts has been proved by calculation, and is an adopted "fact of astronomical science," which long ago was "carried to the eyes and ears of every scientific man," and that the theory of the existence of a tail which the sun carries behind him is simply an hypothesis, without the least foundation.

P. H. VANDER WEYDE, M. D.

New York city.

A Rule for Finding the Exact Length of the Circumference of any Circle.

Multiply the difference of the diameter and diagonal of a square of any dimensions by ten, and from the product subtract the diameter; the remainder is the length of the circumference of the largest circle which can be inscribed within the square.

How to construct a useful measure.—The rule being very brief is easily remembered and applied.

On a planed board draw a square six inches in diameter and through its center a diagonal line from corner to corner. Extend one side of the square in a straight line indefinitely, or about twenty inches. With dividers or compasses take the diameter and set it on the diagonal at one end, marking the distance. Now take the remainder of the diagonal line with the dividers, and walk them on the extended straight line, including the diameter of the square, ten steps. The distance outside the square is the length of the circumference of a circle of the diameter of six inches.

To apply this measure to circumferences of greater diameter, multiply it by the number of times six inches are contained in such diameter; if the given diameter is less, divide the measure accordingly.

Having deduced this rule from the principle demonstrated in the book published by me some months ago, I am willing that others enjoy its utility without paying the expense of a patented instrument, since every mechanic can make his own and can easily test its accuracy by trial.

CYRUS P. GROSVENOR.

McGrawville, N. Y.

School of Mines, Columbia College.

The School of Mines, Columbia College, proposes to establish, in connection with its metallurgical department, a bureau of statistics relating to the working of different ores in this country. It is proposed, with the aid of those engaged in manufactures of the different metals, to form at the School of Mines a bureau like the Bureau of Mineral Statistics connected with the Government School of Mines in London, with a view of having in this city as complete a collection as possible of the statistics of the manufacture of the metals in this country.

To this end a circular letter, being the first of a series to the masters of different establishments, has been issued, requesting the following items of information. As we believe the movement worthy of cordial support, we cheerfully make place for the circular in our columns, and urge those who can give the information desired, to coöperate and respond fully and promptly:

TABLE OF INFORMATION DESIRED.

Name of the Works; Town, County, State; Proprietors; Number of Furnaces; Total Hight; Hight of Bosh; Hight of the Hearth; Hight of the Tweers; Diameter of the Throat; Diameter of the Bosh; Diameter at the Tweers; Number of Tweers; Diameter of Tweers; Hot or Cold Blast; Temperature of the Blast; Pressure of the Blast; Kind of Ore; Yield of the Ore; Kind of Iron—White, Gray, Mottled; Kind of Fuel; Quantity of Fuel per tun of cast iron; Production of Each Furnace in tuns of 2,240 lbs., by 24 hours

Communications may be addressed to Thos. Egleston, Jr., Professor of Mineralogy and Metallurgy, School of Mines, Columbia College, corner of Forty-ninth street and Fourth avenue.

What Railroads do for Farmers.

To haul forty bushels of corn fifty miles on a wagon costs, says the *Agriculturist*, at least $12 for team, driver, and expenses. A railroad would transport it for $4 at most. Allowing an average of forty bushels per acre, the crop would be worth $8 more per acre, or 8 per cent on $100. As the relative advantage is about the same for other crops, it is clear that a railroad passing through a town would add $100 per acre to the value of the farms. A town ten miles square contains 64,000 acres. An increase of $100 per acre is equal to $6,400,000, or enough to build two hundred miles of railroad, even if it cost $12,000 per mile. But two hundred miles of road would extend through twenty towns ten miles square, and cost but $10 per acre if taxed upon the land. These figures are given merely as an illustration. It the farmers had taxed themselves to build all the railroads in this country, and given them away to any companies that would stock and run them, the present increased value of their land would have well repaid all the outlay.

The Sword-Hunters of Abyssinia.

Sir Samuel Baker, in his late work, "The Nile Tributaries of Abyssinia and the Sword-hunters of the Hamran Arabs," describes, as a new and curious fact, the mode of capturing elephants by the sword-hunters, who with great courage and skill cut through the sinews of the beasts hind legs, so that he falls to the earth and is then easily dispatched. Prof. Liebrecht, of Liège, shows that precisely the same thing is related of a people living in the same locality, by Agatharcides, a Greek geographer, who wrote a description of the Red Sea and its coasts, in the second century before the Christian Era. The work of Agatharcides is lost, but certain fragments of it, incorporated in the *Myriobiblon* of Photius, contain a description of the sword-hunters.

Improved Horse Hay Rake.

The teeth of this rake are of the usual curved form, each one set separately in the head and having a bearing against a spring, which insures independence of action and a ready adaptation of the rake to the inequalities of the surface. Horizontal guards, with downward inclining branches, project between the teeth to keep the hay from rising and to turn it more readily into windrows. The rake head is hinged so that it may be moved to raise or depress all the teeth together. They are depressed, when in operation, by the lever seen by the side of the driver in the engraving, and having a foot rest by which it may be moved. A powerful spring on the head keeps the teeth from the ground when not in operation, so that the rake may be used as a vehicle on the road to and from the field. But for convenience in transporting it a long distance or for storing, it is constructed so that it may be taken in pieces in a moment and as readily put together again. This will be recognized by farmers as a valuable advantage. It appears to excellently well adapted to its purpose, its parts being few and easily made.

Patented May 1st, 1866, by Adam R. Reese, who may be addressed for rights and machines at Phillipsburg, N. J. See advertisement on another page.

REESE'S PATENT HORSE HAY RAKE.

Mica.

An esteemed correspondent gives the following: "Base-burning coal stoves are now all the rage, and the illuminating part of them is what takes. So many of this kind of stoves are now being made that the question of clear white mica for this purpose is becoming important. There are hundreds of different inferior grades of mica. "Canada Mica" is of several different shades, from the light brown to the intensely black. New York gives us a very good mica, but no mica can be had equal to that found in the Eastern States. The demand has been so great for the past two or three years that the supply from the Eastern States has been exhausted, at least the mines at present open; what further development can be made remains to be seen. Mica has been so scarce during the past season that it has commanded the most unheard of prices. Six dollars being a common rate per pound and some qualities selling as high as twelve dollars per pound."

AN APPEAL FOR HELP---THE CHILDREN'S AID SOCIETY.

New York absorbed for the most part in money-getting has a good heart in the main. Many a man who will not yield a a hairsbreadth in a matter of business, is in private a large disburser of money for charitable and humane purposes. And not only in private but public charities, New Yorkers are always ready to give cheerfully.

Among the many institutions for the amelioration of the poor and distressed thus supported, there is not one more deserving than the one whose name heads this article. In a circular just issued by this society, an appeal for help is made to children throughout the land, as well as adults, for aid to carry on its work of mercy.

The object of this society is to provide food, shelter, and eventually comfortable homes for the poor little homeless wanderers of New York. That the public may realize the magnitude of the work done by this society during the past year, we append the following extract from the circular referred to: "In its five lodging houses for boys and girls are sheltered, partly fed, and clothed, during the year, about 10,461 different boys and 1,283 girls; number of meals provided in 1867–1868, 151,448, and of lodgings, 107,790. Of the boys over 7,000 were orphans. In its twenty industrial schools were 5,609 different children during the year; about 287,000 meals were given and over 6,500 garments; some $8,000 were spent for bread. During the past year 2,286 persons, mostly children, were provided with homes and employment in the country.

No one who has not seen the filth and slum of the alleys and cellars of this city, the only homes, if any, possessed by the children above provided for, can estimate the mercy of removing 2,286 of these little waifs from these physical and moral hells of filth and vice to the paradise of pure country air and morals.

This is a charity to which all may contribute, except those in actual want. The secretary in his appeal says, "If you have nothing better, we should be glad even of your old clothes to make some poor shivering child warm." Boxes of old clothing can be collected in rural districts and forwarded to the office of the society whose address is given below. It is estimated that it costs twenty dollars to provide a child with a permanent home, and for this purpose as well as the support of the other features of the charity money is needed. The secretary says: "Our work has increased beyond our means; and the 'News Boys' Building Fund' has probably withdrawn some of our largest subscriptions from the current work of the Society. Unless generous donations are made, we shall be obliged to close some of our lodging houses in this inclement season, and suspend or limit our parties to the West."

We sincerely trust that such contraction of the usefulness of this society may not become necessary. Will not the friends of humanity remember during this blessed holiday season those "little ones" and those who are so nobly devoting themselves to their welfare and salvation?

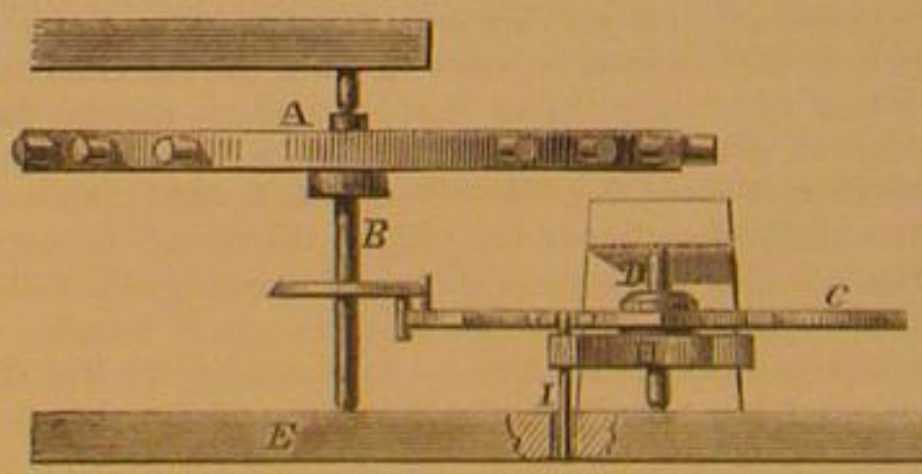
All gifts my be sent to C. L. Brace, Secretary of the Children's Aid Society, No. 8 East Fourth street, near Broadway, New York city.

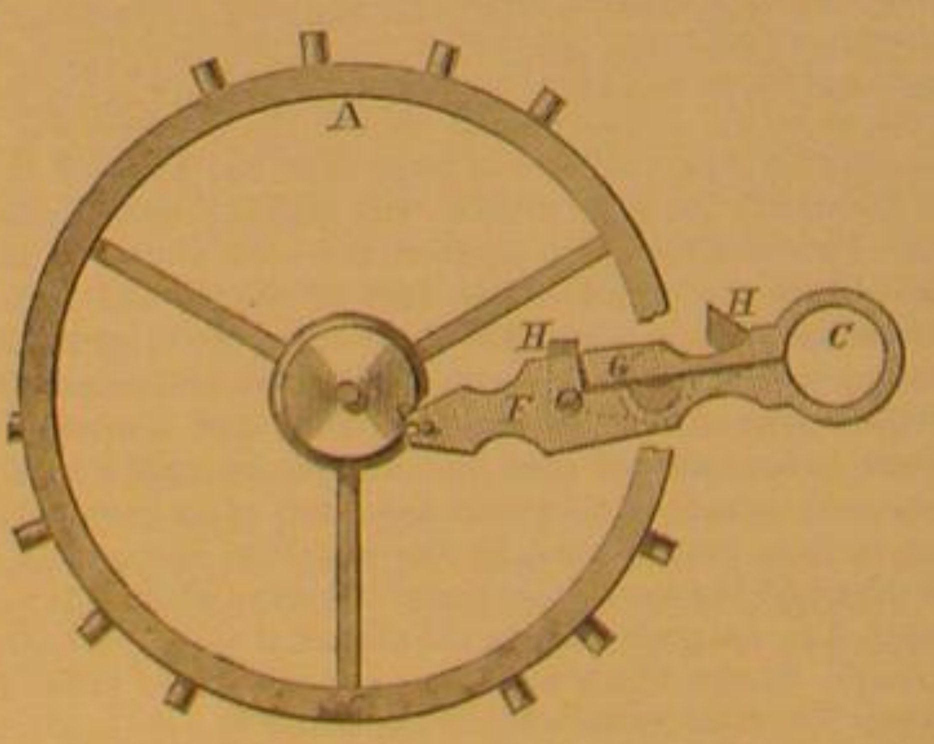
Protection of Sheep from Dogs.

A correspondent alluding to our article on this subject published on page 389, Vol. XIX, says that his father, a prominent sheep raiser, finding that the "bell wether" was never attacked by dogs, conceived the idea that the use of bells would tend to frighten away the murderous canines. Accordingly he furnished fifteen or twenty sheep of a flock of a hundred with globular bells, the size of an ordinary teacup. Having seen it practiced for several years successfully our correspondent is certain of its value.

HIETEL AND GEISSLER'S IMPROVED WATCH ESCAPEMENT.

The design of the invention illustrated in the accompanying engravings is to prevent the breaking of the ruby pin or pivots of watch escapements, when subjected to violent shaking or jarring, and to combine, in a simple form, the advantages of the lever and anchor escapements with the perfection of the chronometer movement.





The anchor escapement is found to be, when properly constructed, but little inferior to the free escapement in keeping correct time, and in durability it frequently excels the too complicated lock-spring escapement. But this latter has the decided advantage of allowing unrestricted freedom of motion to the balance, which is not the case with the lever escapement, as the latter causes occasional breaking of the ruby pin or the pivots. When exposed to sudden or violent motion, as when carried by engineers, conductors, and other employés on railroad trains, watches frequently become disordered, because the amount of play allowed to the balance of the lever escapement is insufficient.

A removal of these drawbacks to the lever would soon find favor not only among the owners of watches, but among watch makers and repairers. This is believed to be effected by the self-correcting spring lever herewith described. It allows the balance to turn freely in either direction, the lever yielding to its motion, but instantly regaining its normal position. It can be applied to all kind of American and foreign lever watches.

A, is the balance mounted on the staff, B; C, the lever vibrating on its staff, D; E being the plate or base. The lever is a spring bar, the spring being the ring at its outer end. It has two arms; one, F, long, and the other, G, short. The long arm fits half way around the staff, D, and the short arm rests against the flattened side of the staff, as seen plainly at G. This flattened portion is slightly hollowed, so that the arm rests against these two extreme points. H are the pallets, mounted on the staff, D, and I is the banking pin, one end passing through a slot in the long arm of the lever, and the other end playing in a groove in the plate, E. The lever and pallets work under ordinary circumstances, exactly like the ordinary lever. When, however, the watch is vehemently shaken so that the balance has a tendency to swing too far in either direction, the ruby pin will, when it has brought the lever to one side so that the banking pin is at the end of its slot in the plate, E, push the long arm F, of the lever still further in such direction; the spring of the lever allowing the arm to yield, thereby permitting the ruby pin to pass the lever, when the lever resumes its original position. Thus the action of the spring lever and the over action of the balance, caused by sudden disturbances, have the effect to equalize the motion and distribute the result of the disturbance; the overstrain of the spring tending to retard the too rapid movement of the balance, and also the rapid motion of the balance tending to a rectification of the position of the lever. The advantages of the device will be apparant to watchmakers.

Patented through the Scientific American Patent Agency, and also in England and France, Nov. 17, 1868, by J. Hietel, J. W. Hietel and J. Geissler. Address Hietel Bros. 327 South 3d street, Philadelphia, Pa.

WHY NOT GROW OUR OWN SILK?

With the stimulus given to American silk manufacture, by the present tariff on silk goods, this industry is assuming unprecedented proportions in the United States. The bulk of all the raw silk used in American silk mills, is imported. Is there any good reason why this should be so? Why should we not ourselves grow all the silk required.

The attempts hitherto made at silk growing in the United States indicate the possibility of its success in many sections. It was successfully grown in South Carolina as early as 1755, in which year Mrs. Pinckney, mother of General Pinckney of revolutionary fame, took to England a quantity of silk grown and spun in that State. Governor N. Johnson cultivated silk successfully as early as 1693. Experiments in the culture of this product in the Carolinas, made at intervals since the above dates, have uniformly been successful; but the cultivation of cotton has so absorbed the attention of Southern agriculturalists, that but little attention has been attracted to results of experiments in silk culture.

Silk growing in Connecticut dates back to a very early period. Governor Law wore in 1747 the first silk coat and stockings produced in that colony. President Stiles of Yale College, took a great interest in the pursuit, for forty years, and the college library contains a manuscript journal of his observations during that period. In Dr. Franklin's time silk was cultivated at Philadelphia. It is recorded that Mrs. Susannah Wright of Columbia, Lancaster, Co. Pa., received in 1771 a premium for a piece of silk sixty yards long, made from cocoons of her own raising, and used for a court dress for the queen of Great Britain. Specimens of this silk are still preserved.

In the more northernly portions of the union, silk growing has not proved very successful, owing to the severity of the climate. The attempts to grow silk in this State some twenty or more years since were failures, probably from this cause. But the southern and middle portions of the country, as well as the greater portions of the Pacific slope, are admirably adapted to this pursuit. California in particular, has advantages for this industry excelled by few localities on the globe.

The present condition of the silk industry in the latter State, is very prosperous, it is estimated that it has increased one fourth during the past year. There are now five millions of mulberry trees under cultivation in that State; two crops of cocoons in a season being the usual production, although three are sometimes obtained. It is also estimated that ten millions of sound cocoons will be the product of 1869. This represents thirty thousand pounds of fiber, produced at a cost twenty-five per cent less than the same quality of silk can be imported.

The conclusions from these facts are unmistakable. Silk manufacturing and silk growing in this country are at last permanent and profitable industries, and will remain so unless destroyed by a false policy on the part of the general government.

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VOL. XX., No. 2....[NEW SERIES.]....*Twenty-fourth Year.*

NEW YORK, SATURDAY, JANUARY 9, 1869.

Contents:

(Illustrated articles are marked with an asterisk.)

INFLUENCE OF VEGETATION UPON THE EXISTENCE OF MIASMS IN THE ATMOSPHERE.

We notice, in an exchange, a statement that a Belgian farmer, residing in a very unhealthy district, has changed his plantation—notoriously insalubrious hitherto—into a perfectly healthy one, by planting sunflowers upon it. Allusion is also made to the practice of the negroes in the Southern States who, to prevent certain local diseases, plant sunflowers and castor beans about their cabins. It states also, upon the authority of travelers in India, that the inhabitants of the marsh counties there, plant the betel pepper around their dwellings, in part for a similar purpose.

We are told, in this sapient article, that investigations following the Belgian experiment, discovered the fact that the sunflower derives the most of its substance from the air and not from the soil; as though that were a new discovery, and that all plants did not, to a greater or less degree, do the same thing. Thereupon the author congratulates himself and the world, that by a proper selection of plants, we may, at the same time we enrich our store, render whole malarial districts healthy. It would, indeed, be a subject of congratulation, if we could, by cultivating castor beans, rhubarb, and the other medicinal though mostly disagreeable plants to tongue and nose, in common use about our houses, avoid the necessity of taking them into our stomachs. But, we fear that the latter alternative will be sometimes necessary, so long as we continue intemperate in eating and drinking, and do not correct our habits in regard to air and exercise. As to the avoidance of pestilence and malarial influences by the cultivation of one kind of plant more than another, we believe that it is a superstition of barbarians, without the shadow of foundation. The stuffed skins of animals, the teeth of snakes, and other things have been believed by savage nations to possess similar virtues.

Recent investigations all tend to establish the fact that so-called miasms are nothing more nor less than microscopic organisms, diffused through the atmosphere; living things, not gases to be absorbed by plants, as the article alluded to would have us suppose; incapable of being assimilated to the economy of a living being, be it plant or animal, and, on this account, a poison when introduced into the system. The conditions favorable to the growth and reproduction of these minute organic bodies, vary with temperature, moisture, and, probably, many other causes not yet understood. But it is specially noted that in low, swampy lands covered with dense rank vegetation, they are more numerous than in localities of opposite character. Such lands, favorable to rank growth, also favor swift decay, and the decay of vegetable matter, as well as animal matter, seems to develop a condition, among other things, favorable to the growth of miasmatic organisms. The clearing up and draining of swamp lands generally end the career of fever and ague in their immediate vicinity; for this reason, and not to the agency of any cultivated crop, as suggested in the article referred to, has the health of those localities improved.

We are willing to concede with Falstaff, that "instinct is a great matter." We do not believe, however, that the negroes, the East Indians, or even the Belgian farmer, have been guided by instinct or by reason, to the selection of a plant that is so potent in its influence upon malaria; and, in the absence of any information as to the nature of the miasm which has disappeared from the once infected plantation, and without knowing any of the collateral circumstances of this case, we prefer to believe that it was owing to some other cause than the presence of the "helianthus annuus."

FREEZING OF SUBMARINE WATER PIPES---PUMPING LONG DISTANCES.

From Mystic Bridge, Conn., we have received a communication in which the writer sets forth two grievances, the subjects of which are stated in the above caption. He says: "We have got a pipe in this place which supplies some of our people with water. Its head is fifty-six feet above tide water and it crosses the river (salt water) in a three-inch iron pipe. This pipe froze up solid and burst in several places while twelve feet under water. Some tell me it is *anchor ice*, but this I cannot believe."

In reply to this portion of the letter we would say that this case is not a singular one. The Croton Water Works managers have experienced the same difficulty in conveying fresh water across the East River at a depth of thirty feet. Salt water requires a lower temperature than fresh for freezing. Fresh water entering a pipe at a temperature nearly freezing and passing through a body of chilled salt water would be apt to part with enough of its caloric to form crystals or *spicula* of anchor frost against the sides of the pipe, and the formation of anchor ice would be very rapid. In the East River there is a strong current, as there probably is at Mystic Bridge, and as the lower stratum must, of course, be the coldest, the result of freezing is natural. The remedy is to encase the submarine pipe in a non-conducting material.

The second difficulty found by our correspondent is in pumping water through 3,000 feet of pipe by means of a lifting or "suction" pump. He says: "The difference in hight between the supply end and the discharge end of the pipe is sixteen feet. The pipe conforms to the inequalities of the ground, being in some places high and in others low. I have attached a pair of good seven-inch lifting pumps and put a vacuum gage within ten feet of the pump which held it at 28 inches or 14 pounds. I filled the pipe the whole length with water and uncovered the high parts and let the air out previous to the filling. Yet I cannot get a stream. When the solid water came I plugged up the air holes, but with this 28-inch vacuum I could not hold the water. The supply end of the pipe has a foot valve."

Neither is this case remarkable. Engineers have often experienced similar difficulties. It is almost impossible to exhaust the air from the bends of a pipe when it rises from a horizontal. This case may be stated thus: 28-inch vacuum—14 lbs. 16 feet to rise—8 lbs., and 14—8—6 lbs. Now the air in the pipe forced out a portion of the water until its pressure was reduced to that of the column. Then the weight of the foot valve, whatever that may be, must be added to the resistance. Very likely the removal of this valve (which, after all, is an unnecessary adjunct), will reduce the resistance and remove the difficulty. If that is ineffectual, use a force pump at the point of supply instead of a lifting pump at the place of delivery.

POLISHED STEEL ORNAMENTS---BERLIN CAST IRON.

The material and style of ornamental articles of wearing apparel change in fashion from time to time. Now the material must be of the most costly character and elaborate design; again it is of the cheapest. Among this latter may be classed the so-called steel ornaments—buttons, ear drops, brooches, bracelets, clasps, etc.—lately and even now all the rage. Yet even this material, cheap as it is, is not what these articles are composed of; they are either cast or wrought iron, mainly of cast iron. The Berlin castings have long been celebrated for their delicacy and finish. One knows not which most to admire, the elegance of the finished work, the intricacy of the pattern and the consequent skill of the molder, or the fine quality of the metal that may be induced to assume such elaborate and intricate forms. Some of the articles, as brooches, have a beauty of network almost rivaling Italian filigree in gold, yet it is nothing but cast iron. The polish is perfect, and, unlike either gold or silver, it is not easily tarnished, even when exposed to the action of the carbonic acid of a crowded, ill-ventilated room. The luster has not the trying yellow or orange of gold, nor the glaring white of silver, but a clear, bluish, almost transparent sheen from which the light is reflected as from the diamond. And when cut into facets, as are some of the ornamental buttons for ladies' dresses, they rival the sparkle of the brilliant. The polish is obtained by the use of crocus on a buff wheel.

Berlin iron is also largely employed in casting statuettes, electroplated or lacquered to resemble bronzes, for which they are frequently sold, and to which they are nowise inferior, except in the intrinsic value of the material, as the peculiarity of the iron used is its capacity for easy flowing when in a fused state and thus filling perfectly the most minute portions of a mold.

IMPORTANT TRADE MARK CASE.

A case was recently decided in the Court of Common Pleas in this city, involving a nice question of the right to use certain well known words to designate a particular manufacture. It appears that Charles M. Town has put upon the market an article which he calls "Desiccated Codfish," which means "dried codfish."

Mr. Town brought a suit against James A. Stetson & Co. for using the same words upon their own manufacture. Judge Barrett decided that the popular word "desiccated," here sought to be burdened with a new and exclusive use, is specially descriptive of the article sold; in fact, it is the only word which correctly describes the process whereby this particular preparation of codfish is produced. No manufacturer can acquire a special property in an ordinary term or expression, the use of which as an entirety is essential to the correct and truthful designation of a particular article or compound. The court will neither prevent people from calling things by their right names nor force a misnomer upon them. The plaintiff may distinguish his "desiccated codfish" as the "Bismarck" or the "Von Beust," or by the prefix of any other proper name or common word not previously applied in that connection, and not essential to the truthful designation of the article produced, and he will be protected in its exclusive use. But he can no more acquire a special property in the word desiccated, as applicable to an article which has undergone that process than he can to the words "dried," "preserved," or "pickled," as applied to that which has, in fact, been thus treated.

This decision of Judge Barrett appears to be based upon good sound sense. Patents can be obtained for ornamented trade marks, but the use of fancy words to designate an article of manufacture will not, it seems to us, confer an exclusive right until the article has acquired a good reputation.

THE HUMAN WHEEL AND ITS RIVAL---THE VELOCIPEDE MANIA.

Dr. Oliver Wendell Holmes, in a former number of the *Atlantic Monthly*, published an article entitled, "The Human Wheel, its Spokes and Felloes," in which he treated the act of walking as analogous to the movement of a wheel; the legs being the spokes, and the feet the felloes. Had he postponed that humorous and instructive essay a year or two, he would have found himself behind the age. The art of walking is becoming obsolete. It is true that a few, like Weston, who still cling to that mode of locomotion, are still admired as fossil specimens of an extinct race of pedestrians; but for the majority of civilized humanity, walking is on its last legs. What with our steamboats, railway cars, horse cars, omnibuses, and last, and least in size though not least in importance, velocipedes, to which category will soon no doubt be added flying machines. We shall soon ride, sail, swim, or fly, wherever we wish to go; we shall have ceased to walk entirely.

We have land velocipedes, and water velocipedes; we still lack velocipedes for ice and air navigation. We have velocipedes with two wheels, and others with three, and even with four wheels; but the two-wheeled machines seem to be the ones most in favor. It might seem difficult at first to learn the manipulation of the two-wheeled species, but it is not so. We have seen them bearing, easily and pleasantly, young and old, light and heavy, with equal facility. Velocipedestrianism, a word coined for the times, is easier to learn than skating; and is fully equal to the latter delightful sport in its invigorating and exhilarating effects.

We lately witnessed an exciting race between a somewhat obese gentleman on the shady side of forty, and a slender boy of perhaps seventeen years, who, notwithstanding the descending ground was in favor of the heavy weight, succeeded in beating his more muscular rival by several lengths.

In Paris we learn that the number of these little vehicles has increased so much, that they are required to carry lamps in the evening. In this city, although we have heard of no police regulation requiring it, young gentlemen may be seen almost every night riding their velocipedes on some of our avenues, with head lights attached.

We have also schools for exhibition and instruction. One is announced in another column; another, recently opened, is conducted by Pearsall Brothers, No. 932 Broadway, where on any week-day evening may be seen upward of a hundred and fifty gentlemen—doctors, bankers, merchants, and representatives from almost every profession—engaged in this training school preparatory to making their appearance upon the public streets and fashionable promenades. Some of them become tolerably expert operators in a single evening; others make awkward work of it even after several nights' hard tugging. We frequently drop into this *Velocinasium* to witness the novel amusement which the exhibition always affords. Here are two well-known stock brokers, jaded by the excitement of Wall street, with their coats off, and faces burning with zeal, gyrating around the room in the most eccentric manner. Some of the time they were upright in the saddle, but more frequently they were engaged in mounting and dismounting their refractory steeds: they looked fatigued, they gave forth the sigh of discouragement; but after an expert had mounted and raced gracefully around the room, they began to rally for another effort, and seemed to be satisfied that the fault was not in the machine after all. We believe the young brokers have since become skillful operators. The large room is devoted to the instruction of new beginners, who, when they show sufficient skill, are promoted to the arena where their friends can witness and applaud their skill.

We are informed that a gentleman, in New Jersey, lately traveled fifty miles on a velocipede in four and a half hours. They are coming rapidly into demand all over the country. There is a great call for improvement in these vehicles, by which their weight can be reduced, and their speed increased.

We expect some ingenious inventor will soon bring out a velocipede upon which our ladies will be able to take their airings, and that, too, without the necessity of any considerable change in the present style of dress. The panier now so generally worn will serve to cushion the seat, and by the introduction of a shorter dress, with flowing pants, which our ladies, who wish to enjoy robust exercise, may safely adopt, we may expect to see parties of both sexes making their morning visits to the Park mounted upon graceful velocipedes. There is evidently to be a good deal of fun and excitement on this subject when spring opens.

Harper's Weekly, in its editorial remarks, after copying from this paper, on this subject, says:

A number of persons in this city and its vicinity are already making use of the velocipede as a means of traversing the distance from their homes to and from their places of business. One gentleman takes his ride of nearly ten miles daily, and saves time as well as enjoying the ride. The Rev. Henry Ward Beecher has secured two of the American machines, and other gentlemen, well known in the literary and artistic world, are possessed of their magic circles.

Youngsters ride down Fifth avenue with their school books strapped in front of their velocipedes, and expert riders cause crowds of spectators to visit the public squares, which afford excellent tracks for the light wheels to move swiftly over.

The best speed thus far attained is a mile in a few seconds less than four minutes. In Paris the Americans carried off the prizes, as well for slow as fast riding. The slow riding is much the most difficult, as it is far easier for the rider to keep his equilibrium in a rapid ride than while moving slowly—just as in the case of a boy driving his hoop, the faster it goes the more direct is its line. To ride a velocipede well is much less difficult than to learn to skate, and the danger of a fall is not imminent. The present scale of prices demanded by dealers is about the same, ranging from sixty to one hundred dollars.

A horse costs more, and will eat, kick, and die; and you cannot stable him under your bed," remarked an expert rider to a friend.

The weight of a medium-sized velocipede is about sixty pounds, and the size of driving wheel most in favor from 30 to 36 inches in diameter. The springs of the vehicle are so arranged as to make it ride easily over a tolerably rough pavement. A fair country road is as good a track as one could desire; but hills of more than one foot ascent in twenty can not be climbed without dismounting and leading the machine.

The winter season is not favorable to *veloce*-riding, but with opening of spring we may expect to see the two-wheeled affairs gliding gracefully about the streets and whizzing swiftly through the smooth roads of the Park.

We are desirous of making this paper foremost in disseminating information on this popular subject. The facts and incidents connected with this new species of locomotion will be read with interest by all, old and young, male and female.

REMINISCENCES OF TRAVEL IN SPAIN.

NO. IV.

THE MADRID PICTURE GALLERY—SPANISH ARTISTS—A VISIT TO TOLEDO, THE POMPEII OF SPAIN.

It is not generally known that the Royal Gallery of Madrid embraces the finest collection of pictures in Europe—a statement which may appear somewhat extravagant to those who have reveled amid the gems of the Louvre, the Dresden, and the Florence galleries. The assertion, however, is supported by some of the most intelligent travelers and critics who have closely studied the fine arts in all the chief centers of art in Europe.

The collection, which numbers about two thousand, consists not in a chronological series of Spanish pictures merely, but of gems by all the best-known masters of the French, Flemish, and Italian schools, to which is added the only good collection of the great Spanish masters to be found in the world. Spain had but one period of art, and a truly glorious one it was, that brought out such great painters as Murillo, Velasquez, Ribera, Alonzo Cano, Zurburan, Juanes, Morales, Coello, and Tobar, masters respecting whom very little is known out of Spain, and can be appreciated only by those who have studied their works. Velasquez was probably the most powerful historical painter that ever lived. He had a style peculiarly his own, and although he studied art in Italy, nothing could change the style which he had adopted, and certainly none other could so graphically portray the cold, haughty, lock-jaw looking figures of the royal subjects which chiefly employed his pencil.

Velasquez was a court favorite, and enjoyed unusual advantages, which he knew how to improve, and one cannot look at his stately figures without feeling that they could speak if they would. His picture of the surrender of Breda to General Spinola is perhaps the finest historical picture in existence. Velasquez rarely ever touched other than historical subjects, yet it would be impossible to forget a remarkable Crucifixion in this gallery, painted by him. Velasquez was employed by Philip the Fourth to paint a picture of the Infanta Margarita surrounded by her favorites, which included his own full-length portrait. Upon its completion he asked his royal master "if there was nothing wanted." "One thing only," said Philip, and taking the brush, he painted with his own hand, on the breast of the artist, the red cross of the order of Santiago, the highest honor he could bestow. There are sixty-four of Velasquez' superb pictures in this gallery.

The Spaniards take most pride in Murillo; they declare that he was never out of Spain, and that he acquired all his skill in the midst of his own people. Murillo's greater works are only to be seen in Madrid and Seville, and the fact that they usually embodied some religious sentiment, some mystery of faith which warmed the fervid impulse of the people, will explain in part the homage which his name and genius inspires. Murillo critically studied nature as he found it in the streets of his native city, and his Madonnas are striking types of Andalusian beauty—human forms which he lifted to the sky, and therefore less refined and ethereal than the angels which Raphael was in the habit of calling down to his canvas.

In the council chamber of the Academy of San Fernando are several Murillos, but the one that hangs over the president's chair, known as the Tinoso, which represents St. Isabella, Queen of Hungary, healing the lepers, is the most natural picture we ever saw. The figure of the queen is an embodiment of saintly grace and beauty, and appears in charming contrast to the diseased lepers, as one after another they come to have their leprous sores cleansed and healed. We have seen ideal pictures far more pleasing to the sight than this, but we doubt if any other artist living or dead, could have excelled it in power and truthfulness of delineation. Murillo has forty-six pictures in this gallery, but his best are at Seville, where he was born and lived and died.

With the exception of Velasquez, the Spanish masters devoted themselves to the deification of the church, by numerous Christs, Virgins, patriarchs, apostles, saints' martyrdoms, and to frighten the ignorant by visions of hell, purgatory, and bodily torture; therefore the visitor hunts the galleries in vain for Spanish landscapes and representations of the social characteristics of the people, which afford a rich field for artistic effects.

The old Spanish masters are all dead and buried, and none have come to take their places. We could not learn of a single artist living in Spain who enjoys a national reputation. The artists are chiefly employed in making tolerably fair copies of the old pictures.

A better idea may be formed of the high character of the Madrid gallery when it is known that there are a number of Raphael's works—one a large picture by this prince of all artists, "Christ Bearing the Cross," surrounded by stern and sorrowing figures—one of the few pictures signed by him. It has never been retouched, though somewhat faulty in coloring, a result possibly due to age and climate; nevertheless critics have pronounced it the finest picture in the world. There are sixty-two Reubens, some of them drawn from Italian and Spanish models, richly colored, and much less sensual than the fat muscular Flemish beauties that he was accustomed to paint. There are nearly three hundred and fifty fine works by Titian, Teniers, Tintoretto, Van Dyck, Paul Veronese, Giordanos, Breughel, Snyders, Poussin, Claude Lorraine, Wo-verman, and other artists of well known celebrity.

From Madrid we made an excursion to Aranjuez, which, in spite of all its wretchedness, boasts a royal palace and gardens of no mean pretensions, where royalty was accustomed to seek retirement in summer, amid shady groves, enlivened by the songs of nightingales, and there

"To sit upon the ground
And tell sad stories of the fate of kings."

From Aranjuez we went on to Toledo, probably the most ancient, curious, and interesting city in Spain. At one time Toledo was the court city, and some idea may be formed of the transformation which it has undergone when it is known that in those days its population numbered upward of 200,000, now reduced to about 17,000. Toledo is the Pompeii of Spain, and abounds in "prout-bits" which deeply interest the seeker after antiquities. The situation of the old city is remarkably picturesque, being perched upon a narrow, rocky bluff, overhanging a sharp bend in the river Tagus, with beautiful surrounding landscapes.

The Cathedral is a marvelous pile—one of the noblest in Spain, which means a good deal—and possesses treasures valued at several millions, which are hurriedly shown at certain times, for a reasonable fee. There is a curious tradition in regard to this cathedral which is worth a brief notice. One of the richest chapels is dedicated to St. Ildefonso, an eloquent controversalist, who flourished 1,200 years ago. This saint was the first advocate of the dogma of the immaculate conception of the Virgin; and the Toledans appear to believe that, in gratitude for this service, the Virgin mother twice came down from heaven and visited the cathedral, on one occasion bringing with her a finely wrought cassock, placing it upon the shoulders of the saint. This event is signalized in a large picture suspended in the church, and the very stone upon which she alighted is mortised into one of the pillars, and has been kissed for so many generations that it is now as smooth and hollow as a porcelain saucer. The garment so miraculously bestowed is preserved among the treasures of the cathedral at Oveido.

Toledo is the most singular, dried-up specimen of an old city that we have ever seen. It is almost dead, but it abounds in fine Moorish buildings, interesting churches, and elegant Jewish synagogues, and it was curious to notice that some of the churches were dismantled, deserted, and given over to ruin, being wholly useless for the want of worshipers to attend them. The streets are too narrow and crooked to permit carriages to pass through them, therefore donkeys are chiefly employed to carry burdens.

We do not know who had the best of the visit, ourselves or the natives. We were followed through the streets by a crowd of people, chiefly ragged women and children, with a liberal admixture of men beggars politely showing us the way. We wanted a pocket photograph apparatus, to catch the curious scene; but alas! the skill of the inventor had not quite met the want.

We spent a part of one night at Toledo simply because we could not conveniently get away. The hotel was altogether the most rickety, cheerless, and comfortless that we found in Europe. We were summoned to be up at four in the morning, to partake of a breakfast consisting of a cold, muddy mixture which they called coffee, and a little hard bread; the butter we could not eat, and we have not to this day the slightest notion of what materials it was composed, but concluded from the smell that foreigners must reside for some years in Spain and take out naturalization papers before they would be able to eat of it.

Breakfast done, we emerged from our chilly prison house, passing through a pompous gateway into the streets, to follow the porters who had our trunks upon their shoulders. The air cut like a razor; it was pitch dark and not a light in the street to cheer our exit, but we followed on as best we could behind the porters, twisting and turning through the dark, narrow alleys, for nearly half a mile, until we reached the Tocodover plaza, where we found a rickety old omnibus in waiting to tote us down to the station, a distance of nearly two miles. We were glad to get out of that dismal spot, which seemed to forebode evil, and to get a view of a locomotive, the only civilizing progressive feature we were able to discover.

ANOTHER SENSATION ON WALL STRERT.

On the night of Saturday, the 19th Dec., an event took place which has produced a sensation in Wall street scarcely inferior to that consequent upon the recent operations in Erie stock, with which the public ear has been filled, *ad nauseam*. This was the watering of the capital stock of the New York Central Railroad to the tune of eighty per cent. The stock before this operation was $25,000,000. It is now $45,000,000. The $20,000,000 of extra stock is called a dividend, yet it will be hard to convince the public that is the proper name for it. A singular circumstance connected with this transaction is the fact, that notwithstanding this enormous increase, the stock rose from 133 on Saturday, to 165 on Monday. Those inside the ring appear to have made a handsome thing out of the operation, while those who are left out in the cold have bled freely. Cornelius Vanderbilt is reported in the papers to have made the snug little sum of $5,000,000 out of this great corner; and his movement is considered the greatest *coup d'etat* Wall street has ever known. We have no doubt of it; and if this scheme is not nipped by judicial interference, which in this city never terminates, the people will soon be treated to an increase in the rates of passenger and freight tariffs in order to enable the stockholders to reap a further reward from that investment. Further comment is unnecessary.

The East River Bridge.

The Common Council of Brooklyn, on the evening of the 20th Dec., voted to subscribe $3,000,000 on behalf of the city toward the $5,000,000 required for the construction of the long-talked of suspension bridge across the East River, to connect New York and Brooklyn.

According to the plans heretofore published, the new bridge will start, on this side, from a point near the Register's office in the City Hall Park, and will strike the other side of the East River at the corner of Sands and Washington streets. Its largest span or reach will be 1,600 feet, which is nearly 600 feet longer than that of the bridge over the Ohio River at Cincinnati, and nearly 800 feet longer than that of the Niagara Falls bridge. Its total length will be a little over a mile, and its width 80 feet, admitting of the passage of 200,000 persons daily.

We do not doubt that the impulse thus given to this enterprise will speedily secure the remainder of the capital required, and that the completion of this great work is now assured. Our readers are familiar with its details, published with engraving on page 88 and 90, last volume of the SCIENTIFIC AMERICAN.

Combustion from Steam Radiators.

A small paper mill at Lawrence, Mass., took fire recently under singular circumstances. The *Daily American* of that town says: "In this mill was a revolving bleaching cylinder, situated over one hundred feet from the boiler supplying it with steam. The pressure of steam supplied was about sixty pounds to the square inch. It revolved within a few inches of the ceiling (as is usual) to facilitate the filling of it from the floor above, and the wood work situated over it had become, as it were, baked by the heat radiated from it. The men employed in the mill at the time of the fire state that the flame seemed, as it were, to spring out of the ceiling over the cylinder. The loss was $970 on the building and $50 on stock, which has been paid by the insurance companies. The peculiarity of its origin ought to command the attention of all who use steam pipes for heating, when they have on high pressure, and wood work around or near the steam.

Reciprocity—Mr. Greeley's Scheme.

Mr. Greeley has recently paid a visit to Montreal, where, in an address to a meeting held at the Corn Exchange in that city, he enunciated the following plan for the settlement of the reciprocity question:

The features of this plan are that the United States and Canada shall arrange matters on a basis like that at present existing among the different states of German Zollverein. A system of tariffs shall be adopted alike for both countries, on imports from abroad. Custom houses along the boundary line between the two countries shall be abandoned, leaving internal trade entirely free, but the duties collected at custom houses of the seaports shall be divided between the two countries in proportion to their population.

CHINESE IN ALASKA.—Capt. Fast late of the U. S. Army, has made a collection of antiquities from graves, etc., in Alaska, during a nine months stay in that country consisting principly of ornaments and weapons richly and skillfully carved, and which resemble those now made by the Chinese. There seems to be no doubt that these relics belong to a totally distinct race from that at present inhabiting Alaska. In this connection we learn with much interest that Professor Carl Neuman, of Munich, a diligent student of Chinese antiquities and bibliography, has discovered from the Chinese year books that a company of Buddhist priests entered this vast country *via* Alaska, a thousand years before Columbus, and explored thoroughly and intelligently the Pacific borders, penetrating into "the land of Fusung"—for so they called the Aztec territory, after the Chineese name of the Mexican aloe.

MANUFACTURE OF ARMS IN PERSIA.

SWORDS.

For the manufacture of a sword, the steel bar is first forged by a smith till it acquires the necessary shape. It then is taken by the armorer, who planes it off by a damask plane. After having been heated, it is again planed, and so on for several times; at last it is gradually brought to a very high degree of heat. In order to be assured that the blade has been exposed to the requisite temperature, it is partly polished with a paste consisting of fat and emery powder. If satisfactory, the whole of the blade is treated in this way; if not, it is again re-heated until the desired result is obtained. The blade is then immersed in fat and again exposed to the fire, which operation is repeated for several times. It then is filed and passes finally into the hands of the polisher. The manufacture of damask swords is, hence, somewhat complicated, and it requires skillful workmen. It is, also, not easy to ascertain their quality. When the back of the blade, which is generally first examined, does not show the least trace of a fissure, it is already a good sign; a better is that, when, by careful examination, it does not present any marks of welding upon its sides. Beside this, great experience is necessary for the testing of blades, which experience is only possessed by the Persians. They are very rarely deceived. De Roche Flouart relates an instance where swords were appraised by several parties at separate times, who all agreed on the same valuation. This is the more surprising as the price of a damask blade varies from $10 to $600.

THE NECESSITY OF HOME MANUFACTURE.

It is astonishing that the Persians have, as yet, shown so great a neglect in regard to their iron ore and coal mines. Though in Mazenderan a beginning has been made in the smelting of native ores, it is of too little account to be of any importance. Nearly all the iron is imported, the prices per pound being, for Prussian iron, in gold, 4·6 cents; for iron from Astrachan, 5·8 cents; for old iron, 4·0; for old nails, 6·5 for square iron, 4·0; for steel, 10·8; for Prussian cast iron, 6·1; for cast iron from Mazenderan, 1·5.

The iron mines exist in the midst of the forests of Mazenderan, where the wood is of no value whatsoever. Here would be a large field for money-making for an enterprising company, as the foreign iron would certainly soon cease to compete with that manufactured in the country itself, and although the consumption of this metal in Persia, with its eighteen millions of inhabitants, is very small compared with that of other countries, it would not be too insignificant for at least one furnace.

THE ART OF DAMASKEENING.

There is another industry in Persia which bears a close relation to the manufacture of arms; it is the damaskeening in gold and silver, which seems to form an indispensable treatment for oriental weapons. They generally use gold, except when the material is of copper, when silver is used. Sometimes designs of both metals are met with. The workmen of the present time, make up, by a great show, the skill which they do not possess, but they, nevertheless, do not lack gracefulness and elegance. The Persian style is easily recognized, in fact, so easily, that the Persian does not need to impress his mark upon his work. But, have the Persians a style of their own? We may answer this question in the affirmative, if it is sufficient to have a new system formed from an already existing one, or to have carried out actual ideas; in one word, if originality may exist in appropriation. But, if invention is indispensable for the originality of a style, the Persians have very little claims to it, for they have not invented anything which was not already the property of other nations.

The choice in designs in damaskeening is naturally very limited, a sword or sheath not affording any space for the carrying out of large geometrical figures. The swords are rarely damaskeened, they, however, bear always two signs, of which the one indicates the name of the workman, and the other a verse or a sacred passage from the Koran. Daggers, or weapons which are carried in the girt, contain more designs, as a rule, than swords.

THE THREE METHODS OF DAMASKEENING.

The first, named "zarkhonden," is employed if designs in relief are wanted. The design is first drawn by a brush; it then is engraved, small gold wires being afterwards laid into it. These wires must, of course, be large enough that they will project; they are fastened at different points with golden nails. The details are accomplished by engraving. If, for instance, a bird is to be represented, the gold which is laid in has, in general, the shape of a bird; but wings, feathers, and eyes are not indicated. This is done by engraving.

In the second method, named "zarnichanest," the design is made even to the surface of the arm. The gold is pressed in by a stone (nephrit) and is afterwards polished by a paste of emery and olive oil.

The third method is termed "zarkouste," which word is derived from the verb Koubiden, to stamp. It is most generally employed, but only is in use for metals, not for minerals or ivory, which would crack under the blows of the hammer. Instead of carving the designs, as is done in the former methods, it is only indicated. By a peculiar instrument it is then covered with holes, scarcely visible, in which the gold is pressed in the form of exceedingly fine pieces of wire. The arm is hereupon strongly heated and polished with "nephrit." This operation, being repeated, the surface is rubbed with emery and olive oil.

The best workmen live in Ispahan, but the art seems to be very much on the wane. Compared with other arts, it cannot be denied that there is still a great skill present, be it in the general arrangement of the drawing, be it in the transferring of the gold; but we must, in judging such works, also consider the time. The gold in the embossed objects which have been used much, has lost its original brightness and assumed a duller but more harmonious color. We, herewith, do not deny the dying out of this art in a more recent period, but it simply shall be indicated that some middling works of ancient times owe their superiority only to the absence of the luster, which is a merit of time and not of the skill of the artisan.

ARTISTIC OR EXPRESSIONAL DENTISTRY.

J. T. Codman, of Boston, Mass., has communicated to the *Dental Cosmos* an article on the above subject which contains some very novel and interesting views. He says:

"The term 'expressional,' applied to dentistry is new; yet I have found no name which better serves my ideas of what is intended to be conveyed by it, viz., the preservation of the expression of the features after the loss of teeth, or the restoration of the normal expression or a better one on the insertion of artificial teeth.

"That the general mode of inserting substitutes for the natural teeth does not restore or preserve the best expression of the faces of our patients, scarcely admits of an argument. That there are dentists who make an exception to this rule is happily true, and that great general progress has been made in the past ten years toward that desirable end is also true; but that better results are attainable is certain. Doubtless, if dentists understood more of the philosophy of expression, they could attain pleasant results where they have made many failures.

"That the extracted teeth are, to a considerable extent, safe guides for the form, color, size, and shape of the new set is true, yet many cases present themselves where the arch has been overcrowded, and where the insertion of a full artificial set would be impossible without distending the lips and making a bad expression. In such cases it were better to omit some of the teeth, lessening the number, and insert teeth of nearly the natural size.

"Among the prominent failures in the expression of the sets of the present day is that of, 1st, Color—by which they are often detected at once; 2d, Length—being often too long, and sometimes too short; 3d, Size of the teeth—often too large, and often, of late, too small; 4th, Deficiency of form of each individual tooth, or what is called 'want of character,' from lack of curved lines; 5th, Want of prominence and length of the eye teeth; 6th, Too great length of the back teeth, especially in upper sets; 7th, Too much evenness or similarity; 8th, The size of the arch—often too large or too broad, sometimes very much so; 9th, The horizontal line, or line of occlusion, is too straight, often looking as though both sets were made together on one piece and cut apart with a knife.

"Turning from this dismal page of failures, let us give a momentary glance at the expression of character as shown in the teeth and physiognomy of animals in connection with man; for being all revelations of one power and parts of one system, they must all bear some analogy to each other.

"How often we all have enjoyed the pictures of animals, dressed as human beings, exclaiming 'Capital?' at these burlesques on humanity. But it is not the picture that burlesques—the animals themselves do.

"That the physiognomy of the lower animals and that of man bears the same imprint may be brought to mind by the fox with his sharp-pointed teeth, his narrow dental arch, neatly covered with his trim, delicate lips. Observe how meek and quiet he looks, with his twinkling eyes half shut and his nose over his paws. Now arouse him with a rod, and how his whole expression changes; his second nature—his savage side—is uppermost, and his teeth have a most offensive look.

"Then look at one of the rodents, as the rat, with his narrow, displayed incisors, with their mean, contemptible look. He is the fellow that sneaks around at night, makes holes in your mop-boards, and gnaws your lead pipes, and occupies your drains. There is expression in his teeth, but to me it is of an ungenerous sort.

"In contrast to these, look at the incisors of the horse, and one can hardly look at the skeleton in the Natural History Society rooms without feeling that he is grinning at you. Observe the teeth of this animal, for they are worthy of a great deal of study. It almost seems that this was the pattern that dentists took for making teeth. Observe the centrals, how broad and flat they are; how unobtrusive the eye teeth, or canines, if you like the term better. Observe the horizontal line of occlusion, and the broad, regular arch. Do we see malice in this expression? Do we not see a broad, generous nature, perhaps a little coarse, but highly amiable? Who has not heard of a horse laugh—that condition of laughter when the head is thrown back, and from central to molar all the teeth are shown in the plentitude of their ivory luster?

"But my limits forbid following this train of thought further.

"You will say, What has all this to do with the expression of artificial teeth? Have a moment's patience and you may see.

"Observe all these animals, and let me ask you if any one of them looked as though it had in a set of artificial teeth, and you will say that the harmony of their color and the complexion and the perfect adaptation will answer that question.

"Our artificial teeth should have this same harmony, and I announce that no artificial teeth can be perfect without harmony of color between them and the complexion.

"In short, if the color is too light, they make the complexion appear ghastly; if too dark, they apparently darken the complexion.

"All the faults I have named have much to do with the expression. If the teeth are too long, the mouth is opened too wide and the lips are drawn down to cover them, thus thinning the lips, giving a close-mouthed look, except when the person laughs or talks, and then there is too much display of dentistry. If the teeth are too short the lips are drawn up and thickened, giving a shrewish expression, and making it appear at times as though the person had no teeth. If the arch is too large, it takes up the lips and cheek, giving also an undue prominence to the lips, making a sensual or babbling expression, varying according to the size of the arch. Want of prominence of the eye teeth allows the corners of the upper lips to fall down, making a mournful expression. If the eye teeth are too long, and prominent or sharp, we have a savage expression. But leaving many of the criticised points, I desire to speak of size and style in giving characteristic effect.

"A fine, brave, generous boy said to me a few days since, 'are not my teeth larger than usual?' 'They are!' said I. I could have told him so with my eyes shut, for he had a winning, open, frank, generous manner that was not consistent with small teeth. Since then I have worked for a lad some years older, with remarkably pointed eye teeth and bicuspids, but I have no insight into his character, although he was the son of an old friend; his secretive disposition made him reserved in expression.

"Show me, if you can, a person with irregular teeth, and not show me one who is undeveloped at some grand point of character; irregularity being, I contend, mostly want of development.

"Take from your specimens any central tooth, and you may judge to a certain degree, the character of the former owner. The delicate-formed slender teeth you will not call the teeth of a giant but of a delicate woman. Those sound, plump looking teeth are a man's. Those short, yellow, small teeth are usually set in a prominent alveolar ridge and large arch; I will testify that the owner came from a long-lived family and is a great worker.

"From these and similar indications, the dentist must build up his science of expression. As I have said, the natural teeth are a prominent and the best guide the dentist can have; but if these are lost beyond recovery, judgment and the eye of an artist are necessary to give or restore the normal expression.

"What, then, shall the dentist do when the patient comes to him without teeth, desiring artificial ones? First, look at the patient. If the skin is light, the teeth must be in harmony. If the features are large, the teeth must be large also. If thin, and narrow, and delicate, the teeth must be so also. If nervous and long limbed, indicated by long thin hands and feet, the teeth should be long in proportion to the width; and if, with plenty of money in his pocket, he quibbles by the hour for the lowest price, put in a set of narrow teeth, and he will be perfectly satisfied, as it will suit his character perfectly.

"If your generous-hearted, full-souled friend desires teeth, and you place some small, narrow teeth in his mouth, it would be like putting teeth like those of a rat in the mouth of a horse or cow; and if in the mouth of your sharp, versatile friend you place a set of teeth, whose horizontal line shall be straight, and whose eye teeth shall be deficient in prominence, it would be like putting the teeth of a horse in the mouth of a fox or dog. And if in the mouth of your mean, sniveling person you place a generous and wide set of centrals and laterals, you give him a character better than he deserves."

BLASTING WITH NITRO-GLYCERIN AT THE HOOSAC TUNNEL.

From the North Adams (Mass.) Transcript.

Monday, March 2, A. D. 1868, ushered in a snowing, gusty day; the wind, during the preceding night, had been urging puffs of snow, dry and crystalline, through every cranny of the mountain shanty, before whose soapstone stove I had been warming my rheumatic limbs; and, since travel seemed impracticable, I made a virtue of necessity, and accepted an invitation from my host to descend the west shaft of the Hoosac Tunnel, where the temperature, 60 deg. F., would at least be more agreeable than on the mountain side, where the thermometer was then 6 deg. below zero.

So donning a miner's suit, rubber boots, Cape Ann oilskin jacket and southeaster, we stalked through the deep drifts of snow, and at 7, A. M., I found myself standing on the cage that is used for lowering and hoisting in the shaft, beside two pails, each having an inner lining of plate tin, with cover, suitable enough, as it seemed to me, to carry down hot coffee for the miners. These pails, and a conductor's lantern, were in charge of a man equipped in miner's costume, similar to our own, who was exchanging remarks with the topman, whose duty it is to signal the movements of the hoisting apparatus.

A gong sounding, we began to descend rapidly, or rather, as it seemed to me, the shaft began to rise around us in a most alarming manner.

The cold air of the outer world, descending and mixing with the warm, saturated air rising from the tunnel, caused a vapor that rendered the light of the miner's lantern scarcely visible at two paces distance. It is an unpleasant position for a stranger to be in, going down, down, down, with streams of condensed vapor pattering on the head, neck, and shoulders; and to relieve the monotony and suspense of the descent, I addressed myself to that man with the "hot coffee" pails.

"By the way, I thought I caught the word 'glycerin' spoken by that man who let us down."

"Possibly."

"Have they ever used nitro-glycerin in this tunnel? I mean that terrible explosive agent, which tears everything to atoms. I should like to see some of it, and know all about it; it would give one a sensation that would relieve a fellow of this—this oppressive feeling."

My companion deliberately lifted the cover of his pail, and taking thence an open slender tube, which seemed to contain clear water, said:

"There it is."

"What! Good —, in this cage? Do you mean to say we are boxed up in this hole with—?"

"Yes," returning his tin cylinder to the pail, and replacing the tin cover, "that is nitro-glycerin—one of twenty cartridges we are about to use in blasting."

I reflected; here I was, in a box four feet by three feet, no escape from a pail containing enough nitro-glycerin to send us up that shaft, and into eternity for the matter of that, and I had been confounding the "perilous stuff" with hot coffee. There was no help for it now, and as the heavy beat of the steam pumps and warm temperature rendered conversation difficult, I certainly felt as if I had put my foot into it, or something like it.

But we are at the bottom of the shaft.

"Stand clear there, glycerin!"

"All right, sir."

"Where's our car?"

"Here, ready; can I help you?"

"Only by keeping clear with your flaring lamps; push on."

And now, impelled by a brakeman, our car is rapidly driven to a small caboose, or cupboard, some three hundred yards from the shaft, the trip reliever by an inquiry:

"How is it the water's so high?"

"A pump gave out last night; water's been gaining since; the machinist will soon fix it."

My companion now unlocked the door of this little caboose on the left side of the tunnel, examined briefly the signal apparatus, an electric magnet and gong, then the switch or brake, which turns off the current from the wires leading to the heading, and assures himself that whilst charging the drill-holes, no electric spark can pass over the wires by any tampering with the instrument above ground; this done, he resumed the pails, and we now rapidly pushed on to the heading, about one hundred yards distant, the way enlivened by a gushing stream of water; ascending the two benches of rock, we now came upon twelve miners, each with his candle, and the foreman busy examining the finished drill-holes.

"Mr. Gregory, will you send your men back?"

"Hands back from the heading! Glycerin, lads! Pick up your tools; hurry up there, and mind you don't run foul of this man!"

"Where are your holes?"

"Here they are, good and strong."

Eighteen holes are now counted, their diameter and depth gaged; these are found to vary from twenty-six to thirty-two inches in depth, and at various angles, and in various directions from the face, each of them being capable of receiving a cartridge eleven inches long, and one and one-fourth in diameter.

"You need not stay, foreman."

"I'se no fear; I'll just help a bit. Don't mind me; I seen glycerin afore."

Carefully and deliberately a cartridge is removed from the pail; an insulated wire, with priming, exploder, and cork attached thereto, closes the open mouth of the tin cartridge; and still more carefully the cartridge, with its mischievous little wire and fulminating exploder, is now passed into the drill-hole, and pressed down to the extreme end, leaving the wire pendant therefrom like a rat's tail; when this performance has taken place in eighteen holes, a count is made—eighteen.

Now the conducting main wire is brought forward and attached to one of these pendant wires, which, by the way, on close examination, consists of two wires, when attached to one of these, the other is carried to one of the double wires of the next hole, until each of the eighteen holes is linked with the one next to it, and that to the next, forming a series of links, the first connected with the conducting, the latter with the return wire.

Then two wires, when the switch or break is suitably disposed, connect the cartridges in the holes with the electrical machine, 1,500 feet distant above ground, in the timekeeper's office.

Now, bear in mind, there is a break, one tenth of an inch from each other, of the points of the wires in each hole, and this break is armed with a sensitive priming, so that the electric spark, as it leaps from one wire to the other, ignites it; this fires a fulminate, and the explosion of this fulminate explodes the nitro-glycerin, and the nitro-glycerin plays the— with the stubborn, tough, solid rock.

But my mining friend is scrutinizing every connection, and now he counts every hole; none have been missed.

"All back!"

We now turn our backs (with a very satisfactory shrug on my part) on the masses of rock, burrowed with the eighteen drill-holes, each charged with sufficient nitro-glycerin to hurl it into fragments, aye, from the very bottom of these holes, and to send a blast of liberated gases that will hurl a puff of steam and air out of the shaft, 1,500 feet distant.

That pail, I perceive, our companion carries with him. We descend the first bench; at the second he deposits his pail, and we all hurry back to the caboose, where the miner's lights, like the *ignes fatui* seem right welcome.

But where is there a recess, a safe recess, where I may avoid the consequences of my curiosity? Narrowly watching the miners, I am aroused by the inquiry, sharp and quick in tone:

"All back away from the heading?"

"All back."

"Look out for yourselves!"

And then our sober, decided friend enters the caboose; the door is locked; the miners converse; I endeavor to secure a position by which a good number of miners are between me and that heading, and sit me down on an iron pipe, which, Mr. Gregory informs me, is to supply air to the machine drills.

"Look out, now!"

Instantly, I notice the miners carry their hands to their ears; instinctively I follow suit; the hum of conversation has ceased; a dead silence succeeds; the pulsation of the steam pump throbs; the breath comes quick;—oh, this suspense—a singular exaltation of excitement thrills through one.

"Boom—oom—ooom!"

A rush of air—my hat has gone with it; pitch dark, for every light and lantern is extinguished.

"Who's got a match?—no one, I bet."

"Yes; here's one."

"A heavy blast, that; she got it that time."

And now the foreman, our companion, and myself, make for the heading; the miners are told to keep back.

We return to where the ingenious arrangement of wires, aided by the electric machine, above ground, has effected this discharge.

As we approach within fifty feet of the heading, a warm, sweetish vapor is looming up; still on, on, on: here is a mass of rock; move carefully, there may have been a cartridge thrown out unexploded, laying at your feet. If so, don't trample on it, that's all.

Scrambling over the masses of torn broken rock, the heading is at last reached—ragged, indented, a scarred witness of the tremendous power of nitro-glycerin.

After carefully noting that each and every hole has been blown out, we return towards the miners. At the second bench, our friend picks up his pail, and assures himself of the safety of the two remaining cartridges.

We soon come to the miners; the word is passed, all safe; another foreman takes in his gang for another eighteen holes, to be drilled in eight hours, the time allotted for each shaft, and pushed back to the shaft, the truck running into the cage.

Signal being given, we commence our ascent—or, better described, now the shaft rushes down, down, down past us.

Daylight once again, and the pleasant warmth of the tunnel is exchanged for the keen north wind, and 6 deg. below zero temperature. We follow the man with the pails, over the drifting snow, to a shanty, where a good breakfast, and a hot and glowing fire, await him.

"Breakfast ready, Hoecake?"

"All ready. Blast go off all right, sah?"

"Made two feet heading—hurry up that coffee."

"What do you think of blasting, Mr. —?"

"Well, I think it gives a fellow a sort, of a kind of—new sensation, decidedly."

DANGERS OF THE USE OF THE LIGHTER PRODUCTS OF PETROLEUM.

Two disastrous accidents occurring from the explosion of the lighter products of the distillation of petroleum, one in Ohio and another in Pennsylvania, may be considered as warnings to those who use or deal with these highly inflammable substances. The first was in East Cleveland, Ohio, where the escaping gas from a reservoir of gasoline destroyed a handsome dwelling and seriously injured several of the inmates. The building was lighted by an independent gas apparatus, the reservoir of the liquid gasoline being at some distance from the house, the vapor being conducted to and through the dwelling by pipes in the ordinary manner, as is the common gas. Steam was used to heat the gas generator in excessively cold weather; but the gas pipes in the building had been leaking for some time, and the flame of a candle ignited the free gas in the basement, producing an explosion that nearly destroyed the building, the fire thus engendered finishing the work. Several of the inmates were severely injured.

The other case we notice occurred at Miller's Farm, just below Titusville, Pa., where a tank of benzine exploded; two men being burned to death and the distillery, or refinery in which the tank was located, destroyed.

The terms "gasoline," "benzine," "benzole," and "naphtha" are generally used indiscriminately to denote the more volatile portions of natural earth oil, or petroleum, released during the process of distillation or refining. Chemists use these terms in a more restricted or exact sense; but these products are so little removed from a gaseous state that they continually and spontaneously give off inflammable and explosive vapors at comparatively low temperatures, which require but a spark or a flame to instantly ignite, when the result is similar to the explosion of gunpowder.

REFORMS NEEDED IN THE CONSTRUCTION OF SOME ARTICLES IN COMMON USE.

The age in which utilitarianism took precedence of everything else has passed. It is no longer enough that an article designed for common use shall simply be useful, a cultivated taste requires that it shall also be beautiful. This is right; and if our designers would content themselves with the proper combination of usefulness with beauty of form, there would be no need to criticize their work. The truth is, however, that in aiming to render their work as fair to the eye as possible they forget in many cases the claims of utility.

Household furniture and table and cooking utensils, are particularly open to criticism on this score. We set ourselves to season our food from a graceful pepperbox having so narrow a neck that the finely-pulverized condiment clogs the passage, and free delivery of the pepper is impeded, while delivery of pungent expletives against the petty cause of our annoyance becomes altogether too free. Tell us also, ye artisans who invent those marvelous instruments of torture called chairs, why we should not revenge our aching backs, and affections of the spine, by wishing your handiwork at the bottom of the ocean. Beautiful to look upon are your carvings and your upholstery, but to sit upon most wearisome. True, you sometimes give us a luxurious arm chair, with angles properly inclined, and soft luxurious cushions that lap us as comfortably as a mother her child. That shows what you can do when you take into consideration the proper use of a chair. But those cushioned inclined planes, with backs for ornament not for use, since if you lean back against them you must exert yourself to keep from sliding off the seat upon the carpet, why condemn us to these persecutors and destroyers of vertebral columns? Why put casters on delusive footstools that no sooner feel the weight of your weary limbs than they commence a struggle to run off and shirk their duty? Why make our writing desks and tables so high that in order to avoid that lancinating torment under our right shoulder blade, we must amputate their legs and thus secure comfort for ourselves by a sacrifice of the comeliness of your handiwork, for whose graceful proportions you have made us pay liberally in dollars and cents, as well as in patience, while we yet hesitated to mutilate them?

But it is not alone of household furniture or utensils that we find reason to complain. The same criticism can be made upon nearly all the articles which we most commonly use. Is it not possible to combine utility with beauty in the construction of such articles? We answer, yes. But if it were not possible, we for our part, would pronounce in favor of comfort minus beauty rather than beauty minus comfort.

The New Orleans Elevator.

Large elevators seem to be coming more and more into use throughout the country. The rapidity with which these are being erected at different points is a demonstration of the great value and convenience to the grain dealers. A new one, of very large proportions, has just been completed at New Orleans, a description of which we extract from the New Orleans *Crescent*:

The storage capacity of elevator, which is situated 240 feet from edge of wharf and across the street and sidewalk, is 750,000 bushels; built after the style and material of Chicago, Milwaukee, and St. Louis elevators. The marine elevator at edge of wharf is 102 feet high—will take grain out of the largest or smallest vessel in high or low water at the rate of 6,000 bushels per hour. The grain is carried into elevator 240 feet through the conveyor building over wharf and street, so the handling and exposure to the air are equal to ordinary drying machines.

The drying machine is built in a fire-proof house attached, and the drying is done through tiles rapidly at the rate of 2,000 bushels per hour, and all by machinery, and so constructed and done there is no risk from fire, and at the trifling expense above.

The warehouse has a storage capacity of 60,000 barrels, which covers the whole wharf, 2,000 by 275 feet, one story, covered with plastic slate roof and sides, and doors of iron. Two large iron tanks of water of 200 barrels capacity stand on top of the elevator, kept constantly full by a force pump, with iron pipes which run down through each story of the building, arranged so hose can be attached in each story, and carry water anywhere in elevator or warehouse or boat or wharf.

Editorial Summary.

The managers of the Erie Railway Company have introduced a reform worthy of imitation by other roads. It is that of advertising for proposals for supplies, instead of buying them, as is too often the case, from some director or favored official, at his own price. The Erie Company invite all the manufacturers of spikes, chairs, nails, car springs, car axles, locks, and other hardware, and dealers in lumber, to come forward and name the terms at which they will furnish the articles wanted.

Ink.—W. R. Shelmire, of Philadelphia, writes us that he has succeeded in making a good copying ink from common violet writing ink, by the addition of 6 parts of glycerin to 8 parts of the ink. Using only 5 parts of glycerin to 8 of the ink, he has found the ink to copy well fifteen minutes after it has been used. He says with fine white copying paper the ink will copy well without the use of a press.

According to the *Mechanics' Magazine*, a patent has been taken out in France for making crucibles from magnesia, which forms the best materials for crucibles to melt platinum, iron, or steel in. They are molded by pressure, and are then exposed to the heat of an oxyhydrogen flame, by which they are brought to a semi-pasty condition, when the magnesia acquires its greatest density, cohesion, and hardness.

Damages Recovered against a Brooklyn Druggist.—Damages amounting to five thousand dollars were recently recovered from a South Brooklyn druggist, for having sent in October 1867, to a patient, an over dose of morphine which caused her death. Our recent article on "Poisonous Drugs and Cosmetics," was written before this judgement was rendered.

An expedition has started from Germany to visit Egypt. for the purpose of making a collection of photographic views of ancient inscriptions and monuments. An attempt has been made to photograph subterranean chambers at Memphis, by the use of the magnesium light.

The American Institute proposes to test the merits of the various petroleum burners, those who desire to find out the relative merits of their inventions can address John W. Chambers, care of the Institute, New York.

Employers in any business would subserve their own interests by so closely observing the behavior of their help as to note their attempts to do their duty, rather than to watch for every infraction of rules.

Amount of material used is no proper estimate of the product. The watch spring is more costly than the spike. Labor costs, generally, more than material; brains, than iron.

In using the grindstone it is more important to sharpen the tool than to raze the stone. It does not require a hundred pounds pressure to the square inch to grind an ax.

MANUFACTURING, MINING, AND RAILROAD ITEMS.

The new steel manufactory established last March in Chicago, is we learn from the Chicago *Railway Review*, in successful operation, having a capacity of turning out 2 600 pounds of steel daily, the steel being of excellent quality.

According to the *Ellsworth American*, Maine, the annual production of lumber there is 35,000,000 feet of long lumber; 203,000 sugar box shooks; 200,600 laths; 5,000,000 shingles; 200,000 clap boards, and a large quantity of smaller stuff. Value of annual production estimated at from $790,000 to $950,000.

Holyoke, Mass., has ten paper mills in operation, turning out twenty-six tuns of paper daily. The largest manufactory of writing paper in the United States is said to be located in this place. It turns out five tuns per day.

The October product of the Hecla copper mine was 259 tuns; of the Calumet 162; of the Hancock, 20 tuns, 69 pounds; of the Evergreen Bluff, 22 tuns 941 pounds; of the Knowlton, 20 tuns, 1,306 pounds.

All the operatives under fifteen years of age, in the knitting factory in New Britain, Conn., have been discharged for three months, in accordance with the statute forbidding their employment more than nine months in the year.

Building railroads in winter and by moonlight may seem strange to Eastern people, says the Kansas *Journal*, but it has been done heretofore, and will be again, if we have our usual Kansas weather.

The Union Pacific has a lodging house for a force of four hundred men near the summit of Sierra Nevada, whose sole duty is to keep the track in that vicinity clear of snow during the winter.

Only 330 miles of railroad need be built to connect Portland, Oregon, with the Pacific Railroad by steam; 315 miles of the 645 miles can be traveled by steamboat.

The purchase of the leased lines of the Chicago and Northwestern Railroad Company by the Union Pacific is mooted.

Veins of coal three feet in thickness are being worked in Southern Kansas, and reports say are passing well.

NEW PUBLICATIONS.

NEWSPAPER DIRECTORY.

Messrs. Geo. P. Rowell & Co., the enterprising advertising agents, No. 40 Park Row, New York, are about to issue a complete directory of American newspapers, to be printed on fine paper and well bound. Price $5.

EVERY SATURDAY.

One of the features of the new volume of "Every Saturday," published by Field, Osgood & Co., of Boston, will be the series of occasional papers entitled "New Uncommercial Samples," by Charles Dickens.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

PAPER PULP.—C. C. Fitzgerald, Phœnix, N. Y.—This invention relates to a new article of manufacture prepared from the stock of the common plantain—plantago-major—which, especially in the West Indies, grows to a considerable size, and from which, by proper manipulation, a superior paper pulp can be produced.

ICE CUTTER.—C. W. Flint, Washington, D. C.—This invention has for its object to furnish a simple, convenient, and effective machine for cutting or shaving ice in restaurants, saloons, for soda fountains, and for similar uses.

WAGON BRAKE.—George Wesley Welsh, and George Wylie, Arlington, Wis.—This invention relates to a new and improved automatic brake for wheel vehicles, and it consists in a novel construction and application of the same, whereby a very simple, economical device for the purpose specified is obtained.

SHINGLING ROOF ANGLES.—Benjamin Flowers, Jerusalem, Ohio.—This invention relates to a new and improved method of shingling the gutters, valleys, or angles formed by the joining of roofs, whereby all leakage is prevented without any important increase in the expense.

BILL HOLDER.—James D. Field, Wataga, Ill.—This invention relates to a new and improved method for holding bills, or orders, or other paper which it may be necessary to refer to.

STEAM GENERATOR.—D. F. McKim, Austin, Nevada.—This invention consists in using, in combination with a steam boiler, a series of generating and conducting tubes, connected together and to the boiler, through which the feed water is forced by the feed pump.

METHOD OF CONSTRUCTING THE CYLINDERS OF STEAM ENGINES.—William Inglis, Manchester, England.—This invention has for its object, by certain improvements in the constructive details, to render certain kinds of steam engines more durable, and less likely to get out of order, than they have hitherto been.

TUBES OR FLUES OF STEAM BOILERS.—George E. Van Amringe, New York city.—This invention has for its object to improve the construction of the flues of steam boilers so as to economise the heat, or in other words, to obtain a greater practical effect from the same amount of fuel than when the flues are constructed in the ordinary manner.

SUMMER ATTACHMENT FOR STOVES OR RANGES.—N. O. Bond, Hyannis, Mass.—The object of this invention is to provide an attachment for stoves, whereby the necessity of building a fire in the fireplace of a stove or range s obviated in summer, when a small temporary fire only is needed; thus economizing fuel, labor, and time, and avoiding the excessive heat occasioned by the ordinary fire.

COOLER FOR WATER, MILK, ETC.—Herman Pietsch, New York city.—This invention has for its object to furnish a simple and convenient cooler for water, milk, etc., and which may at the same time be used as a refrigerator when required.

DOOR RUG ALARM.—R. B. Carsley, New York city.—This invention has for its object to furnish an improved alarm for attachment to doorways and window frames, which shall be so constructed and arranged that it may be impossible for any one to enter through the door or window even when said door or window may be open, without sounding an alarm, and which shall at the same time be simple in construction, easily applied, and readily disengaged when not required.

MAKING CONFECTIONARY.—John Gardner, Philadelphia, Pa.—This invention relates to a new and useful improvement in the manufacture of ornamental confectionary, whereby the same is greatly improved.

BREECH LOADING FIRE-ARMS.—Pierre Jules Jacob Noël, Paris, France.—This invention relates to improvements in breech-loading ordnance of the revolving breech class, designed to provide an arrangement whereby plurality of shots may be fired simultaneously if desired, or successively with intervals for sighting when accuracy of firing is required.

WATER SUPPLY REGULATOR.—George P. Nutting, Chicago, Ill.—The object of this invention is to maintain the proper water supply in boilers by admitting steam to the supply pump, whereby the water reaches a certain level; and also to announce to the attendant the state of the water level when for any reason the supply pump fails to maintain the proper level.

VENTILATOR OPENER FOR CARS, ETC.—W. C. Stickney, and J. McGee, Steubenville, Ohio.—This invention has for its object to furnish an improved device, by means of which the pivoted sash shutter or valve of the ventilator may be opened, closed, or secured at any desired angle, conveniently and securely.

ATMOSPHERIC GOVERNOR.—B. Mackerley, Paint, Ohio.—This invention consists of a cylinder having a piston actuated by a crank or other suitable means connected to the machine or motor for which it is to act as a governor. The cylinder being provided at each end with weighted valves, which govern the ingress and egress of air into the cylinder, and thereby the resistance of the piston to the machines by the force of the blast on the valves.

CULTIVATOR.—James Hinds and James Gee, Conologue, Ill.—This invention consists of an improved arrangement of means for raising the plows out of the ground and suspending them above it; also an improved method of hanging the plow beams to the frame; and also an improved means of adjusting the pitch of the plow.

HAND RAKE.—A. Winters, Washington, Pa.—The object of this invention is to provide a more efficient hand rake than was heretofore in use. It consists in forming the rake head curved and attached to the handle with its concave side toward the handle. The tang is also bent up so that the whole of the teeth will operate when in contact with the ground.

AUTOMATIC ICE CHUTE.—John A. Wolfer, Rondout, N. Y.—This invention relates to a new and useful improvement in the method of handling ice in the process of transferring it from the ice house to barges or vessels for transportation.

PAPER-MAKING MACHINERY.—James Wrinkle, Lee, Mass.—This invention relates to a new and useful invention in paper-making machinery, and has for its object the prevention of the blue spots and lumps being formed or made in the paper during the process of manufacture.

HORSESHOE.—Joseph Barker, Champlain, N. Y.—This invention is designed to prevent what is termed "over-reaching" in horses, which consists in striking the rearpart of the fore feet with the bent part of the hind feet while trotting.

DEVICE FOR TAKING UP TREES.—Jesse Ryder, Sing Sing, N. Y.—This invention relates to a new improved device for taking up trees with a view of transplanting them, and is more especially designed to facilitate the transplanting of large trees.

APPLYING CAST STEEL TO ARTICLES OF IRON.—William H. Singer, Pittsburgh, Pa.—This invention relates to an improvement in making "iron center," "iron face," "iron back," or "cast steel," whereby (for the uses for which steel is intended) the articles are equal to pure steel.

PLOW.—Edward Wiard, Louisville, Ky.—The object of this invention is to provide a simple and effective means for attaching the straight handle of plows to the mold board.

LAMP.—W. W. Jacobs, Hagerstown, Md.—This invention relates to a new and improved lamp of that class which are designed for burning coal oil and other similar hydro-carbons which require a large amount of oxygen to support proper combustion.

COTTON GINS.—A. A. Porter, Griffin, Pa.—This invention relates to an improved arrangement of means for causing the cotton being fed with the gin to have a to-and-fro movement in a lateral direction for bringing it more perfectly into contact with the saws, thereby more thoroughly separating the seed, and at the same time working the fiber more evenly.

REEL AND SWIFT.—Wm. G. Brown, Canton, N. Y.—The nature of my invention relates to improvements in reels for winding yarn whereby it is designed to provide a reel that may be also used as a swift, and with adjustable arms which may be adapted to wind skeins of any length, and which will also give a signal to indicate when a given number of yards have been wound.

BORING TOOLS.—C. W. LeCount, Norwalk, Conn.—This invention relates to a useful improvement in tools (as drills and augers in boring bits) for boring metals and wood, and it consists in grooving the sides of the drills for boring metals, and the lips of augers and double-lipped bits for boring wood; whereby they are made to operate more perfectly and with much ease than ordinary boring tools.

STOP FASTENER FOR WINDOWS.—Henry E. Hull and Burlin T. Merritt, Sag Harbor, N. Y.—This invention relates to an improvement in the method of fastening the stop or bead casings which hold in the sashes of windows, and it consists in the application of an eccentric lever for that purpose, in combination with a pin in the bead or stop casing.

FILTERING OR POURING BOTTLE.—V. M. Griswold, Peekskill, N. Y.—The object of this invention is to construct a bottle for photographers, chemists, apothecaries, and other uses, which is so arranged that in it the liquid is filtered, and that such filtered liquid can, at the same time, be at will poured out of the bottle. It further consists in fiting an open tube through the stopper of a larger bottle. The liquid to be filtered is poured into the larger bottle, and is, before it can ascend in the tube, filtered so as to be pure when in the tube. It can then be conveniently poured out through the upper end of the tube without interfering with the filtering process.

CHILDREN'S CHAIR.—J. H. Apel, Boston, Mass.—This invention has for its object to prevent the chairs of children from falling over while the children sit at table. Many children have been injured by the tipping back of chairs, and as their chairs have to be higher in order to bring them within reach of the table, the danger of falling, as well as the subsequent injury, will be greater than on ordinary chairs. It also consists in connecting the arm supports of the chair with the table by means of chains and screw-clamps, so that thereby the chair will be fastened to the table and cannot fall.

FEED ATTACHMENT FOR MACHINES.—Samuel Brown, Philadelphia, Pa.—The object of this invention is to provide an improved motion of the fingers of the feed attachment, whereby the said fingers are actuated to move forward in feeding the material to the machine in a horizontal manner, and at the completion of the forward movement, withdraw below the surface of the feed board or apron and return beneath the said board to again rise and repeat the feeding movement, thus leaving room (during their backward movement beneath the feed board), to place on the apron the succeeding quantity of material which is to be fed up to the operating mechanism of the machine.

MACHINE FOR WEIGHING AND MEASURING GRAIN.—Lester Reynolds, Owatonna, Minn.—This invention is a cheap, simple, and durable apparatus for automatically weighing and measuring grain and registering the quantity thereof.

WROUGHT-IRON PIER FOR BRIDGES.—E. M. Grant, Macon, Ga.—This invention has for its object the construction of a simple, strong, cheap and durable iron pier for bridges and other lofty structures.

GAS MACHINE.—Jacob D. Spang, Dayton, Ohio.—The object of this invention is to improve the process of making illuminating gas or vapor from naphtha, gasoline, and other hydro-carbons, that a better gas can be produced, in larger quantities and at less expense, than heretofore; and the same machine can be employed, at pleasure, either to the manufacture of gas, directly from the hydrocarbon, or to the carbureting of common atmospheric air, as may be desired.

Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; beside, as sometimes happens, we may prefer to address correspondents by mail.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisemets at $1 00 a line, under the head of "Business and Personal."

☞ *All reference to back numbers should be by volume and page.*

W. R. W., of Wis.—A caveat may be extended from year to year upon payment of the $10 official fee. There is considerable excitement about velocipedes in this city, and training schools are in operation. With the opening of spring the interest will increase. Some manufacturers are overcrowded with orders. Such an improvement as you speak of ought to pay; but this depends so much upon proper management that we cannot give advice.

J. S., of R. I.—You will find nothing better for removing external and temporary rust from steel and iron than cocoa nut husk. It is better than cotton waste and oil or turpentine. We always kept it in the shop for cleaning polished surfaces that had become rusted.

W. B. C., of Mass.—Oiled furniture that has been scratched or marred may be restored to its original beauty simply by rubbing boiled linseed oil, used by painters, on the surface with a wad of woolen rags. Varnished furniture, dulled, may be similarly restored by the use of a varnish, composed of shellac dissolved in alcohol applied in a similar manner. Common beeswax rubbed over furniture and heated by the friction of a woolen wad briskly used is also an excellent furniture polish.

A. N. B., of N. Y.—Writing ink should be kept carefully from the air if it is desired to preserve it limpid and in proper condition for writing. We have kept ink in a small office inkstand for several months pure and in good condition by keeping it covered from atmospheric contact. The atmosphere oxygenizes it and renders it thick and viscid.

J. W. H., of———Informs our readers that a better material than shagreen or shark skin for striking matches upon, is a section of iron wire cloth of the grade from No. 29 to No. 30; not being affected by damp weather, nor clogging. Our correspondent says it is not in general use. This is so, but it is used by those who, thinking, know.

A. G. B., of Mass.—To remove clinkers from the fire bricks of an ordinary cooking stove, put in a half peck of oyster shells on the top of a hot coal fire. The clinkers will loosen from the bricks. You may need to repeat the process.

B. H. M., of N. H., writes that he has succeeded in making plaster casts so tough that they will bear the driving of a nail into them without cracking, by immersing them for a sufficient time in a hot solution of glue, to permit its permeating the entire mass.

J. H., of Mass.—A lacquer for "bronzed dipped work" may be made thus: Alcohol, 12 gallons; seed lac, 9 lbs.; turmeric, 1 lb. to the gallon; Spanish saffron 4 oz. The saffron may be omitted if the lacquer is to be very light. A varnish for silvered brass may be obtained by dissolving shellac in alcohol. Some prefer pure copal varnish and others gum Arabic dissolved in alcohol.

D. F., of Nova Scotia.—This correspondent sends a specimen of concretion from the inside of his boiler, which is simply a carbonate of lime, very hard and about one eighth of an inch thick. He says his boiler is of the locomotive pattern and therefore difficult to free from scale by chipping. He asks for some composition that will remove the scale and prevent its future formation. Such compositions are advertised in our columns, but we have never tested them. Winan's boiler powder, however, we have heard recommended by practical engineers. Pure water for the boiler is a certain remedy.

P. V. C., of Me., asks if wearing rubber boots continuously is injurious to the feet. We do not consider them particularly so. They retain the perspiration and keep the feet moist which may be uncomfortable and inconvenient, but not necessarily injurious. A friend states that wearing rubber boots for several months while mining in California softened his corns and reduced them to natural flesh.

J. O. S., of Mass.—Asafœtida, which you incorrectly denominate "that stinking African gum," inasmuch as it is of Asiatic origin, is largely used as a condiment by the people of India and Persia, and is an important component of some of our relishes and sauces. Its effects on the system is that of a moderate stimulant, an expectorant, and anti-spasmodic. Prejudice concerning its odor is the worst objection that can be urged against it, an objection that may also be brought against that delicious vegetable, the onion.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, an Extra Charge will be made.

An Amateur offers for sale an elegant lathe, a small planer, and many attachments and tools. Address Amateur, Box 5669, New York P. O.

For sale cheap—one engine lathe, 5 feet swing, 20 feet bed, in perfect running order. Address D. Lane, Montpelier, Vt.

Second-hand locomotive or other tubular boilers, of 100-H. P., in good order, wanted. Address M. P. Smith, Box 1158 P. O., Baltimore.

A brass molder, who thoroughly understands the whole business of a brass foundery, can obtain a permanent situation at the Cleveland Brass and Pipe Works, No. 61 Center st., Cleveland, Ohio.

Air-pump manufacturers please send circulars to B. Mackerley, Paint, Highland Co., Ohio.

Get a fire extinguisher for your building. It may save it from destruction. Send to U. S. Fire Extinguisher Company, 8 Dey st., New York, for descriptive circular.

Peck's patent drop press. Milo Peck & Co., New Haven, Ct.

For fifty cents I will send, postpaid, one of my patent paper cutters and rulers. Address S. W. Wilcox, South Milford, Mass.

Wanted—A man competent to furnish drawings and make wood patterns. Address D. S. Quimby, Henry, cor. Poplar st., Brooklyn, N. Y.

$1000 will buy the entire right for the cheapest, strongest, and best "Screw Wrench in the United States, (latest patent). Sample sent to manufacturers. Address Alling & Co., Madison, Ind.

Wanted—Marbelizer of slate, marble, and iron mantles. Address Bissell & Co., Pittsburgh, Pa.

Water-power, with grist & saw mill, 90 miles from N.Y., for sale, good location for paper mill or manufactory. H. Stewart, Stroudsburg, Pa.

Fire-arm patent for sale.—The patent for breech-loading fire-arm, issued to Robert E. Stephens, June 11, 1867. A new and useful improvement. For terms, address C. Legge box 773 New York Postoffice.

J. H. White, Newark, N. J., will make and introduce to the trade all descriptions of sheet and cast metal small wares, dies and tools for all kinds of cutting and stamping, patterns, etc., etc., for new and experimental work.

Wanted—A good man, thoroughly posted in the working of spoke and wheel-making machinery, as foreman in a wheel factory at Marietta, Ohio. A good salary will be paid to one who can come well recommended. Address F. W. Minshall, Sec., Postoffice box 204, Marietta, Ohio.

See A. S. & J. Gear & Co.'s advertisement elsewhere. Keep posted.

For descriptive circular of the best grate bar in use, address Hutchinson & Laurence, No. 8 Dey st., New York.

For solid wrought-iron beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for Lithograph, etc.

N. C. Stiles' pat. punching and drop presses, Middletown, Ct.

Prang's American chromos for sale at all respectable art stores. Catalogues mailed free by L. Prang & Co., Boston.

Winans' boiler powder, N. Y., removes and prevents incrustations without injury or foaming; 12 years in use. Beware of imitations.

The paper that meets the eye of all the leading manufacturers throughout the United States—The Boston Bulletin.

Official List of Patents.

Issued by the United States Patent Office.

FOR THE WEEK ENDING DECEMBER 22, 1868.

Reported Officially for the Scientific American.

SCHEDULE OF PATENT OFFICE FEES:

On filing each caveat	$10
On filing each application for a Patent (seventeen years)	$15
On issuing each original Patent	$20
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On granting the Extension	$50
On filing a Disclaimer	$10
On filing application for Design (three and a half years)	$10
On filing application for Design (seven years)	$15
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85,059.—Apparatus for Drying and Pressing Pantaloons.—Joseph Braun, Rochester, Pa. Antedated Dec. 11, 1868.

85,060.—Apparatus for Cleansing Clothes.—Joseph Braun, Rochester, Pa. Antedated Dec. 8, 1868.

85,061.—Brick Machine.—John Bretz, Wm. Sangster, and John F. Bretz, Springfield, Ill.

85,062.—Base Burning Stove.—W.S.Bronson,Hartford,Conn.

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85,070.—Article of Food.—Wm. J. Coleman, Bury St. Edmunds, and Alfred Coleman, London, England. Patented in England Nov. 19, 1867.

85,071.—Furniture Tip.—O.B.Collins,Carthage Landing,N.Y.

85,072.—Gate.—Wm. H. Cowley, Cleveland, Ohio.

85,073.—Chuck.—Samuel G. Dare, New York city.

85,074.—Car Brake.—D. H. Dotterer, Philadelphia, Pa. Antedated Dec, 5, 1868.

85,075.—Horse Blinder.—John Dunlap,Madison township,Pa.

85,076.—Locomotive Steam Engine.—Robert F. Fairle, London, England. Patented in England Nov. 14, 1867.

85,077.—Boot and Shoe Shave.—L. H. Farnsworth, Hudson, Mass.

85,078.—Paper File.—James D. Field, Watage, Ill.

85,079.—Paper Pulp.—C. C. Fitzgerald, Phœnix, N. Y.

85,080.—Ice Cutter.—C. W. Flint, Washington, D. C. Antedated Dec. 19, 1868.

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85,093.—Carriage.—N. L. Hatch (assignor to himself and Charles Dyer, Cape Elizabeth, Me.

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85,175.—Apparatus for Concentrating Extract of Tanbark.—Benjamin Irving, New York city, assignor to H. A. Taylor, Malone, N. Y.

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85,180.—Cartridge Charger.—Palemon Powell, Cincinnati, Ohio.

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REISSUES.

70,775.—Belt Lacing.—Dated November 12, 1867; reissue 3,236.—Holland C. Babcock, Cincinnati, Ohio, assignor to himself and Marshall Jewell, Hartford Conn.

48,244.—Circular Kiln.—Dated June 13, 1865; reissue 3,237.—Friedrich Edward Hoffman, Berlin, Prussia.

77,291.—Tea and Coffee Pot.—Dated April 28, 1868; reissue 3,238.—Amasa C. Kasson and Nelson C. Gridley, Milwaukee, Wis., assignees of A. C. Kasson.

71,191.—Process for Cleaning Wool and other Fibers.—Dated November 19, 1867; reissue 3,239.—Division A.—Osborne Macdaniel, New York city.

71,191.—Process for Cleaning Woolen and other Fabrics.—Dated November 19, 1867; reissue 3,240.—Division B.—Osborne Macdaniel, New York city.

69,588.—Carriage Spring.—Dated October 8, 1867; re-issue 3,241.—Jacob G. Reiff, Lancaster, Pa.

31,404.—Knitting Machine.—Dated February 12, 1861; reissue 3,242.—Mark L. Roberts, Mount Union, Ohio.

71,241.—Railroad Car Axle Box.—Dated November 19, 1867; reissue 3,243.—T. B. Stewart, Wethersfield, Conn.

DESIGN.

3,297.—School Desk.—W. P. Uhlinger, Philadelphia, Pa

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For 1869.

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES

Vol. XX.—No. 3. [NEW SERIES.] | NEW YORK, JANUARY 16, 1869 | $3 per Annum [IN ADVANCE.]

Improved Machinery for Planing and Molding Curved Forms.

In No. 24, Vol. XIX, SCIENTIFIC AMERICAN we illustrated and described two machines, manufactured by the Combination Molding and Planing Machine Company, designed to plane and cut moldings of straight or irregular forms with rapidity, exactness, and economy of material. In this number we present views of two other machines involving the same principles, and manufactured by the same concern, who claim to the proprietorship of no less than sixteen patents on wood working machinery. The one represented in Fig. 1 is called the Elliptical Molding Machine and is intended to "stick" or cut moldings of an elliptical, or oval, circular, or sinuous form. Its parts are simple and direct in operation; it is adapted to all thicknesses of stock and every variety of pattern. The cutter shaft is horizontal, and the projecting end in front is adapted to receive a number of cutters of different forms, which may be almost instantly adjusted to cut to any depth required. The work to be cut is held and guided firmly and accurately by means of feed and friction rollers in combination with vertical guides which keep the work down to the table by means of adjustable weights.

The engraving is so exact and clear in its details that a mere reference by letters to the principal parts will be sufficient for a proper understanding of the principle and the operation of the machine. The cutter shaft is driven from the pulley, A, on the horizontal shaft that receives power on the pulleys, B, one fast and the other loose. A belt from this shaft is received on a back intermediate shaft, C, from which a quarter turned belt is led on to an upright shaft, D, that in turn, by a similar belt, rotates a horizontal shaft under the working table. This shaft by means of a worm engaging with a gear on an upright shaft drives the feed roller which is set with spurs or teeth, that engage with a perforated metallic strap secured to the pattern on which the piece to be molded is fastened. This pattern with its piece is held to the feed roller by means of two friction rollers revolving on studs that are secured to a sliding piece in the table. They are held against the pattern by means of a weight, E, and can be disengaged instantly for the release of one piece of work and the reception of another by means of the lever, F. The handle, or crank, G, is used to raise or lower the table and its appurtenances by means of a worm, gear, pinion, and rack. The hand wheel, H, turns a screw that moves the head with the cutter shaft forward or back. The weights, I, serve to hold the work to the table, having on the lower end of their shafts horizontal guides for this purpose, which may be adjusted by means of nuts engaging with the threads on the upright shafts.

Fig. 2 represents the Universal Molding Machine, and is a combination of the Variety Molding Machine illustrated in No. 24, Vol. XIX, and the machine just described. It is intended to subserve the purposes of both these machines in establishments of limited capacity. The principles involved and the operations are the same as those of the other machines, except that it may be used with horizontal or vertical cutter shafts at will. The engraving shows one upright cutter head projecting above the main table, as in the Variety Molding Machine, and another in a horizontal position, as in the Elliptical Machine. This latter cutter, can, however, be turned to an upright position and be made to perform the same work as the cutter head in the Variety Machine. The method of holding, guiding, and feeding the stock, of elevating, depressing, or adjusting laterally the table and cutter heads is the same as before described for the other machines, with this difference: that the working table corresponding to that of the Elliptical Machine is supported on an independent pedestal, so that when not in use, and the room it occupies may be wanted for other purposes, it may be removed. This table can be elevated with its superincumbent work and parts by means of the hand wheel seen in front, a worm, gear, pinion, and rack. The support of the main table is a single casting, very strong, and so constructed as to allow plenty of room for the action of the belts, and yet give a very firm foundation. Letters of reference are deemed unnecessary in describing this machine.

These machines, together with the Grosvenor Saw Bench, illustrated and described in No. 3, Vol XIX, form a set of tools with which all kinds of straight and curved moldings may be produced with a great saving of labor and time. They are manufactured by the Combination Molding and Planing Machine Company, who may be addressed at No. 424 East Twenty-third Street, New York.

Fig. 1

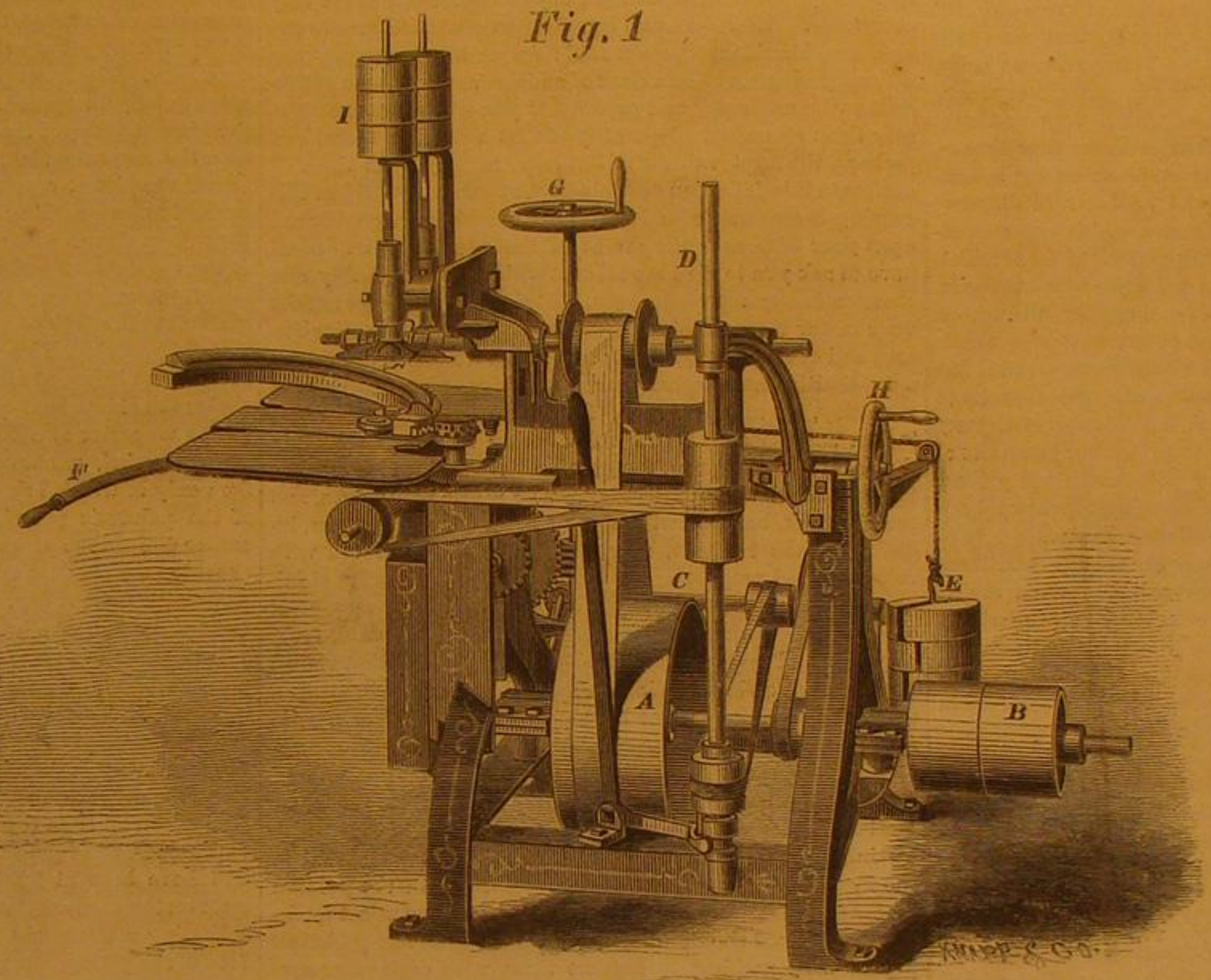
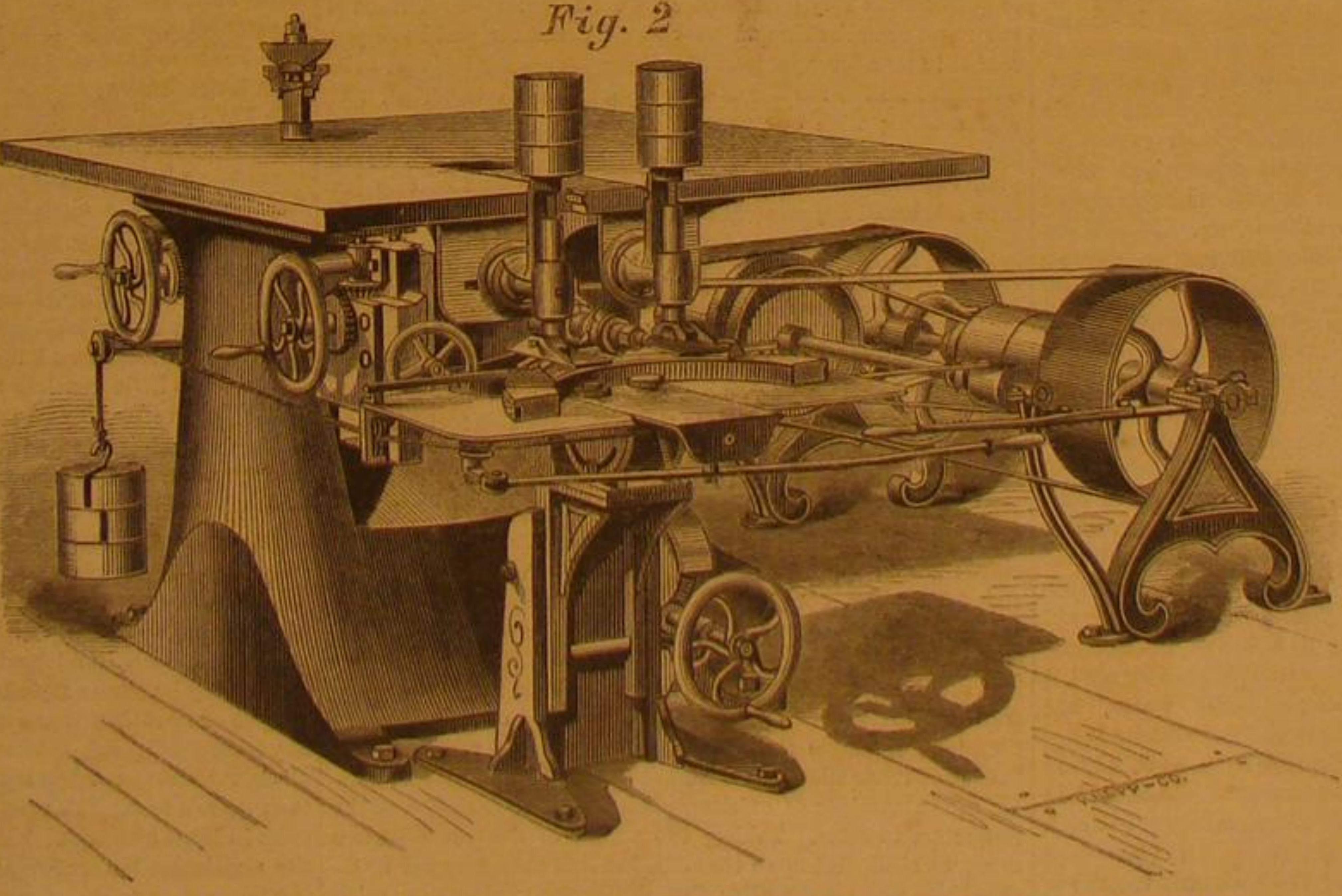


Fig. 2



ELLIPTICAL MOLDING MACHINE AND UNIVERSAL MOLDING MACHINE.

THE EVILS OF PAINTING, AND THEIR REMEDY.

It has been said, and with much truth, too, that "House-painting might, with study, and acquirement of correct taste and more extensive information, resume its rank as a liberal art." There is no reason why it should not. It is an art, and should be recognized as such, and will be when the painter shall have sufficient interest to do something more for its elevation. It is at a low ebb at present; for, while the various other branches of the fine arts have their elaborate volumes of reference, and art journals of deep research and investigation, and latest discoveries and improvements, for the benefit of their artists, the house and sign painter and the grainer are left to their own resources, to catch what they may by individual experiment and the careful observation of their own mistakes.

Though America may boast of many excellent painters, who may not be excelled on the earth, yet they are almost lost amid the vast multitude of ordinary, indifferent, and miserable ones. The long apprenticeship and practice of the former seem almost thrown away, for they stand a very little better chance, in the aggregate of success, than others who have spent little or no time in the study of the business. A poor workman can and will work cheaper than a good one; and, consequently, competition comes into service, and the finished workmen are obliged to learn their trade more thoroughly, that is, learn the art of slighting, before they are able to cope with their competitors, and obtain, like them, an honest living. This spirit is caught up by the employer, and, in the rage to get everything cheap in this go-ahead age, the lowest bidder, without regard to quality, too often gets the job; so, many good and poor workmen naturally fall into that uncertain and unsubstantial manner of doing work that characterizes all the sham, slop-shop works of decorative art. It must be understood, however, that these remarks have only a limited reference, for there are both painters and employers who well understand these practices, and whose correct taste—and liberal pockets—keep them mindful of the purity of the art of decoration. And, in justice to the inferior workmen, it may be remarked that it is not so much a fault with them as it is a want of facilities for learning. There are no published books of any utility; and then painters are very chary of their knowledge, and do not like to impart it too freely.

There should be a remedy for this evil, and there can be. Painters should be more communicative, and not so tenacious of whatever superior method they may have acquired or discovered. It is quite a mistaken idea that one's business would be injured by discovering the secret of a superior method to his brother painter. If all this secret knowledge was more generally diffused among the craft, the benefit would be mutual. Knowledge should not be monopolized, but should be imparted to all alike, and all alike would be benefited. A better style of work would be the result of such a reciprocity, and better prices would be realized (which is a feature devoutly to be wished by a class of painters, who, as a whole, are no more than half paid for their labor, in a vocation so deleterious to health). It would require more time and labor, and just as many hands be employed, and the trade would then be worth learning.

However, one is not to blame, if he has made any discovery which has cost him time and money, should he wish to keep it a secret, or patent it, until he can make his money out of it; yet in all minor matters, it is not only neighborly to instruct one another, but is really an honor to the craft.

The art of painting, in all its various branches, is, perhaps, under present regulations, quite as injurious to health as almost any other branch of mechanical business, especially house and general shop-painting.

It is supposed that painters, in the aggregate, pay an interest on their life of about twenty-four per cent.; that is, they shorten their lives about two months every year for the privilege of following the noxious business, and getting a taste of the colic every other moon. In fact, it is statistically true that the average lives of painters do not come up to the average standard of longevity.

It is well known that painting is an unhealthy business; and to such an extent is this prejudice abroad, that it is with difficulty, in some places, that master workmen can procure an apprentice.

The house-painter is much more exposed, and liable to the poisonous effects of colors, than those who follow other branches, on account of the large quantities of vapor exhaled from lead and the arsenious greens, especially that most brilliant but deadly color, emerald green. This poisonous color, as all arsenious preparations will, gives out exceedingly large quantities of vapor, the inhalation of which very suddenly show itself, and is quite often mistaken for some other disease, and frequently, by physicians, so treated. It causes inflammation of the throat and lungs, and produces, in different parts of the body, small watery pustules, which are exceedingly troublesome. We have known painters to be so afflicted with this affection upon their breast, groins, and armpits, that they were unable, for several days together, to move a limb without great inconvenience and pain.

In England, where much more of this green is used, it has been ascertained from actual observation, and the experience of physicians and other scientific men, that a series of diseases the most complicated have resulted from having the walls of houses washed, painted, or papered with arsenious greens. Cases have been known where whole families have been poisoned by living within the walls of such houses.

Copper, arsenic, and lead are exceedingly volatile, and those persons immured within the walls covered with them are so perfectly enveloped with the vapor arising therefrom that they are continually inhaling it, greatly to their detriment.

A very singular case (and a remarkable and unmistakable evidence of the noxious effects of arsenious vapor) occurred in England a few years ago. A family, a short time after moving into a certain house, were taken suddenly and violently sick. A physician was sent for, who pronounced it a case of poisoning from arsenic. The patients were relieved, but lingered on for some time, and finding they did not recover their health, left the building. Another family moved into the tenement, and were attacked in like manner; still other persons occupied the rooms, and the same results followed, until, at last, it was alleged that the house was haunted, and Madame Rumor set about making up the legends. But science eventually got hold of the matter, when, by investigation, the premises were known to have formerly been occupied by painters, who were accordingly called upon, when it was ascertained that previous to leaving the house they had buried a large quantity of refuse arsenic three feet deep, in the bottom of the cellar. The deadly drug was removed, and people were no longer haunted with this arsenious ghost.

Almost every painter is familiar with the noxious effects of lead, especially when cooped up in a close room, with *drawn flatting*, and perhaps the keyholes stopped up. Few there are who can work three hours thus, who will not, on coming to the fresh air, almost immediately fall, or stagger as though they had imbibed something of a different nature from turpentine. This part of the business will soon produce the painter's colic, and eventually paralyze, unless much care be taken to guard against it.

In England, benefit has been experienced in cases of painter's or lead colic, both by those who manufacture and those who use white lead, in the use of sulphuric acid in very small quantities. One way of using it is to put one dram of acid into ten pints of table or spruce beer, or mild ale; to shake it up well, and allow it to stand a few hours. A tumbler-full twice or three times a day is used. Another way, not so convenient, is to make the beer as follows: Take of molasses, 14 pounds; bruised ginger, $\frac{1}{2}$ pound; coriander seed, $\frac{1}{2}$ ounce; capsicum and cloves, $\frac{1}{4}$ ounce each; water, $12\frac{1}{2}$ gallons; yeast, 1 pint. Put the yeast in last, and let it ferment. When the fermentation has nearly ceased, add $1\frac{1}{2}$ ounces of oil of vitriol mixed with 12 ounces of water, and $1\frac{1}{2}$ ounces bicarbonate of soda dissolved in water. Fit to drink in three or four days.

The painter is often asked what the painter's colic feels like. He could not, probably, describe it better than to say to those who do not wish to try the experiment, that if the strands of a rope, while being twisted together, should be passed through the bowels horizontally, and the whole abdominal viscera be twisted with it, a faint idea might be formed of the lead colic.—*Haney's Painters' Manual.*

Another Solar Engine.

The London *Scientific Review* announces that similar researches to those made by Capt. Ericsson, announced some weeks since in the SCIENTIFIC AMERICAN, have been made by Prof. Mouchot, at Tours in France. It further states that Prof. Mouchot took out a patent in March 1861, for an apparatus of this description which he allowed to lapse. However, in 1864, he constructed a solar boiler on the same principle which worked at Meudon with satisfactory results. On the 2nd September, 1866, he brought a machine of this description to the palace of St. Cloud that it might be seen at work by the Emperor. It was a small steam engine worked by a solar boiler, but the bad state of the weather interrupted the experiment. A little later, however, the Emperor having gone to Biarritz the machine was taken thither and the experiment succeeded. Since that time M. Mouchot has contrived various kinds of apparatus on the same principle for cooking meat and vegetables, distilling spirits, baking and latterly steam and hot air engines. Prof. Mouchot also announces a work upon the subject in preparation and soon to be in press.

THE PRIMEVAL FLORA---LECTURE BEFORE THE AMERICAN INSTITUTE, BY PROFESSOR DAWSON.

Reported for the Scientific American.

The above topic formed the subject of a very interesting lecture by President Dawson, of McGill College, Montreal, at Steinway Hall, in this city, on the evening of the 23d December. Notwithstanding the lecture embraced altogether too wide a field for anything like thorough treatment, the happy style and popular method adopted by the lecturer, made it very acceptable. After the usual introduction of the lecturer to the audience, President Dawson said: An eminent authority has defined geologists to be a class of amiable and harmless enthusiasts, who are happy and grateful if you will only consent to give them an unlimited quantity of that which, to them, has, perhaps, the most value of all things, namely, past time. I confess to this definition of geologists, so far as my subject this evening is concerned, for I shall have to make a large demand upon your faith as to the extent of the past time, and shall have to ask you to give me all of it which you reasonably and conscientiously may. Geology, indeed, works strange revelations in our view of things, new and old. The primitive forests, and even the gray rocks and hills themselves are things not primitive and unchanging, not things, comparatively, of yesterday, the successions of olden forests and olden rocks that in dim and ghost-like procession recede from our view into the past of an antiquity, compared with which all human antiquities are things of yesterday. The murmuring pines, and the hemlock, bearded with moss and in garments green, indistinct in the twilight, may stand like Druids of old with voices sad and prophetic; but they belong not to the forest primeval of the earth's younger days, though they may point backward to perished predecessors of truly old date, truly primitive and geological antiquity. It is to them that I must try to carry you back in imagination this evening, to awaken those slumbering ages and make them green again in your eyes and vocal in your ears. Transferring our thoughts to these old forests, and imagining their strange fantastic forms, and the singular creatures that lived beneath their shade, we shall find ourselves in a new world different from that which we inhabit, and differently peopled. Could we marshal in one view four or five planets, each clothed with the peculiar flora, and inhabited by the peculiar fauna of a distinct geological period, we should truly have before us so many distinct worlds with nothing to connect them with each other save only certain similarities of plan and conception. But when we view these several worlds as successive, and destined the one to prepare the way for the other, we can perceive relations of the most remarkable and unexpected character, and have presented to us a long protracted scheme of creation too vast to be contained on the surface of our planet at any one period, and representing with our present flora all the possibilities of vegetable existence, and all the uses, present and past, which plants can serve. I have selected as the subject of this lecture one small department of the vast field of fossil plants, a department of peculiar interest as relating to the oldest known plants, and which, as a special and favorite study of my own I must endeavor to make attractive to you. But I must not rest contented with this, but in justice to the subject must try also to present it in an orderly and systematic manner. I must endeavor to give you something like a connected sketch of that primeval flora which is the subject of this lecture; and in order to do this, I must first say a few words on the relations of their primeval flora to existing plants; 2d, I shall say something of their relations to the geologic time; 3d, I shall enter upon the subject proper by describing to you some of the more remarkable plants that flourished in that primeval age; and, 4th, I shall conclude with noticing some of the uses of this primeval flora to us, the practical use it serves to our present race; and I shall endeavor to give you, if possible, some idea of the light which geology gives us as to the first appearance of plants on our planet, and how far back they can be traced in geologic time. First, then, I shall speak for the benefit of those who may not have pursued the study of botany, of the relations of existing planets, and the relation of the fossil flora to them. Taking the whole of the plants known to us, we shall find upon examination that they may all be divided into two great series; first, that series of plants in which we observe distinct flowers, and fruit containing seeds. These constitute the phenogamous plants of the botanist. Then we have a great class of plants of a lower and humbler organization, which are destitute of true flowers, and which instead of producing seeds, produce granules, performing the functions of seeds, called spores. These are the cryptogamous plants of the botanist. The whole vegetable kingdom is divided into these two great classes. Now, taking first the phenogams, we shall find three classes of them. We have, first, that group of plants to which all our trees and shrubs and the greater part of our cultivated plants and weeds belong—the exogens, which have a distinct pith, and wood, and bark. Then we have a class in which these features are more or less mixed through the entire structure, and in which there is little distinction of wood and bark, and of which the palms of the tropics and the grasses of our own latitude are examples. These are called endogens. A third class are the gymnosperms, which have naked seeds, specimens of which are the well known pines and the sago of the tropics. Thus, to recapitulate, we have three groups of the phenogams, of which the oak or maple, the palm, and the pine tree, are respectively representatives.

In the cryptogams we may also make a three-fold division respectively represented by the ferns and club mosses, the common mosses, and lichens, fungi and seaweeds.

Next let us see what relation these primeval flora bears to that of modern times. Two relations are possible: First, that the primeval flora may belong to a different classification altogether; and second, which is the true supposition, that the whole flora of the earth, from the earliest geologic times, comes under one classification. This shows that, from the beginning of geologic time, one plan has been followed out in the construction of the vegetable kingdom, and that the whole vegetable kingdom consists not of the plants now living upon the earth, but includes all the plants that have ever lived upon it. Again, there is another possibility, that the primitive flora may include representatives of all our modern classes of plants, or only some of them. The fact is, that it includes mainly representatives of some of them, and those of a medium grade, neither the lowest nor the highest, so far as the land flora is concerned. The fossil plants are not chiefly exogens or endogens, but gymnosperms. On the other hand the acrogens, or the highest group of the cryptogamous plants in our day were then the most abundant. The primeval flora, therefore, embraced the higher cryptogams and the lower phenogams. If we had known nothing of vegetation but that manifested by the primeval flora we should not have known the possibilities of the vegetable kingdom, either in its highest ranks or its lowest ranks, but only in the middle of the scale. Next let us glance at the relations of the primeval flora to geologic time. The oldest rocks we know, the eozoic, have afforded no plants, so far as we know, at all. The next stratum, the paleozoic, includes the oldest land plants we know. But in the mesozoic period we arrive at a different flora, and in the cainozoic, or modern period, we have two other floras. It is the paleozoic flora only of which I shall speak to-night. During the whole of the paleozoic period, the seaweeds have existed. In the earlier periods the classes of acrogens and gymnosperms far exceeded the exogens and endogens, while the reverse is the fact at the present day. The warm and moist climate of portions of the southern hemisphere at the present day, now have a flora more nearly resembling the early epochs than any other portions of the earth. The uniformity of the flora of that early period indicates a temperature nearly uniform throughout the earth. At present we have in our atmosphere but a small quantity of carbonic acid gas. If we had more, it would tend to make the climate more uniform, by preventing the radiation of heat from the earth. The carbon locked up in our coal mines, and then existing in the atmosphere, may therefore have been at least one reason for the uniformity of climate on the earth in the paleozoic period, the flora of that day indicating a warm and moist climate. Next, looking to the flora of the plants, we will turn to the carboniferous period, when there was a vast amount of vegetation, afterward made fossil and becoming coal. In that moist, warm, but unwholesome atmosphere, we find the sigillaria, or seal-tree, one of those most abundant in the swamps of the carboniferous period. Here we have a large tall stalk, without branches, covered with large leaves; or perhaps divided into a few branches. We have remains showing the ribbed structure of the stalk, and the scars of the leaves. There are no trees in our latitude resembling it in structure. We know of the fruit of the sigillaria only by the abundance of a certain nut that is found around them. Trees of two and three feet in diameter were not uncommon. The root of this tree is more remarkable even than its stem, having attracted the attention of geologists before the stem, and obtained the name of stigmaria. These roots are bifurcated and spread out in a remarkably regular way, all the little rootlets spreading as regularly as leaves. These roots occur very often in the coal formation without the stems; and at first it was supposed that they were the whole of the plant. The first process in the formation of a bed of coal was usually the growth of a forest of sigillaria.

The next class are the calamites. The lecturer here related an anecdote of an unlearned individual who having been shown some specimens of ferns and calamites, the former being called filices, reported to his friends that he had seen the savant's "felicities" and "calamities." In one sense the calamites may be justly styled calamities, for they had been the subject of more dispute on the part of geologists perhaps than any other fossil plant. They seem to have grown on muddy flats along the margin of the sigillarian woods, resembling equiseta or mare's tails; and they are still preserved in coal formations in large numbers. The calamites seem to have preserved the sigillarian forests from the effects of inundation, by causing the mud to settle before the waters passed into the forests. The calamites thus contributed very much to the purity of our coal beds. The next plant is the lepidodendron, or scale-tree, of a size equal to the sigillaria, resembling our ground pines or club-mosses. This tree was more plentiful in the earlier coal formations than in later periods. Many other diagrams and petrifactions of fossil plants were here exhibited. The plants of the carboniferous period would have presented to our eyes a very monotonous appearance; for it was characteristic of the flora of that period that there was a large number of species, but few genera. There were also some plants more familiar to our eyes. The ferns are to be found in the coal beds preserved as beautifully as they could have been preserved in an herbarium. They resembled more closely the ferns of New Zealand or the Hebrides than the ferns with which we are familiar. Some of these ferns grew to the dignity and beauty of the palm-tree itself. One species was peculiar, having only two leaves at a time. We find sometimes in the coal-beds things looking like enormous brooms, which are tree ferns, with roots sent out to straighten the stems. We also find in the coal formation varieties of pine, the wood of which much resembled our modern pines. It is remarkable that the pine is widely diffused at the present day; and it is not wonderful, therefore, that they should have existed in the carboniferous period. Those pines have features more nearly resembling those of Australia and New Zealand than those of our climate. When wood is buried in the earth and its cells filled with water holding silica or lime in solution, they become filled with stone, and the wood becomes coal; and this is the form in which we find these fossil remains. By removing the mineral we can observe the vegetable structure of the plants, and determine their character. Next to the soil on which we tread, the most valuable substance we have is mineral coal, which is derived from the plants of the carboniferous period. A bed of coal is usually composed of the remains of the trunks and bark of sigillaria trees. Examining coal with a microscope, after proper preparation, we can see the structure of the wood from which the coal was derived. Of eighty-one distinct seams of coal in Nova Scotia, every one but two or three had sigillaria, either in the coal or immediately above or beneath it. The top of a coal seam is merely the debris of the last forest that grew on this swamp where the coal was produced. Great Britain annually consumes 100,000,000 tuns of coal, and we know of nothing that will supply its place. The consumption of coal in America is already equal to the labor of 150,000,000 horses, and our coal beds are as yet hardly opened. All this power is extracted from the sunbeams of the paleozoic period. (Applause.) What did these magnificent forests grow for? There seem to have been no higher animals to enjoy them. We know of no birds that lived among their branches. We know of a few insignificant reptiles that crawled beneath them, but we know of nothing higher in that age. What were they created for? For two great purposes. First, to purify the atmosphere so that it might be made suitable for the higher animals that were to live in a future geologic period; and that very process of purifying the atmosphere was made the means of laying up those enormous stores of fossil fuel upon which so much of our modern civilization is based. See how grand are the economies of nature, preparing far back in geologic periods before man existed, for the existence of the present state of the arts in the world. Next to coal in its value comes iron; and although we are not so dependent upon the coal formation for iron as we are for coal, still we get an immense quantity of iron from the carboniferous rocks, accumulated by the agency of these very plants; for as they went to decay, and were converted into coal, they helped to gather together the particles of iron out of the clays and sands, and to store them up for us in iron ore. Therefore we owe to the growth of those old forests not only our coal but a large portion of our iron. And whether we look to the value of the coal in boiling the tea-kettle, of which Prof. Silliman spoke to you in the last lecture, or to the use of the iron which makes our iron horse, and the steam engine of our factories, we owe it all to the primeval plants, or rather the Maker and Creator of these old plants. Now let me trace these plants a little further back than the period of the coal formation. If we go back from the carboniferous rocks to the Devonian, we shall find a different flora, which no doubt helped to purify the air, and prepare the world for the carboniferous flora. We have in Canada a bed of coal two or three inches thick, belonging to that epoch, and it is the only one I know in America. In this drawing, some of the plants of that period are represented; and here you find the sigillaria, the lepidodendron, the calamites, the pines, etc., as in the later period; so that you see that the Devonian flora was really not very different from that of the carboniferous period. The species are mostly different but the generic forms are the same. As a whole the Devonian flora may be characterized as less massive and magnificent, more delicate and slender in its proportions; not less beautiful but less useful perhaps in the accumulation for us of vast stores of fuel. If we go down below the Devonian rocks into the Silurian, we find a few plants; but in the lower Silurian formation we hardly find any traces of plants. Nearly all the rocks known to us of that age were marine rocks. Prof. D. was not hopeless of the eozoic period even. We have as yet found no plants there; but we have found carbon. We have found plumbago; and even in later formations the remains of plants have sometimes been converted into black-lead in the eozoic strata, occurring in beds, so as much to resemble the remains of plants. They have been sea plants. If they were land plants we may guess what they were—anophytes and thallophytes, gigantic mosses and gigantic lichens. If we were to walk among those ancient forests of mosses, if they really did exist, we should be in a world something like what this would appear to an insect creeping upon the mosses of our woods. I have given you but a faint outline of a great subject, on which treatises might be and have been written, which would afford the material for a course of lectures more interesting than a single one can possibly be. The chief interest of the subject, no doubt, is to the botanist and geologist. The vegetable kingdom now is most beautiful and most varied, especially when we look at it as presenting forms of plants adapted to every climate and every situation upon earth, all of them finding their proper place and their own due season. But the subject before us carries us back into geologic times, and shows us a plan too large to be realized on one earth.

The plan of the Creator was so vast that the whole surface of the earth was not big enough to hold it. It required a series of earths, one after the other, to develop it, just as it has required a series of ages to develop the history of the human race. We have in these old plants something that adds enormously to the variety of the vegetable kingdom; something that shows us how small is our own knowledge, and how great and capable of extension is the plan of the vegetable kingdom. And when we consider further that we know of these fossil plants only what their remnants have taught us, it affords a widening field of wonder and of thought. As it is more interesting to the botanist to go out and collect plants for himself than to study them in the class books, so this subject is of the deepest interest to those who will examine the primeval flora and the coal formations; who will split open the rocks and see the forms that no one ever saw before, and perhaps make discoveries of facts which the world never knew before concerning that remote period of time. I must plead guilty as a fossil botanist—I mean a botanist studying fossils [laughter]—to having the deepest interest in this subject. And it arises in part from the very fact that different names are sometimes given to the same plant—as the tree is called sigillaria, the root stigmaria, and the nut still another name; and it requires much observation and study to discover and to show that these different names all belong to what was really one and the same plant. As our knowledge increases we may be able to dispense with many of these old names, which is more than can be said for modern botany. What would we have been without these old plants, without this great provision made for us in primitive times before man existed upon the earth? These plants form a part of the same plan to which we belong, and undoubtedly that plan existed at the time these old paleozoic plants grew. And now, I may say, even in this Christmas time, as we gather around the hearth, although our coal fire does not burn, and cackle and blaze like the old yew log of our ancestors, yet the trunks of our old sigillaria, burning upon our hearths to-night, send forth a quiet, kindly look, befitting their great age and long burial in the earth. And the happy hearts that gather around the Christmas fireside may thank God that we have had these great stores prepared for us in the times of old, and that we have hearts and minds fitted to enter somewhat into that great plan which stored them up, and for the enjoyment in a measure, even of the beauty of the plants that lived so long ago.

THE EVOLUTION OF THE NORTH AMERICAN CONTINENT---LECTURE BY PROFESSOR HALL.

Reported for the Scientific American.

The above was the subject of a lecture by Professor James Hall, State Geologist of New York State, before the American Institute at Steinway Hall, New York City. The lecturer was introduced by Judge Daly, who referred to the interesting character of the preceding lecture, delivered, as he said by a distinguished Canadian geologist. We shall to-night have the pleasure of listening to a distinguished geologist of our own State, whose reputation, however, is not limited to our own state or the United States. His reputation will be perpetuated by that noble monument, the Natural History of New York, published under his scientific supervision, and of which more than one fourth is the work of the speaker who is about to address us. It is not too much to say that this great work is unequaled by any similar work in existence not comprising a greater area of the earth's surface.

In reply to the complimentary introduction of Judge Daly, Professor Hall said: I am unprepared to say a word in response to the complimentary introduction of your president, but I will say as an adopted citizen of the State of New York, that the natural history of the State is a monument of which, in succeeding generations, every man, woman, and child will have reason to be proud. It has been carried on many years, amid many conflicting circumstances. For the humble part I have had in the work, I have had many pleasures, many griefs and sore trials. But when these are all past, those that follow will reap the benefit of a work that has developed more of natural science than any other American work; which was, in fact the earliest development of natural science upon the American continent

Professor Hall then proceeded to the discussion of the topic of the lecture, the evolution of the North American continent. The lecturer made such frequent references to diagrams upon the blackboard and to charts, that it is impossible to give in a printed report, without diagrams, the arguments by which he sustained his propositions. We shall therefore limit ourselves to an outline of the lecture, giving as far as possible the order in which the continent was evolved as stated by the speaker.

A period existed, ages upon ages ago, when the surface of the earth was entirely covered with water. Under this universal ocean the solid nucleus existed, and by gradual cooling of the earth's crust or by other causes, upheavals took place. These upheavals occurred first at the northern portion of the globe, and extended until a portion of dry land of the so called granitic formation extended down as far as Nova Scotia—at that period an island—and to the great lakes, and westward nearly to the Rocky Mountains. The whole of the continent remaining is formed of sedimentary deposits from the currents which existed in the ocean then as now, layer upon layer of different periods and characters, many of which are from thirty to forty thousand feet in thickness.

Upon every portion of the surface of the earth, we have mountain chains, plains, and valleys; and we have rocks, loose materials, sand, pebbles, gravel, and other materials of that kind, which are distributed over the surface. These are distributed, not regularly, but according to certain laws, which have prevailed in all geologic time. This pebble, for example, which I have before me, has at one time been an angular fragment of rock, broken from a rock which had itself been, at a still earlier time, a loose mass of sand. It has been consolidated. It has become rock. It has again become broken, and these pebbles have been triturated by the motion of the water, the action of the sea, or of rivers and streams, until they have been rounded, the corners worn off, the finer materials being gradually worn away and disappearing, being reduced by the water to an impalpable condition beyond our reach. The harder particles of material like this makes the sand which strews the sea beaches every where. The sand was not from the breaking down of sand stone, but from the breaking down of materials containing sand. While the finer and more impalpable portions have been widely separated, the harder portions, which are a silicious sand, remain to make sea beaches and river beaches. In this respect nature is constantly active. There is no moment of time when this process, this degradation of the surface of the globe is not going on. During every shower, or if you will go back to the first of all this, the evaporation of water by the action of the sun's rays, in the ocean and upon the surface of the earth, lifting it into the atmosphere and precipitating it again upon the surface, transfers the loose materials into the smaller streams, thence into rivers, and thence into the ocean where they are spread out evenly from the facility of their transportation by currents, the coarser materials being first deposited, and then the finer. And the action of the frost annually prepares these materials for the subsequent action of the rain. The water percolating into the crevices of the rocks, freezes, and by its expansion in freezing separates them, until, year by year, more and more of the rocky mass is broken down, and the material prepared to be transported by the rain storms into the ocean.

The continent has been produced step by step during several geological formations; it has never been elevated above the ocean as an entire continent; it has been produced from sediments which have been made by the distribution of materials from pre-existing continents, pre-existing materials lying above the surface of the water. In the northern portion we find the earliest continent, and the breaking down of its materials has given us the silurian, devonian, and carboniferous formations. Constantly have the materials of the land, during all the period subsequent to the carboniferous, been carried westwardly and southwardly, and spread over that portion of our continent. And then, subsequent to this, all this portion of our continent has been elevated. The North American Continent, so far as it is known, although there have been numerous minor oscillations, has had three great phases: First, that in which this portion of the continent alone was above the sea (indicating the northern portion upon the chart); second, that in which the continent extended southward to this second line; and, third, that in which the whole of the western and southern portions have risen above the sea. In each of these epochs there have been distinctly marked the characteristic conditions of ocean and of dry land, indicated by fossils in immense numbers; so that we are able to trace step by step, in each one of these geological formations, each thousands of feet in thickness, not only the characteristic fossils of each successive bed, but we can easily subdivide them. So that in this portion, from the base of the silurian to the devonian, we recognize 20 or 30 different epochs, each marked by its characteristic fossils, with its fauna and its flora as distinct as upon the shores of the country at the present time. Taking the shores of the United States at the present time, and observing the number of animals living along the coast, we have that repeated some 20 or 30 times in this one epoch; each of these having been superseded by and given place to another, and so on in succession, during the silurian period. When we consider that these various animals have lived and died, that each has occupied its place for successive generations, for we do not know how long a time, when we consider that this country has been covered entirely by subsequent deposits, and other creations have taken their place, and so on, while accumulations hundreds of feet thick have been spread over them, when we remember that hundreds, and even thousands of these animals have lived and died, perhaps in each of those 20 or 30 subdivisions of the time, and thus on fauna after fauna, and flora after flora, through all these epochs, you have at last an incomprehensible number of generations of animals, a result which could only have been reached by a process carried on for an infinitely long period of time. One point which I have endeavored to impress upon you is that while this has been going on, there has been, so far as our own continent is concerned, a constant evolution of dry land. If we begin at the latest period, and go backward through these periods, you have in them all the distinction of ocean and dry land, the latest land being formed from the sediment distributed by the ocean, until at last we trace back the continent to the time when it was included within this area (indicating the northern portion). But we have nothing thus far of the original crust of the globe—nothing which geology can tell us of a nucleus which has been of melted matter. Still further north is a portion of the continent we know very little of. It is possible that this may be of older rocks. We know that there are older rocks that are stratified rocks, not only on this continent but on the continent of Europe; but we have no evidence that there were ever any rocks earlier than the sedimentary rocks. The granite of the Rocky Mountains is as much stratified as that of Northern New York; and wherever these strata are found we know that they have been deposited by water. Even in the old Laurentian rocks, those granite rocks of the North, there are same portions of the rocks containing pebbles derived from pre-existing stratified rocks. When we know that in the old sienite of the northern portion of this country we have pebbles which are stratified, like that which I hold in my hand, showing the remains of sediment, particles of sand transported to another place, and there becoming rock previous to the deposit of the materials which have been converted into gneiss, sienite, and granite, we know that there must have been other stratified rocks older than our granites, previously existing and broken down, pebbles from which were transported and imbedded in the sediments now constituting those oldest known rocks. So that we go back not only as far as we can absolutely see the rocks, but still farther, and we demonstrate that there are still earlier periods, when there were deposits of rocks yet to be discovered by geology, earlier than the earliest rocks we know, lower than the lowest rocks we know; and these being stratified rocks, we may say that water from the beginning of our knowledge has existed upon the surface of the globe. We have, then, no knowledge whatever of the primary nucleus. We see that by the action of water materials have been transported from one part of the surface of the globe to another, covering the former ocean beds with enormous accumulations of sediment; which, after a time, by this change in the relation of the parts, and by the increase of temperature beneath the landed part, have risen up and become, step by step, islands or continents. It is by this process that, age after age, the American continent has assumed its present form. But I desire to impress upon you this one truth; that we have, in our geological investigation, succeeded in going back one step beyond the existence of water and stratification —one step toward this original and so-called primary nucleus, a nucleus of molten matter. This original nucleus that has been talked about in geology, has produced no effect upon the surface of the earth; neither upon its mountain chains or any other of the great features of the continent. Neither have these features been produced by it or by materials derived from it. I have shown that in the form of the continent the materials composing it have been derived from the breaking down of pre-existing materials transported and deposited along certain lines, or spread out in mid-ocean and there accumulating uniformly. The inequalities upon the surface of the country are not due to any special action along these lines of elevation. Those mountain ranges, whether the Rocky Mountains of the West, the Appalachian chain of the East, or any other chain of mountains, so far as we know, are not due to any action or any forces along those lines, but only to the greater currents in the bed of the ocean near those lines, as I have shown you regarding the Appalachian chain. Everywhere the same law has prevailed. The transporting power of the ocean has deposited in the line of its currents larger quantities of material. The elevation has been a continental one, and not the elevation of a mountain or of a chain of mountains. The elevation of the eastern portion of the North American continent has nothing to do with the mountain chains constituting a portion of the continental elevation. Going back, then, step by step, from the more recent to the earliest times in relation to which we have any evidence whatever, we have no proof that the action of the interior of our globe has produced any of the great features of the globe. This idea of a great primary nucleus is only theoretical. It has not in it anything tangible. The earliest rocks of which we have any knowledge were deposited by the ocean under conditions similar to those which now exist. The conditions of the ocean currents are the same now that they have been from the earliest time. From the earliest history of the American continent, from the earliest history of any other, we know that the ocean currents have prevailed as they now prevail, moving northward and southward; and here, at least, the transporting power has generally been from the north toward the south and west; and we have abundant evidence that all the materials composing our continent have been derived in that way from the transporting agency of currents of water alone.

The Rabbit Plague of Australia.

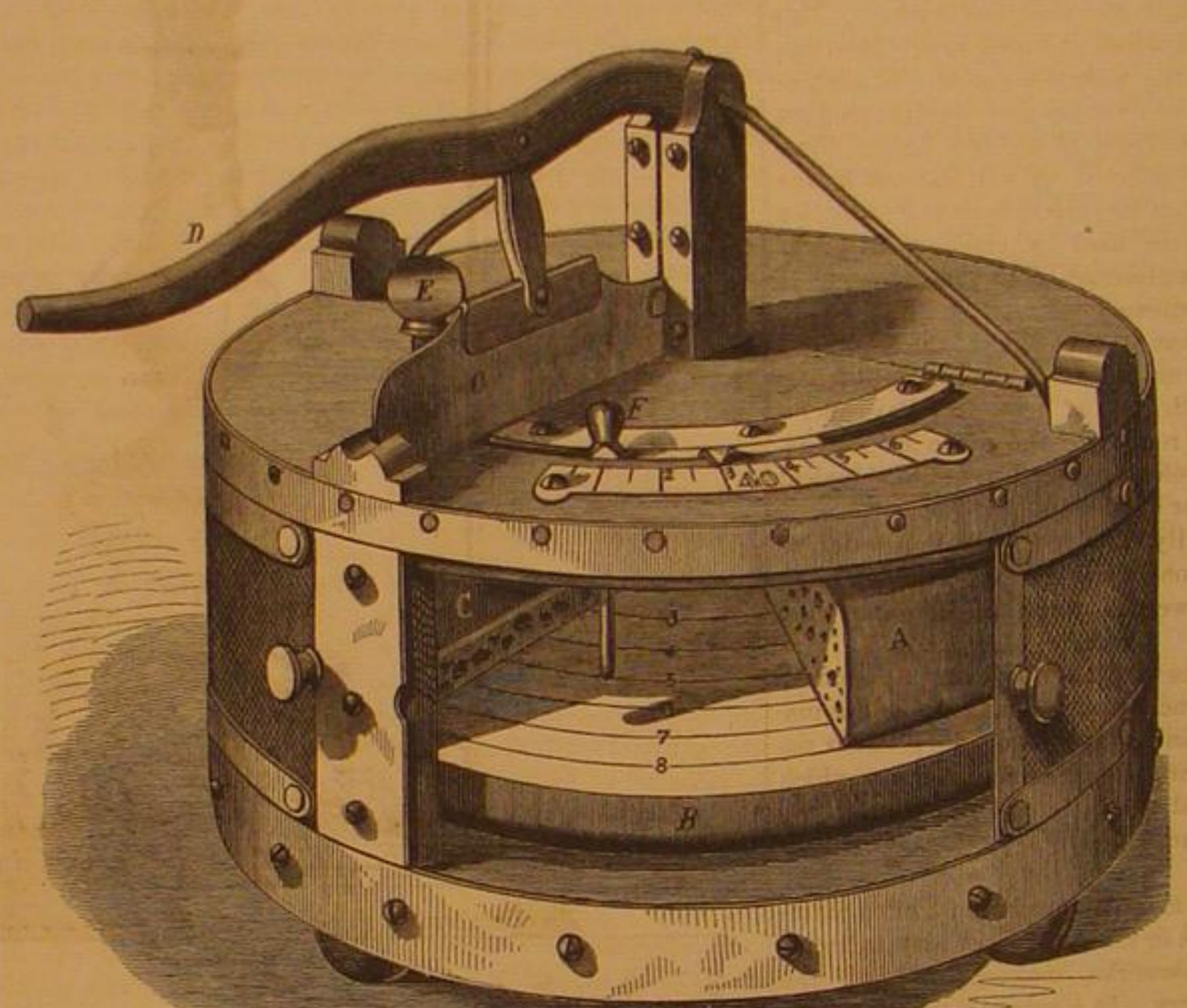
The rabbit originally brought from England into Australia is now threatening to become a plague of almost Egyptian magnitude in the distant and thinly populated plains. Only a year or two ago not a rabbit was to be seen save as a curiosity in a hutch; but the wild rabbit, most prolific of importations, has so increased in numbers in some parts of the country that it threatens to starve the very sheep out of their runs. Mr. William Robertson, a large landholder and squatter near Colac, has been put to a cost of four or five thousand pounds in the, as yet, abortive effort to exterminate these now considered vermin, and he estimates that it will cost him £10,000, in wages to trappers and killers before he will have achieved any marked success in abating the nuisance. "At the same time they are spreading more or less in all parts of the country, and I have seen them scampering about even in gardens near Melbourne. As food they greatly affect some of the most beautiful of our flowers—nothing, however coming amiss to them—and they are, therefore, becoming the terror of horticulturists. Now that the plague is on us in full force we can, of course, all very easily account for what no one foresaw. Any equally prolific animal, equally well circumstanced as to climate and feed, must become equally numerous in any country as thinly populated as ours. In England the wild rabbit meets with many destroyers; here there are very few. In England rabbit killing is sport; in Australia it is generally work to be paid for. Dead rabbits are daily hawked about the streets at six pence each, and the market is always glutted."

The Sword-Fish.

A marine insurance case is now being tried in England, which involves a serious question as to the power of a sword fish to inflict damage and endanger lives. The ship *Dreadnought*, an East Indiaman, was recently taken into port leaking badly from a small hole below the water line. Her owners demanded the cost of repairs from the insurance company, claiming that the hole was made by a sword fish. If it was not made by some external force, nothing can be collected. The insurance company answers that there is no instance on record in which a sword fish, having punctured the side of a vessel, has escaped without leaving his sword in the hole. The plaintiffs prove that a few hours before the discovery of the leak, the crew had seen a very large sword fish in the water, and had tried to capture it with lines and hooks. Prof. Owen delivered a scientific lecture on the sword fish from the witness-box during the trial. The sword of this fish, is the hardest bony material known; it has a sheath harder than the enamel of human teeth; within his personal experience the sides of two ships have been pierced by this submarine stiletto; the blade was usually left in the wound, while the hilt, or in other words, the fish itself, broke away. He quoted examples of this wonderful weapon being driven through fourteen inches of copper sheathing, felt, deal, and oak; his evidence simply demonstrated the enormous power of this formidable monster. In the case before him, Prof. Owen admitted that the fish, having passed its dagger through only three inches of wood, might possibly have withdrawn it. A precisely similar illustration was presented to him several years ago, except that the sword was broken, and actually stopped a leak which might otherwise have been fatal to the ship.

Improved Safe for Preserving Cheese.

Safes for protecting cheeses, when cut, from the attacks of flies, are common enough; they are used in every well managed grocery; but their contents are often mutilated in so miserable a style that the satisfaction in purchasing a bit of cheese is alloyed by the consideration that its shape is such that it cannot be subdivided into convenient and symmetrical portions, and if one calls for a certain amount, it will be either



BULGIN'S IMPROVED CHEESE SAFE AND CHEESE CUTTER.

short or excessive in weight. This is an annoyance to the purchaser and a loss to the seller. The object of the device shown in the engraving is to obviate these difficulties.

The safe is in general construction similar to those in common use, the sides being covered with wire gauze. But the cheese is received on a revolving circular platform, one half of the cover and side opening to admit it in the usual manner. The face of the platform is divided into concentric circles numbered to show their relations, or the relative weights of the cheeses the platform receives. The cheese, A, being placed on the platform, B, concentric with one of the circular lines, it is cut by means of the knife, C, worked by the lever, D. The thumb screw, E, has a flat revolving head on its lower end that engages with the top of the cheese by which it may be held in position while being cut, and be prevented from rising when the knife is withdrawn. The pin, F, passes through the cover or top of the safe, the knob being used to slide a segmental strip having a pointer that designates on a fixed and graded segment the proportionate weight or amount of the cheese to be cut, the downward projecting portion of the pin coming in contact with the cut face of the cheese, and serving as an additional guide to the amount to be cut. The front of the safe is composed of two sliding doors seen open in the engraving.

Patented July 7, 1868 to Edwin G. Bulgin. Letters of inquiry may be addressed to W. G. Bulgin, Vienna, N. J.

GLASS--ITS COMPOSITION.

The discovery of glass was no doubt in the first instance accidental. Whether credit is given to the statement of Pliny in regard to its origin or not, it is scarcely conceivable that in the manufacture of pottery, and some other arts known from the earliest periods, the materials of which glass is composed should not have come together and have been fused so as to have become glass. His account is that glass was discovered by mariners, who, compelled to seek the shore as a refuge from a severe tempest, discovered glass in the ashes of a fire with which they cooked their food. Whether this event ever happened or not, it is quite certain that it might have happened, as the sand of many beaches, with the ashes of some kinds of fuel would, when fused together inevitably form glass, as will be seen upon a consideration of its composition.

Glass may be composed of various materials, but one is essential to all glass, viz., silica. The other materials may be potash, soda ash, lime, alumina (the oxide of aluminum which with some impurities constitutes the various clays), minium (red oxide of lead, red lead), magnesia, etc., which may be varied in their proportions to suit the quality of the glass required; the purity of the materials, of course, regulating the fineness of the product.

Silica is the oxide of a metal called silicon or silicium. It is found nearly pure in quartz, and is with various coloring matters, the substance of agates, opals, flints, etc. Its purest native form is that of rock crystal, of which beautiful specimens are found in England, Scotland, California, and other parts of the world. These crystals are cut into proper shape for ornaments and lenses for spectacles called pebbles. The latter are considered superior to those made of glass. Sand and sandstone are quartz more or less pure. Glass can be made with quartz and flints pulverized, but sand if sufficiently pure is preferred, as it obviates the expense of pulverizing. Sand to be useful for making clear white glass, should be free from earthy matters and certain metallic oxides. The latter give various colors to glass, and when present to any great extent, unfit the material for anything but the coarser varieties of work, as green bottle glass, etc.

Silica has been shown by chemists to be an acid. As it is insoluble in water however, its acid properties do not readily appear. Alkaline solutions, and hydrofluoric acid, dissolve it very readily. With the alkalies, alkaline earths, and some of the metallic oxides it unites to form salts called silicates, for the most part insoluble in water, or in acids, except hydro-fluoric acid, but soluble in strong alkaline solutions. Thus a strong solution of potash will eventually dissolve through an ordinary glass bottle if kept in it long enough.

Glass is a fused mixture of some of the silicates of potash, soda, lime, magnesia, alumina, and lead. These silicates might be formed separately and fused together afterwards, but the requisite homogeneousness is better obtained by mixing in the proper proportions the materials of which they are composed and melting them together, the combinations taking place during the "melt."

The process of melting is performed in large pots made of refractory clay, placed in a conical furnace with a chimney at the apex. The heat is carried to a very high point to insure perfect combination and fusion, and is continued from ten to thirty hours, according to the kind of glass to be made. The heat is kept up as constantly as possible day and night, as much loss would accrue by allowing the furnaces to cool and re-heating them. In order that the temperature of the furnace shall be kept as even as possible the coal is added lump by lump, being thrown in through a small hole in the side of the furnace by a man who performs only that special service. Each furnace contains a number of these pots with an aperture to correspond with each, at proper intervals around the cone. From each of these apertures the fused glass is taken as wanted and manipulated so as to form the various articles of glassware in use. These manipulations, comprising what is technically known as "glass-blowing," will form the subject of a future article.

Dr. Ure makes the following classes of glass, based upon their chemical composition:

1. Soluble glass, sometimes called waterglass—a simple silicate of potash or soda, or both of these alkalies—so called because it is soluble in water.
2. Bohemian or crown glass; silicates of potash and lime.
3. Common window and mirror glass; silicates of soda and lime; sometimes also of potash.
4. Bottle glass; silicates of soda, lime, alumina, and iron.
5. Ordinary crystal glass; silicates of potash and lead.
6. Flint glass—silicates of potash and lead with larger proportion of lead than crystal glass—so called because it was made originally with powdered flint.
7. Strass; same as preceding with still more lead.
8. Enamel; silicate and stannate or antimoniate of potash, or soda or lead. A stannate of potash or soda is a compound of stannic acid, formed by the combination of oxygen and tin, with either potash or soda. An antimoniate of potash or soda is a compound of antimonic acid, formed by the chemical union of antimony, and oxygen with one or the other of those alkalies.

The quality of glass depends very much upon the method of manufacture as well as the materials employed. In particular the process of annealing is a very important one, as if this be neglected or imperfectly done, articles of glass are so brittle as to be almost worthless for any practical use. The manner in which annealing is performed will be hereafter described. To give the proportions used in various manufactories for the different kinds of glass would occupy too much space. We give, therefore, an analysis of only one variety, the best English crystal glass, made by the chemist Berthier.

Silicic acid	59·20	parts.
Oxide of lead	28·20	"
Potash	9·00	"
Oxides of iron and manganese	1·40	"

Now it will be seen that in this glass there is iron, which we have stated gives a green color to glass; in fact it will be seen below that it is capable of giving many other colors; but it also contains manganese, which in common with arsenic possesses the property of decolorizing the alkaline silicates when colored by other metallic oxides.

This leads us to the means whereby color of any desired tint can be imparted to glass. In an article published in No. 2, current volume, an allusion was made to the use of the oxides of cobalt, copper, gold, etc., as surface colors for glass. When these and some other oxides are melted with the silicates, they become a part of the mass and color it throughout without impairing its transparency. Thus, oxide of cobalt gives a brilliant blue; oxide of copper, green; oxide of gold, a ruby red; oxide of antimony, orange yellow; uranium, a delicate greenish color very beautiful but costly; suboxide of copper, brilliant red, but renders the glass almost opaque, etc., etc. A dirty yellow may be given to glass by the admixture of soot or powdered charcoal. The beautiful Bohemian ruby glass is of very complex composition. It contains gold, peroxide of tin, peroxide of iron, oxide of lead, magnesia, lime, soda, potash, silica, and arsenic. Manganese gives a splendid amethystine tint to glass.

Some of these colors change after the glass is made. This is the case with the copper red, which at first is nearly colorless, but becomes red upon reheating after it is cooled. Blueish or greenish colored glass becomes by exposure to sunlight almost colorless from the combined effects of air and light. Glass containing lead is frequently affected by sulphureted hydrogen gas, becoming opaque upon its surface from the formation of sulphide of lead. The glass used by chemists is for the most part free from lead; the presence of the latter being in many cases a serious inconvenience.

M. Bontemps has shown that all the colors of the solar spectrum can be obtained by the use of oxide of iron in different proportions and by different degrees of heat. Similar conclusions have been arrived at in regard to the oxide of manganese. These differences of color are ascribed not to chemical combinations but to molecular conditions.

Most crystal glass is partially dissolved by boiling water, as it has a very large proportion of alkali. Glasses rich in alkalies have also a more powerful attraction for water than others.

The extent to which articles of glass now enter into domestic use, as well as certain branches of the arts, renders this material one of great interest and importance. Its peculiar nature gives rise to very peculiar methods of manufacture, which in the skill and taste required for their performance and the beauty of their product are unexcelled by any other department of industry.

The chief seat of the glass manufacture in the United States is Pittsburgh, which contains in the city proper and its immediate vicinity sixty-eight glassworks, making over half the glass consumed in the country. In a subsequent article we shall take our readers through some of these busy hives, and show them by what unique means and adroit operations some of the beautiful glass articles in common use are formed.

The Zirconia Light.

Messrs. Tessie du Motay & Co. have patented an invention for improvements in preparing zirconia, and the employment of the same to develop the light of oxyhydrogen flame. The specification is as follows: "Zirconia, or oxide of zirconium, in whatever manner it may be extracted from its ores, can be agglomerated by compression; for example, into sticks, disks, cylinders, or other forms suitable for being exposed to the flame of mixtures of oxygen and hydrogen without undergoing fusion or other alteration. Of all the known terrous oxides it is the only one which remains entirely unaltered when submitted to the action of a blowpipe fed by oxygen and hydrogen, or mixtures of oxygen with gaseous or liquid carbonated hydrogens. Zirconia is also, of all the terrous oxides, that which, when introduced into an oxhydrogen flame, develops the most intense and the most fixed light.

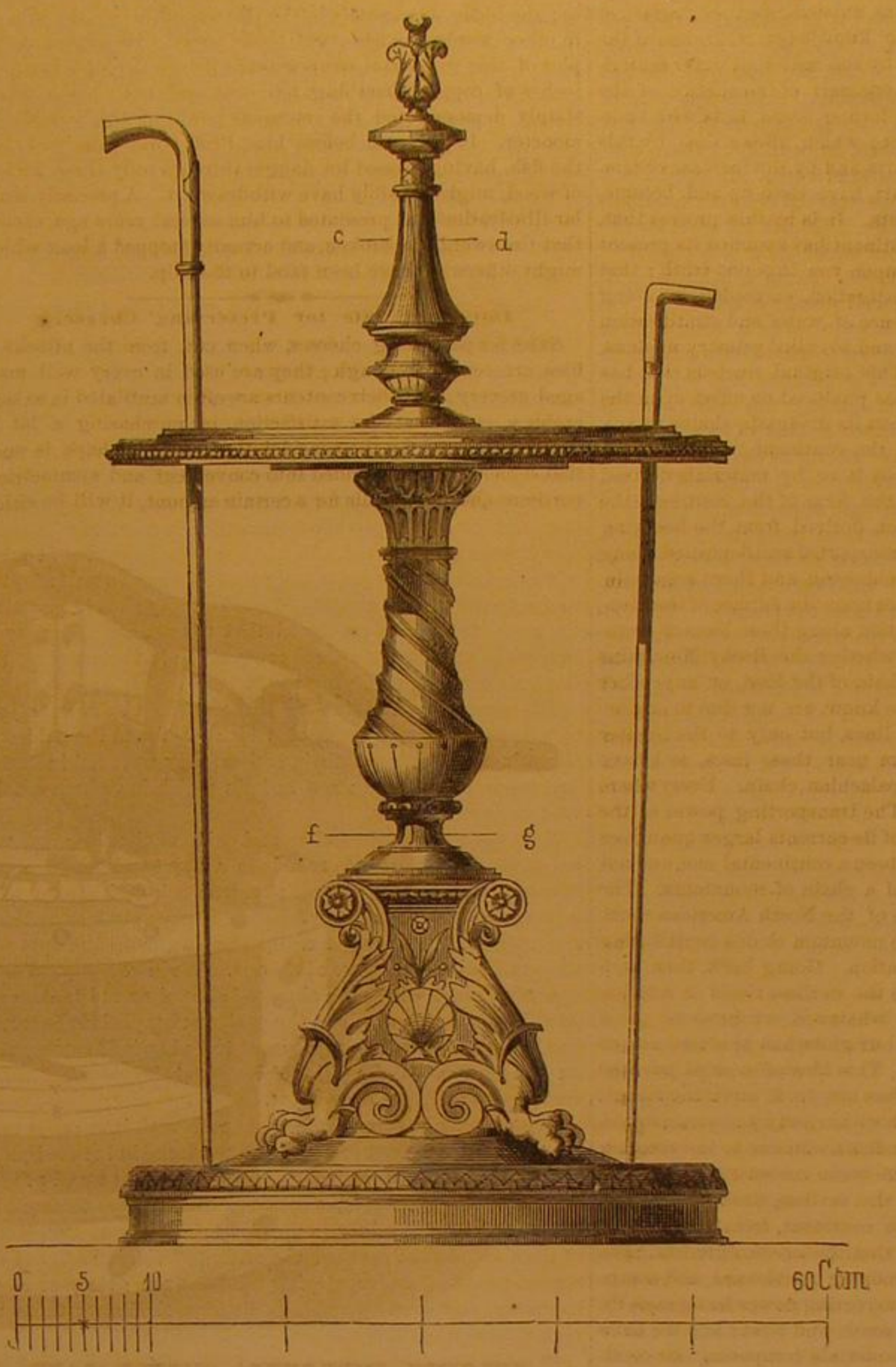
"To obtain zirconia in a commercial state I extract it from its native ores by transforming by the action of chlorine in the presence of coal or charcoal the silicate of zirconium into double chloride of zirconium and of silicium. The chloride of silicium, which is more volatile than the chloride of zirconium, is separated from the latter by the action of heat; the chloride of zirconium remaining is afterwards converted to the state of oxide by any of the methods now used in chemistry. The zirconia thus obtained is first calcined, then moistened, and submitted in molds to the action of a press with or without the intervention of agglutinant substances, such as borax, boracic acid, or clay. The sticks, cylinders, disks, or other forms thus agglomerated, are brought to a high temperature, and thus receive a kind of tempering or preparing, the effect of which is to increase their density and molecular compactness.

"I can also compress in molds shaped for the purpose a small quantity of zirconium capable of forming a cylinder or piece of little thickness, which may be united by compression in the same mold to other refractory earths, such as magnesia and clay. In this manner I obtain sticks or pieces of which the only part exposed to the action of the flame is of pure zirconia, while the remaining portion which serves as a support to it is composed of a cheap material.

"The property composed by zirconia of being at once the most infusible, the most unalterable, and the most luminous of all the chemical substances at present known when it is exposed to the action of an oxhydrogen flame, has never before been discovered, nor has its property of being capable of agglomeration and molding, either separately or mixed with a small portion of an agglutinant substance.—*Chemical News*.

Stick and Umbrella Stand.

We herewith reproduce from the *Workshop*, published by E. Steiger, 17 North William street, New York, the annexed



STICK AND UMBRELLA STAND.

unique and beautiful design for an umbrella stand, which speaks not only for itself but the excellent character of the publication.

LYCEUM OF NATURAL HISTORY.

This Society met at its rooms at the Mott Memorial Library on the evening of December 28th, and after the usual preliminary business, Dr. Schweitzer, of the School of Mines, stated that he had made a qualitative analysis of the green substance discovered by Mr. E. G. Squier in the Peruvian girl's dressing case. It contained silicate of lime with some alumina. He did not consider his investigation satisfactory, as owing to the small quantity given him, he was unable to make a quantitative analysis.

Professor Eggleston (in the chair) inquired what was the coloring matter. Was it of an organic nature?

Dr. Schweitzer—Undoubtedly so. The coloring matter was of a decided grayish blue, which on ignition turned white.

Dr. Feuchtwanger stated that near Rockwell, in Canada, he had met with specimens of phosphate of lime which when broken open showed crystals which contained a round hole. he asked for explanation as the phenomenon was extremely rare.

Professor Eggleston pointed out that this hole occurred at the conjunction of the crystals. He supposed it was caused by some accident in the course of formation.

A member stated that it had a geodic aspect.

Professor Joy said: It will be in the recollection of members that Professor Graham, Master of the Mint, discovered on May 16, 1867, the occlusion of hydrogen gas in meteoric iron. It would now appear that he had discovered a new metal, or rather had demonstrated the existence of a very old metal. In a letter to Professor Horsford that eminent scholar states that he is preparing a paper for the Royal Society on certain experiments of his with palladium, magnesium, and hydrogen, which have resulted in the discovery of what appears to him to be a white magnetic metal, hitherto unknown, with a specific gravity of 2. He thinks it is the metalic base of hydrogen. This, said Professor Joy, is a discovery of remarkable importance—one that the gentleman who prepares the cable telegrams for us would have announced at once had he sufficient knowledge of its interest. We must, however, now wait for further particulars until we find them in the proceedings of the Royal Society.

Professor Eggleston spoke briefly and emphatically of the importance of this discovery.

Professor Joy said—The regular subject for our discussion this evening is pisiculture, a study of comparatively recent date. It was in 1763 that a German named Jacobi first published in the *Magazine of Hanover* a paper on the subject. It did not, however, attract much attention, and his discovery appears to have been lost and practically forgotten. In 1840, or thereabout, a fisherman of the department of the Vosges, named Reme, entirely illiterate, discovered by his own observation, the art of artificially propagating fish. In 1843 the administration of that department took the matter up, and in its official journal, published in 1844, a report on the subject. It was not until 1848 that the French Institute took up the subject. In 1855 he had purchased at the French Exposition a guide to fish culture. Little progress had been made in the art hitherto, so that in the year almost elapsed we are barely on its threshold. He asked Mr. Gilmore to state his experience on the subject.

Mr. Gilmore said that interested as we all are in the study of natural history, it did not seem to him that sufficient attention has been paid to the fish. His observation had shown him that fish were most intelligent. When in Japan, he had seen in the fish pond of one of the American Vice-Consuls, fish that knew the Consul, and would approach him, while timorous of every one else. He knew this to be characteristic of tame carp he had seen in various parts of Europe. It struck him that the tunny—a fish well known in the Mediterranean for several thousand years—knew America before the *genus homo* did, at least before Europeans. It was well known that the tunny in the autumn season rushed up the Mediterranean in hordes like buffaloes to the Black Sea, whence after spawning they returned, and in the month of March were seen pouring through the straits of Gibraltar westward. They then disappeared, and it was stated by some—even by naturalists of position—that they remained inanimate at the bottom of the sea. Some time ago when coming across the Atlantic he was walking one night on deck with the captain of the steamer, who had called his attention to the fact that at certain seasons he met large shoals of tunny crossing the Atlantic. It did not surprise them, therefore, to find that in the month of September large numbers of tunny are found in the neighborhood of the Gulf of St. Lawrence and the coast of Labrador. Recurring to the subject of artificial fish propagation, he stated that it was known to the Chinese twelve hundred years ago, who made use of their large inland rivers to support their teeming population. About fifty years ago it was introduced into England. He thought that it made greater progress in America than it had in England. He had heard there of the exertions of Mr. Seth Greene of this country. Mr. Frank Buckland, formerly an officer of the army, and now her Majesty's Commissioner of Fisheries, had paid much attention to the subject. Mr. Gilmore then proceeded to describe the artificial culture of salmon and trout. It was well known that the salmon was migratory. The season of its migration varied according to the temperature of the water. They ascended the rivers early if the water was cold, and not until December if it were warm as in the South of England. They ascend the river with but one object, which is to deposit their ova. After overcoming all difficulties intervening, they ascend as near as possible to the head water of the rivers. The female then forms a deep furrow in the sand and deposits her ova. While doing this she guards them against all the other denizens of the waters. When she has accomplished her task, the male fish comes and deposits the milt which impregnates the eggs. Both then cover up the eggs with sand. Those anxious to propagate the fish artificially throw a net over the female when she comes to deposit the egg, and by bending her back slightly over a pannikin, the eggs are expressed. There are generally 1,000 eggs to every pound a salmon weighs. Suppose then in the case of a twenty-pound salmon but half the eggs are matured, what an immense amount of fish is produced by one salmon! After the ova are expressed the milt are obtained in the same manner from the male fish, by dropping it into the pannikin the ova are impregnated. They are then placed in boxes built with steps, which, however, are hollow and partially filled with sand. The water passes in through a pipe from the upper step. By the action of the water the fish are hatched. It sometimes takes one hundred and sixty days to hatch them. Salmon in their first form are ungainly, having depending from them a little bag. This after six weeks passes away, being used by the fish as its nutriment. Having grown quite lively, they are removed to ponds, care being taken not to allow fish of different ages to live together, for they are cannibals and devour those younger than themselves. After a time they are allowed to go down to the sea, and it is noticeable that salmon always return to the place where they were bred, making allowance, of course, for those that are destroyed. He had made an estimate of the value of artificial cultivation of trout and salmon, from observations made at tanks on the Tay and in Vermont. Ova sold $8 per 1,000. In pond No. 1 there were 10,000 fish fed daily by three quarts of curds. In pond No. 2 there were 8,000 fish of the second year fed upon six quarts of curds daily. In the third there are 7,000 fish fed upon twelve quarts of curds. The total return which these fish produced, was $4,350, and the net profit $3,644. From this he inferred that the cultivation of fish was well worthy of adoption.

Mr. Waterhouse Hawkins, in a response to a request from Professor Joy, added some particulars to what Captain Gilmore had stated. He wished that thet gentleman had said something about the cultivation of the delicious fish called char. It was conducted in the same manner as that of trout and salmon. Some two years ago, while acting as the honorary secretary of the Acclimatization Society, in the absence of Mr. Buckland, he undertook to propagate some char. He received the ova from Windermere. They were in—some 30,000—admirable condition. He treated them as Mr. Gilmore had already described, but the gravel was boiled to remove all its inhabitants previous to being used in the troughs. The impregnated ova were removed to the ponds just before the pellicle burst, as soon as the eyes appeared. Mr. Hawkins then detailed his efforts to send some ova to the Duke of Argyll, and strongly impressed on the lyceum the value of pisciculture. In compliance with a request of Professor Joy, he explained, by means of the blackboard and one of his inimitable free-hand sketches, the difference between the salmon, trout, and char.

Mr Gilmore at the suggestion of Mr. Hawkins, detailed the circumstances which led to his discovery of the char in this country. He had caught some magnificent fish in this country of striking appearance and luscious taste.

No other matter matter coming before the lyceum it adjourned.

A Coal Miner in the British Parliament.

Mr. Carter, alderman and coal merchant, is the liberal colleague of Mr. Baines in Leeds. The *European Mail* says he is a remarkable man and perhaps may astonish the House. He began life as a worker in a colliery, and by his own unaided ability has risen to be a merchant, alderman, and member of parliament. He has had but little school education, but from assiduously reading bluebooks he has got to be fairly instructed in politics. He is a fluent speaker, and is never at a loss for a word. He speaks with the real Yorkshire burr; has not an H in his vocabulary; and if any preceding speaker says anything with which he (Mr. Carter) cannot agree, he says "I am of the *contrairy* opinion." His manner is energetic, even forcible; and takes with the Leeds clothweavers. He is in politics a radical of the radicals—bold, defiant; denouncing the church, denouncing the state, the army, the navy—denouncing, indeed, everything. He is president of the Leeds branch of the Reform League, and is said to be the only member of that illustrious association returned to parliament.

Military Cart.

This is a cart which was designed by Mr. W. J. Addis, executive engineer to the Local Fund Works at Bombay, to meet the exigencies of the Abyssinian War, comprising many essential points, and differs from any existing construction. The wheels are formed of segmentary parts of wrought iron, circumferenced with wooden fellies, and tired in the usual manner. By this arrangement the shrinkage is reduced to a minimum, so that the wheels are better adapted for hot climates. Among other advantages, it is calculated to be more durable than the ordinary wooden wheel, and runs much easier. The nave is flush with the spoke and tire, thereby lessening the risk of collisions. The axles are two in number, nine inches in length, and work in two plummer blocks fixed in the frames of the cart, and and are easily arranged in case of damage. Another palpable advantage is that the pole is so arranged as to admit of the cart being drawn back without the necessity of turning, while it can also be wholly withdrawn and passed through the center of the box in the body of the cart, which contains a tent, and it can also be used as a tent pole.

How to Preserve Sodium Untarnished.

Many teachers, particularly in our high schools, have sodium preserved in the usual way, under naphtha. But the beautiful metallic luster is not seen under these circumstances; and if the metal is taken out and a fresh cut made, this only shows the luster for an instant. By the following artifice the *metallic appearance of sodium may be permanently exhibited.* Take two test tubes, one a little smaller than the other, so as to slip into the latter without leaving much space between the two glass walls, put some carefully cleaned sodium in the wider tube insert the more narrow tube, having previously given a thin coating of beeswax to the upper part of this latter; then gently heating the whole on a sand bath. The sodium will fuse, and by a gentle pressure, the inner tube was pressed down, so as to force the fused metal over a large surface between the two tubes, while the air is totally excluded by the beeswax. I have kept sodium for more than six months in this way, and it is now as bright and brilliant, as when first put up.—*Prof. Gustavus Hinrichs.*

New Method of Mixing Mortar.

A correspondent from Syracuse, N. Y., sends us an account of an invention perfected in that city for mixing mortar, which is simply this: The lime is first slacked in a vat with water enough to make it to a paste, and allowed to retain its heat for about twenty-four hours—it is next run off into a second vat, from which it is pumped by a chain pump to a revolving cylinder that has a large quantity of spikes on the inside. As it flows from the cylinder, it passes through a sieve of ten meshes to the inch, and every particle that is used has to go through these very fine holes no larger than a pins' head. From this machine it falls into a large vat, from which it is pumped as required to a similar revolving machine called the mixing machine, into which it flows in a continuous stream, and sand, previously sifted, is added at the rate of about eighty bushels per hour. The mortar made in this way is said to be of a very superior quality.

INFLUENCE OF THE OXIDES OF CHROMIUM AND TITANIUM ON THE COMPOSITION OF PIG IRON.

BY AUG. A. AND S. DANA HAYES, ASSAYERS TO STATE OF MASSACHUSETTS.

Within the last four years we have been frequently employed in chemical investigations of the altered characters of some pig irons, which resulted apparently under the usual circumstances in the reduction of uniform ore.

In these cases the amount of carbon united with the iron had been diminished, without the introduction of other matter, in quantity sufficient to influence a change in this connection, and generally no variation in the composition of the ore was known or suspected. We had analyzed the ores in some of the beds in former years and regarded them as well adapted to the production of pig iron of good quality; but in pursuing the research we were convinced that the change in quality of iron could be traced to altered composition in the ore of part of the beds used for supplying the furnaces.

The correctness of this view was confirmed by our analyses of many iron ores, in some of which we found the oxides of chromium or titanium, existing where they were not indicated and connected with the ore in beds which have been considered as pure iron ores.

Both the oxide of chromium and oxide of titanium, seem to act in the furnace or the crucible in a way to withdraw a portion of the carbon, or prevent that true union of carbon with a portion of the iron, which constitutes gray pig iron, without the metals of these oxides really alloying with the iron and thus indicating the cause of change. We have analyzed samples of pig iron where the alloys of chromium or titanium existed in the pigs, and where the oxides accompanied the ores in the beds, but we were not prepared to find an influence exerted on the quality of the pig metal *without the refractory metals forming a part of the composition.*

The occurrence of oxide of manganese with iron ore is common, and titanium compounds are often found in both magnetic and brown iron ores, as insoluble substances, in small proportions, and these compounds combine with and are removed by the fluxes without injury to the pig metal. These compounds of titanium are the cause of the often superb blue color of the cinder, produced under varying conditions of glassy or stony character, and must be carefully distinguished from those we regard as more detrimental in their influence on the metal.

In a number of analyses of iron ores we had found both oxide of chromium and oxide of titanium in a state rendering them soluble in diluted acids, and in a condition to escape detection in the ordinary modes of analysis. Both magnetic and brown iron ores have been found to contain either oxide of chromium, or oxide of titanium in this soluble state. Among the samples from contiguous beds, this diversity in composition made by the presence of some oxide of chromium or oxide of titanium existed; and while the bulk of a bed of ore was pure, continuations of the bed, or associated ore, yielded notable weights of oxide of chromium or oxide of titanium in the different samples.

The suggestion we would make to the iron master in view of these facts is, the possibility of the quality of the pig metals in anomalous cases being greatly influenced by the admixture of some ore, containing the oxides of chromium or titanium, with the basis ore of good quality. This may take place by the main bed being crossed by veins of mixed ore, or by the workings passing into contiguous beds where one kind of ore is used. In other cases, where the iron master can gain the great advantage arising from mixing ores, one of the kinds may contain the contaminating oxides and injure the iron.

We subjoin some results of analyses showing the proportion of oxide of chromium to the metallic iron contained in the ores:

1st. Magnetic ore—iron, 49; oxide of chromium, 1·40. 2d. Hematite ore—iron, 42·47; oxide of chromium, 1·60. 3d. Brown Massive ore—iron, 54·32; oxide of chromium, 1·90. 4th. Same —iron, 46·70; oxide of chromium, 1·04.

More traces have been discovered in some cases, while in other instances a larger proportion of chromium formed an alloy with the iron produced from the ore.

"ARE PAINTED LIGHTNING RODS ANY PROTECTION?"

BY JOHN H. PATTERSON.

We do not believe that paint or rust totally destroys the conducting power of a lightning rod; only in proportion to the amount of impurities with which it is coated. There is, doubtless, a point beyond which a conductor will cease to be one, because the impurities upon it may be so great that it will possess no more facilities for conducting the fluid to the earth than the building itself. It would all depend upon the extent of the charge, and whether there was any tin or zinc spouting in connection with it. The very best scientific authority says that iron has 12° of conducting power, tin 14°, zinc 24°, and copper 92°. All admit that electricity will follow the best conductors only. If such is a fact it cannot be reasonably supposed that if such spouting was in contact with a perfect iron rod, that a charge of electricity would follow the main conductor to the earth. Would it not rather leave the iron rod and pass over the spouting? It certainly would if the theory alluded to is correct. Whether or not the lightning rod was painted, it is natural to suppose that combustion would ensue. The explosion might not be very great, and no serious damage might be done, and no lives lost, yet that does not refute the principle. Every few days we read of the freaks of lightning, and upon buildings, too, protected by iron rods. Why is this? Professor Douglass, of the University of Michigan, in an elaborate paper upon this subject says, that the design of a lightning rod is to prevent a stroke of lightning by silently relieving the positive atmosphere of its overcharge. This idea looks very reasonable, for Dr. Franklin said that explosions only occurred when conductors could not discharge it as fast as they received it. Now if a conductor cannot discharge the fluid there must be a cause for it. Either it is not large enough, is not perfectly applied, or it is coated with impurities. We know that an ordinary iron rod will conduct off an ordinary stroke of lightning, for it has been seen; but when an explosion occurs it cannot be stated which of the other two causes is the particular one unless the conductor is in direct contact with spouting of a superior conducting metal. Then the case is very clear. If it is in contact with such spouting, the idea that electricity follows the best conductors is correct. If the rod is insulated from both building and spouting, then the cause must be the impurities on the rod, be they paint or rust.

Lightning rods of a proper metal, copper, applied in a proper manner, are certainly a means of protection.

A recent writer quotes Professor Henry to prove that conductors should be brought in contact with the spouting on a building. This principle is certainly true respecting copper, but for the reasons given above, we hardly think it correct to expect electricity to leave a good conductor (the zinc spouting) for a poor one (an iron lightning rod), and we do not believe that Professor Henry desires to be so understood.

There can be no doubt but what the conducting power of a lightning rod is affected in proportion as it is coated with impurities of any character. If electricity, in its passage to the earth, passed into the conductor, there might be some reason to suppose that paint would not interfere with it; but when it has been demonstrated by scientific investigation that it resides only upon its exterior surface, we are not at a loss to understand why the surface of a lightning rod must be free from such impurities. That electricity does not enter into a conductor, we will refer to "Silliman's Natural Philosophy," page 540; "Olmsted's Philosophy," by Snell, page 327, and "Nichol's Cyclopedia of Physical Science," article—Electricity. In "Parker's Philosophy," page 280, we read: ". . . . and paint destroys the conducting power of a lightning rod."

We are aware that our ideas are at variance with one of the most distinguished scholars in the world—Professor Henry—and, of course, we do not think of setting aside his authority; but we have given them, and let them go for what they are worth. In this connection we refer to a letter from Professor Henry, of the Smithsonian institute, in which he says:

> The paint with which lightning rods are usually covered consists principally of carbon, and as this is, in itself, a good conductor, it could hardly interfere with the conducting power of the rod. Beside this, though the electricity tends to pass at the surface of a conductor, it in reality passes within the metal, as a wire which fully conducts a discharge from a battery, may be coated with non-conducting varnish or sealing wax.
>
> The office of a lightning rod is to protect a building from a discharge from the heavens. As a general thing its effect upon a distant cloud must be too small to silently discharge its redundant electricity, though in some rare instances it is possible that it may so reduce the intensity of the cloud as to prevent a discharge, when, without such reduction, a discharge would take place.

JOHN MACADAM—INVENTOR OF MACADAMIZED ROADS

BY JAMES PARTON.

Few persons are aware who ride over the excellent macadamized roads of the Central Park, that Mr. Macadam, the inventor of the roads which bear his name, was once a resident of New York, and probably often walked or rode over the fields and farms which then occupied the site of the park. Yet such was the fact. Though born and buried in Scotland, he lived for some years in New York; and, possibly, the horrid condition of American roads before the revolutionary war, may have first impressed upon his mind the urgent necessity there was for a better road system.

John Loudon Macadam was born in 1756, in Ayr county, Scotland, not far from the birthplace of Robert Burns. His family was ancient and highly respectable. When he was little more than an infant, one of his uncles, William Macadam, accompanied the British forces which came to America under Lord Loudoun, during the old French war, for the conquest of Canada. This William Macadam, it appears, had something to do with supplying the British army with provisions; and when the war was over, instead of returning to Europe, he settled in the city of New York, where he became a thriving merchant. When John Macadam was fourteen years of age, his father died, and the boy was sent to America to become a member of the family of his uncle William, who procured him a place in the counting-house of a friend.

This was in 1770, when New York was a quaint old place, half English, half Dutch, situated at the end of Manhattan Island; the residue of which was verdant with woods and farms, and adorned with the villas and mansions of the wealthier citizens. People who are only acquainted with Manhattan Island now, when its beautiful groves are gone, its commanding bluffs dug away, its surface excavated and excoriated for railroads and streets, can form no idea of its loveliness a hundred years ago, when Johnny Macadam was a junior clerk.

Five years after his arrival here, the revolutionary war broke out, and he was compelled to side for the king or the colonies. Being but nineteen years of age at the time, and of Scottish birth (there is a great deal of Tory blood in Scottish veins), he espoused the cause of George the Third, along with his uncle William, and a majority of the wealthier merchants of the city. In 1776, when he was still but twenty years old, General Washington was compelled to abandon New York, which, for the next seven years was in the hands of the British. After a time, this young man received the valuable appointment of prize-agent for the port of New York, which gave him a percentage upon the prizes brought in by British privateers and men-of-war. His percentage was probably pretty liberal, for he is reported to have gained a considerable fortune from his office.

Far indeed was it from the thoughts of the New York loyalists that the time would ever come when it would be beyond the power of their king to protect his faithful subjects in Manhattan. And yet that time came. In 1783, John Macadam, then twenty-seven years of age, with all the other Tories of note, was obliged to leave New York, and abandon so much of their property as they could not carry off.

On reaching his native Scotland, however, Macadam was rich enough to buy an estate in the county of Ayr, and that estate was large enough to make him an important man in the county. We find him soon a county magistrate, a trustee of the public roads, and Deputy Lord Lieutenant—offices which are never bestowed in Great Britain except upon persons of wealth and social importance. It was while he held the office of Ayrshire road trustee that he began seriously to study the subject of road making. At that time roads were universally bad, except where Nature herself had made them good.

"A broad-wheeled wagon," wrote Adam Smith, in 1774, "attended by two men, and drawn by eight horses, in about *six week's time*, carries and brings back, between London and Edinburgh (404 miles), near four tun weight of goods."

Dr. Franklin, writing in 1751, speaks of traveling seventy miles a day in England, by a post-chaise, as a most extraordinary achievement—killing to man and beast. Much of the soil of England and Scotland is a deep, rich clay, which makes the best farms and the worst roads in the universe; and yet it is particularly well adapted to the system of Macadam.

What it was which suggested to him the simple expedient of covering the soft miry roads with broken stones, averaging six ounces each in weight, has not been recorded. We only know, that, during the long wars between England and France, he held important appointments under the Crown, which made it his duty to superintend the transportation of supplies.

He then renewed the study of roads, and pursued it with all the unflagging perseverance of a thorough Scotchman. At his own expense, he traveled thirty thousand miles for the observation of roads, which occupied him more than five years, and cost him more than five thousand pounds sterling. I presume his idea was entirely original; for we cannot find any trace of a macadamized road previous to his day. The only notion which existed, previous to his time, of making a permanent road, was to pave the whole surface with pebbles, blocks, or slabs of stone; either of which was far too expensive to become general.

It was not until 1811, when he was fifty-five years of age, that Macadam made his celebrated report to the House of Commons, in which he described the condition of the roads of Great Britain, and gave an outline of his system for repairing them. In 1815, a district was assigned him for an experiment. Need I say that he met with nothing but opposition, not only from every one connected with the old road system, but even from the farmers through whose lands the first macadamized road was to be made! Such was the prejudice against his plan that he could not get the old road-makers to execute his orders, and he was obliged to get his three sons to come and assist him in superintending the details.

But the tide soon turned. A good macadamized road is an irresistible argument; and there soon arose a rage for making such roads, as furious as the former prejudice against them. Four years after he began operations, there were seven hundred miles of macadamized road in Great Britain; and, before the death of the inventor, out of the twenty-five thousand six hundred miles of high roads in England, there were not more, it is said, than two hundred and fifty miles not macadamized.

John Macadam was a strangely disinterested man. He not only refused to receive any reward for his services, including an offered knighthood, but he would not take a contract to make or repair a road, and he declined some pressing and liberal offers to take charge of the roads in foreign countries.

He was twice married; first, during his residence in New York, to a Long Island lady; and again, in his seventy-first year, to another American lady, Miss de Lancey, of New York, a member of the family which has given its name to one of our streets. He died in 1836, aged eighty years.

I have spoken above of the excellent roads in the Central Park of New York, as macadamized. I should, perhaps, have styled them *Telfordized*, for it was Thomas Telford, a famous English engineer, cotemporary with Macadam, who invented the particular plan upon which those roads are built. Macadam laid his broken stones upon the naked soil; but it was Thomas Telford who improved upon Macadam's idea by laying large, rough, flat stones upon the soil, placing upon them the broken stones of Macadam, and covering the surface with fragments of the size of a boy's marble.—*New York Ledger*.

The Fort Montgomery Explosion.

The New York *Sun* states that the recent terrible explosion in a mine near Fort Montgomery, on the Hudson river, was occasioned by nitro-glycerin in its new form of "dynamite." Some of it had been sent to the mine for trial. Having a three-inch hole, four feet deep, to fire, the foreman pounded the compound under a hammer to the consistency of fine powder, while the boss of the gang scraped it from the plank on which it was pulverized, and put about seven pounds in his can which had a thimble stopper, when the gang of three men left for the shaft. While on their way, the can was opened by the man who had it in charge to exhibit the powder to others, and as there were lighted pipes in the company, a spark came in contact, when the explosion took place. It is quite evident that this terrible substance has been somewhat tamed, but not yet sufficiently so as to justify the neglect of ordinary precaution in handling it.

Manufacture of Silk in California.

Since writing the article entitled "Why not Grow our own Silk?" we find the following additional particulars in a California exchange, relative to the silk culture in that State: "Mulberry trees are here in great abundance, the 'Natural Wealth of California' giving 4,000,000 of trees for 1867, and we may say at least 5,000,000 for next year's use. The production of eggs has kept pace with the means to supply food for the worms, for it has been stimulated by a full demand from abroad. We raise two crops of cocoons in a season, as the rule, but three crops are not unfrequent, though the third crop draws too severely on the vitality of the tree, by overplucking of the leaves, and it should be discouraged. We can expect but one crop of eggs in a season. The second is left to us for home use. The cocoon, which the miller cuts his way through, suffers a loss of value by the continuity of the thread being broken. But it makes good silk for goods not requiring long staple. Of this spun silk, we are accumulating stock. Mr. Englander, who made so creditable a display of silk fringes at the Fair, says it can be worked up here by our present facilities. Beside this stock, the sound cocoons left for silk, this year, may be rated at one million, and so rapid is the reproduction, that this would make ten millions for 1869. To reel, weave, and complete the fabric would give steady employment to one thousand hands, beside the great number that would find work gathering leaves, attending and feeding the worms. When we consider, that in 1870 the rapid increase of silkworms, all healthy, will give us five to ten times more cocoons than 1869, we are sensible there is no time to be lost in going into the making of silks. In one season the simple unwinding of cocoons may be taught very expertly to any number of girls. Making silk sewing thread is as simple as making other thread. Dyeing silk, though it has some peculiarities, can be done by workmen skilled in other fine coloring, and, at least, the artesian waters of our San Bruno range have the requisite freedom from impurity. Can we weave silk? will not be questioned by any one who has seen the silk cloth actually and continuously made during four weeks at the Fair, by Messrs. Joseph and Isidor Neumann, whose perseverance is worthy of the highest reward; and we trust they will soon realize it in substantial success and in public acknowledgment. Mr. Neumann has a number of new looms of the best construction ready for use, and he has invented a reel, which was in use at the Fair, and which is all that can be desired. Though silk eggs bring a price that tempts us to export them just now, the establishment of manufactories would show that it would pay us better to lose the surplus eggs and save the cocoons for thread and cloth. Notwithstanding the price of labor, we can make our own silk for 25 per cent less than the importer can put the foreign fabric on his shelves. Our land is cheaper, our trees are more prolific of leaves, our worms are not infected with disease that kills half of them and injures the silk-making perfection of the rest; our trees are new, and the quality of the leaves for food is untainted by the effects of long-continued plucking. Our climate alone gives advantages in the superior weight of our cocoons, and in the perfection of the silk they yield, to counterbalance the greater wages of labor, if we had not the other advantages enumerated; and no branch of industry affords so great a proportion of light and pleasant work for the employment of women and children."

Carbonic Acid in the Atmosphere.

The German chemist Pettenkofer, several years ago, introduced a new and more accurate method for the quantitative determination of the amount of carbonic acid in the atmosphere. By means of this method, Thorpe has obtained the following result: On the land the amount of carbonic acid in the atmosphere varies from $2\frac{1}{2}$ to 8 volumes for 10,000 volumes of air; the mean for Europe is 4 volumes in 10,000 of air; in New Granada, South America, Levy had previously found 3·8 volumes during the rainy season, and 4·6 during the dry season. On the sea the variations are much less, and the amount of carbonic acid is also less; the mean of all determinations of sea air being only 3, while land air gave 4 volumes in 10,000 of air.

To show the difference between the free atmospheric air and the air in our school rooms and other crowded places, we collect the following from results, most of which were obtained by means of Pettenkofer's method; all the figures given as the amount of carbonic acid express the number of volumes of carbonic acid in 10,000 volumes of the air analyzed:

Free atmospheric air, 4. Pettenkofer's study, 3,000 cubic feet capacity—after having been there for four hours, 5 2-3; after his assistant had been with him for a little while, 9. Liebig's laboratory—capacity 46,000 cubic feet—air taken at various intervals during a lecture (about 3,000 persons present), in March, 6 P. M., 11; same lecture, 6 1-2 P. M., 23; same lecture, 7 P. M., 32 this last time the air was somewhat oppressive. A school room—10,400 cubic feet capacity—70 girls between nine and ten years old; temperature of room, 66 deg. Fah., at the close of the instruction, 72—or about eighteen times as much as in the free air! Sleeping rooms, for soldiers in Munich—one room, 10,147 cubic feet capacity, 19 soldiers—in the morning, 46; another room—capacity 10,255 cubic feet, 10 soldiers—in the morning, 34. A theater, very crowded, Roscoe found, 4 feet above the stage, 23; 34 feet above the stage, 32. A court room, in London, 44; Underground Railways, London, from 4 to 12. Air, fresh, inhaled, 4. Air, exhaled, on average, 400—or 100 times as much as the air inhaled.

From all determinations yet made, it may be concluded that 10 volumes of carbonic acid for 10,000 of air, are quite comfortable; when this quantity is not exceeded, the ventilation is good, no unpleasant odors are observed; but that rooms containing much more than 10 of carbonic acid in 10,000 of air (or one in a thousand) are not fit for a prolonged sojourn of people.—*Prof. Gustavus Hinrichs.*

OPINIONS OF THE PRESS.

We are indebted to our cotemporaries for many very flattering notices, only a few of which we can copy. The Chicago *Railway Review* says:

Our readers are well aware of the value which we attach to the SCIENTIFIC AMERICAN, from the frequency with which we quote its articles and refer to its conclusions. The excellence thus indorsed by us, in common with the entire newspaper press, lies not only in its scope and versatility, but in the simplicity and intelligibleness of its style. It covers the whole field of practical science, but without pretension, technicality, and dreary pedantry. It is emphatically a journal of to-day—an "abstract and brief chronicle"—brief but comprehensive and exhaustive of all branches of applied science which find a field in modern invention and industry. The last number of the XIXth volume comes to hand with a finely engraved representative title page, an earnest of the realization of the liberal promises of the prospectus of volume XX. Glancing at the index of subjects discussed and illustrated in the volume just closing, it is hard to see where improvements can be made; but we take the word of the liberal and enlightened publishers, that noticeable improvements will be made, and wait curiously, but not skeptically, to see what they will be.

The *Ambassador*, published in this city, says:

The SCIENTIFIC AMERICAN has a place, all to itself, in the world of scientific readers and writers—having neither peer nor second. It is a just compliment to American thought and enterprise, that America can lead the world in the publication of such a journal. Its specialties are practical information, art, science, mechanics, chemistry, and manufactures. Every patent invention is recorded; many of them described; many illustrated by large and handsome engravings. Every created thing, from a steam engine to a top, has a biography in the SCIENTIFIC AMERICAN. For reading matter it has carefully prepared papers on all sorts of subjects within the limits of science and art.

The Iowa *Instructor*, the educational organ *par excellence* of Iowa, thus speaks of the value of the information obtainable from the perusal of our columns to the proper qualification of teachers for their arduous and responsible labors:

The SCIENTIFIC AMERICAN is unquestionably *the* journal for all those who delight in following the inventive genius of the people of this country in that direction which at present is most prominently developed. If we were at all phrenologically inclined, we should, in giving a description of Uncle Sam's cranium, pronounce his bump of mechanical contrivances most wonderfully large—especially after a close inspection of a few numbers of the SCIENTIFIC AMERICAN. Yet it is astonishing to notice that few persons outside of the mechanical arts take an interest in these matters. Surely it is as important to understand the peculiar appliances and ingenious processes, which, as by magic, transform the natural products into such articles which civilized society demand, as it is to be able to know what peculiar twists the ancients were fond of attaching to nouns and verbs, to indicate their mutual relations. At any rate *we think it neither improper nor ungenteel not to be ignorant* of some of the processes of the mechanical arts; and, indeed, we know that in other countries such knowledge is considered essential to education. If, therefore, any teacher has a predilection for such matters, we trust he will cultivate this faculty of his mind and give the result of his readings, study, and work to the pupils under his care—in order to make the children honor labor and love those who have benefited mankind by their mechanical genius.

More About the Suez Canal.

A captain of an English merchant vessel who has recently been making a trip through the Suez Canal, writes as follows to the *London Times:*

The canal, as designed, is about a hundred miles long. Of this length about half is sufficiently advanced for the sea water to reach fifty miles—that is, into the middle of the Isthmus. It is finished to its full breadth, which is a hundred yards, or the width of a considerable river, but not to the intended depth of twenty-six feet. The remaining fifty miles not yet penetrated by the sea water, are in various states of progress: parts are excavated, parts are under water, parts will have to be laid under water, which is to be supplied from a great lake not yet filled, while a good many miles have to wait for large blasting operations. To English ears it must sound promising that a good deal of clay has to be cut through; for nothing can be dealt with so successfully in this country as that material. The completion of the southern half of the canal would look like a very long work but for the fact of the immense subsidiary works being completed and a vast mass of appliances being on the spot. The service canal from the Nile to the mid point of the salt water canal, and branching thence to either extremity, is an immense work, not less than a hundred and fifty miles long, and in full use for the supply of fresh water for navigation and for otherwise assisting the work to be done. The port at the Mediterranean end is an immense work, already available. The sea channel at the Suez end has difficulties, but only such as engineers are familiar with. Forty enormous and costly dredging machines are at work on different parts of the canal—chiefly, we conclude, the northern half—discharging mountains of mud, sand and clay over the banks or into barges. The rate of expenditure is put at £200,000 per month, or two and a half millions a year. Our informant calculates that a driving wind, after blowing a month together, will send into the canal, when finished, five hundred tuns of sand a day, or fifteen thousand tuns a month. This, however, is no more than a single dredging machine would be able to keep down at a certain moderate cost in coal. The difficulty of keeping up the banks of the canal, exposed as they will be to the wash of steamers, and to a surface often agitated by the wind, is a more serious matter, but one which does not enter into the present question. Upon the whole, it does seem a moral certainty that, at least in two or three years—for one year seems out of the question—this great undertaking, worthy of a heroic age, will be brought to what we may fairly call an actual completion. In the course of the year 1871, we may probably see the sea water of one ocean flowing into the other.

Improved Automatic Horse Hay Rake.

That the department of agriculture is highly estimated by inventors, at least as affording a field for the exercise of their tal- ents, is sufficiently proved by the frequently offered improvements in implements of husbandry, especially those designed to save labor and time. Among these none have received more frequent attention than those relating to the cutting and gathering of the hay crop, and none have been of greater utility. To be sure, objections to their use and difficulties in their management have been found in a number of horse rakes, but improvements following improvements are rapidly bringing this implement to perfection. The engraving presents a perspective view of a horse hay rake which offers some points believed to be improvements not found on other machines.

The wheels, two in number, are rigidly secured to their respective axles, the outer bearings of which are in a box secured to the under side of the main frame of the machine and the inner portion supported by similar boxes secured to cross bars of the frame. The inner ends of the two axles support a gear or pinion turning freely, the outer faces, or sides of which are formed into ratchets with which sliding ratchets on the respective axles engage, these latter allowed to slide on the axles, but held to the ratchet sides of the pinion by means of spiral springs, and connected to the axles by pins traversing slots in the axle, or by forming the axle ends and the holes in the clutches square. This gives independent action to each wheel in backing and unites the two wheels, when the vehicle moves forward, so that the two axles act as one. A toothed rack bar, connecting at one end with a lever having a handle at the top, and at the other end with a foot lever in front of the driver's seat, serves to raise by means of the pinion on the main shaft or combined axle, the teeth of the rake, which pass through slots in a hinged bar at the rear of the machine. The separate teeth are attached to thimbles that turn freely and independently on the rake head shaft, so as to enable them to reach depressions in the surface of the field. When driven on the road the rake teeth are held from the ground by the lever at the right hand of the driver's seat. To discharge a rake-full of hay the driver presses upon the foot lever, bringing the rack in contact with the pinion that raises the rake, and allows it to fall soon as the rack section has passed the circumference of the pinion. The operation of the machine and its advantages may be comprehended by an examination of the engraving in connection with this description. It will be seen that the operation of the rake is at all times under the control of the driver, and that except when he wishes to instantly elevate the rake teeth by means of the hand lever, both hands will be free to guide the horse.

Patented June 16, 1868, through the Scientific American Patent Agency, by Jonathan Hunsberger, who may be addressed for the sale of the entire right, or for state and county rights, at Skippackville, Montgomery Co., Pa.

HUNSBERGER'S PATENT SELF-DISCHARGING HORSE RAKE.

Improved Engine and Signal Oils for Railroads.

Throughout the country, says Pease's Oil Circular, there is a better demand for first-class oils. In many cases what is gained in price of cheap oils is lost ten times over in the repair account. There is an enormous loss of power in our railroads by the use of cheap oils, and we include in this those oils easily affected by heat. The experiments of Metz and Morin in 1831, and others up to the present date establish the fact that the amount of friction is found to be dependent rather upon the nature of the unguents than upon the surface of contact, and the nature of the oils must be measured by the pressure or weight tending to force the surfaces together.

There is no question but that there is a loss of 30 to 56 per cent of power on most of the roads in this country by not looking into and understanding the laws of friction, and the effects of heat and pressure upon the oils used. They must be based upon scientific principles, and adapted to the uses intended, otherwise they fail to accomplish any satisfatory results, and a great loss of power and destruction of machinery is the result.

Friction, immediate or long continued has the same effect upon oils; in one case it is immediate, as in a steam cylinder, in the other it is slow and long continued, as on the slides and smaller bearings. Oils must be made to form a perfect separation, otherwise the friction is increased and is dependent upon its greater or less viscosity, whose effect is proportional to the extent of the surface between which it interposed.

Those roads that have looked into this important matter, ranking the third or fourth in expenses, are now saving tens of thousands of dollars every year.

There is no occasion for a hot journal on any road under ordinary circumstances and using proper oils. There is no occasion for cutting of journals and destruction of valve seats, if a little thought would only be given to the subject of pressure and friction. The wonderful chemical effect of some of the poor cheap oils upon the iron surfaces and journals of some of the roads is entirely overlooked. Has it ever occurred to railroad men that the use of oils of strong acid reaction has a tendency to weaken the strength of the boiler itself, as they have the power to cut and destroy the bolts of the steam chest and cylinder?

THE INVENTOR OF THE VELOCIPEDE.—The last number of the *Moniteur de la Photographie* of Paris, (1st Nov., 1868) has an interesting series of letters upon the invention of the velocipede, which, it appears, would be due to Niepce, for whom is claimed also the invention of photography. The letters in question are written from Claude Niepce to his brother Nicephore Niepce, and are dated from Hammersmith, near London, Nov. and Dec., 1818, and August, 1819. We do not glean from them that the first idea of a velocipede originated with Nicephore Niepce, but simply that he was occupied with some experiments concerning the improvement of this kind of locomotive. If no mention can be found of a velocipede prior to the year 1818 doubtless Niepce has good claim to its invention.

KASSON'S CONCAVO-CONVEX AUGER AND BIT.

The front or working faces of this auger bit are concave and the rear faces are convex giving great strength to the twist and removing the chips without undue friction against the edges of the hole, thus preventing clogging and gumming. The cutting lip is merely a continuation of the twist, so that if the auger should be broken at any portion of its length another screw and other cutting edges can be formed by cutting the twist at a plane nearly at right angles with the axis of the auger. The convexity of the cross section of the twist, increasing toward the center, is, in effect, a strengthening rib, making a very stiff tool. This auger, or bit, is adapted to all kinds of wood, hard or soft, and is specially adapted for boring hubs, pumps, etc., and to all descriptions of wood boring machinery. Having less friction than the ordinary style of auger it is less liable to become heated, and it relieves itself perfectly of the chips, without clogging, and does not require to be withdrawn for clearance.

Patented through the Scientific American Patent Agency, January 15, 1867 (reissue dated April 9, 1867), by A. C. Kasson of Milwaukee, Wis., assignor to himself and N C. Gridley of St. Louis, Mo. Manufactured and for sale by the Humphreysville Manufacturing Company; J. M. Watkins, agent, who may be addressed at No. 5 Gold street, New York.

A CURIOUS fact in connection with the practical working of the Atlantic Cable Telegraph is that messages sent from London to-day arrive in New York yesterday.

A Newly Discovered Property of Gun-cotton.

It has been found that the explosive force of gun-cotton may, like that of nitro-glycerin, be developed by the exposure of the substance to the sudden concussion produced by a detonation; and that if exploded by that agency, the suddenness and consequent violence of its action greatly exceed that of its explosion by means of a highly heated body or flame. This is a most important discovery, and one which invests gun-cotton with totally new and valuable characteristics; for it follows, as recent experiments have fully demonstrated, that gun-cotton, even when freely exposed to air, may be made to explode with destructive violence, apparently not inferior to that of nitro-glycerin, simply by employing for its explosion a fuse to which is attached a small detonating charge. Some remarkable results have been already obtained with this new mode of exploding gun-cotton. Large blocks of granite and other very hard rock, and iron plates of some thickness, have been shattered by exploding small charges of gun-cotton, which simply rested upon their upper surfaces—an effect which will be sufficiently surprising to those who have hitherto believed, as every one has believed, that unconfined gun-cotton was scarcely to be considered as explosive at all, that it puffed harmlessly away into the air, not exerting sufficient force upon the body on which it might be resting to depress a nicely balanced pair of scales, supposing the charge to be fired upon one plate of the scale. Further, long charges or trains of gun-cotton, simply placed upon the ground against stockades of great strength, and wholly unconfined, have been exploded by means of detonating fuzes placed in the centre or at one end of the train, and produced uniformly destructive effects throughout their entire length, the results corresponding to those produced by eight or ten times the amount of gunpowder when applied under the most favorable conditions. Mining and quarrying operations with gun-cotton applied in the new manner have furnished results quite equal to those obtained with nitro-glycerin, and have proved conclusively, that if gun-cotton is exploded by detonation, it is unnecessary to confine the charge in the blast hole by the process of hard tamping, as the explosion of the entire charge takes place too suddenly for its effects to be appreciably diminished by the line of escape presented by the blast hole.

Thus the most dangerous of all operations connected with mining may be dispensed with when gun-cotton fired by the new system is employed. It will readily be observed that this discovery, which we believe is due to Mr. Brown, of the English War Office Chemical Establishment, is likely to be attended with the most important results. Not merely is the strength of gun-cotton exploded in this way much greater than that of the same substance fired by simple ignition, but it now operates under conditions which were sufficient under the old system practically to deprive gun-cotton of its power. It has been said, and said justly, that if you want gun-cotton to exert itself you must coax it into the belief that it has a great deal to do. You must give it bonds to break and physical obstacles to overcome, with no outlet or possibility of escape. But now gun-cotton will exert itself, and put forth more than what was believed to be its full strength, whether to see any work to do or not. It will behave as less coy explosives have behaved before it—always with this difference, that it is half a dozen times as powerful as any of its rivals, with the exception of nitro-glycerin, to which in mere power even it is not inferior. This discovery, therefore, can hardly fail to give a considerable impetus to gun-cotton, and to lead to its universal adoption for mining purposes, as soon as its new properties become generally known. In connection with possible military applications the discovery is invaluable. There can no longer be any doubt what agent should be employed for the breaching of stockades and the like; and the absence of all necessity for the use of strong confining envelopes will have an important bearing on the employment of gun-cotton for torpedoes and all submarine explosive operations, beside greatly simplifying mining and breaching operations in the field. We have, in fact, discovered several new advantages to add to those which already had sufficed to recommend gun-cotton as an explosive agent in preference to all others. The conditions that are fulfilled by a detonating fuse in determining the violent explosion of gun-cotton, under circumstances which hitherto have been altogether unfavorable to such a result, have been made the subject of investigation by Mr. Abel, and we hope at some future time to notice the conclusions at which he has arrived, as they appear to have a very important general bearing upon the conditions which regulate the development of explosive force, not merely from gun-cotton and nitro-glycerin, but from explosive compounds and mixtures generally.

A MICROSCOPIC club has been organized in Chicago. Two well-known citizens express a willingness to give liberally toward purchasing instruments and scientific works upon the subject of microscopic instruments.

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Contents:

(Illustrated articles are marked with an asterisk.)

HONOR OF WORKMEN—THE VALUE OF A GOOD NAME.

That "honesty is the best policy" requires no argument addressed to the intellect, nor moral appeal to the conscience to prove. He who has studied history, used his opportunities for observation, or allowed his own experience to become his teacher, needs no further evidence that it "pays" to be honest. We do not use the verb in only its lower and ultimate sense, but in its true signification; for no condition is so abject as that in which a man cannot respect himself. Injustice or neglect may be borne philosophically, but a consciousness of meanness and a knowledge of deliberate wrong-doing are worse than the brand of Cain, and destroy the manly pride that is the glory of every honest man. He who gives his neighbor the fair return for his money leaves no obligation unredeemed, no promise unfulfilled to return like a "curse come home to roost." The laborer who faithfully works his allotted hours, honestly fulfilling his part of the contract; the mechanic who earnestly uses his best endeavors to understand the job in hand; and the employé who works for his employer as earnestly and honestly as he would for himself, or as he would require others to work for him, know that honesty *is* the best policy. The false economy which induces the "middle man," or merchant, to take advantage of the producer and consumer by belittling the value of the article he buys, and adding improperly to the price of the article when sold, and which encourages the belief among workmen that they gain by the loss of the employer through their negligence or overreaching, is entirely unworthy the character of an honest man, and is also unprofitable. Such cases we believe to be rare among mechanics. No department of our business life is more honorably conducted than that in which the mechanic and employer, the manufacturer and his customer are concerned.

Generally, we believe, our mechanics take such pride in their work that they prefer to suffer a personal pecuniary loss rather than impair their good name. We have known manufacturers to condemn a large number of finished or partly finished articles, and bear the loss of the labor, time, and material expended, rather than risk impairing the good name their perfect work had gained for them. To prevent any injury to his reputation, we know of instances where a manufacturer has so utterly destroyed imperfect work that it could not be used except in its elements, as the crude material, when the loss was counted by the thousands of dollars.

And this sense of honor is no less strong among workmen who depend wholly on their daily work for a livelihood. How often the workman refuses to permit himself to eat his lunch or rest during the hour of recess, preferring rather to rectify an error or to perfect an unfinished piece of work. He will even deprive himself of sleep or neglect domestic duties in order to keep up his self-imposed standard of excellence as a mechanic. Yet in many such cases the workman was paid by the day, with no special consideration of the amount of work performed. But his innate sense of justice, or, rather, his pride in his handiwork, has been the impelling power, even the approval of his "boss" or employer being frequently unexpected and perhaps withheld. The fascination of the exercise of mechanical skill may account for part of this earnestness and self-denial; for scarcely any other employment can equal, in absorbing interest, that of the mechanic who sees, day by day and week by week, the crude materials assume form, and beauty, and at last acquire the quality of usefulness. Yet something must be attributed to the *esprit de corps*, the generous honor of excellence that undoubtedly prevails among mechanics, and preserves the trades from becoming only a resort for miserable mercenaries.

The good name attained by the exercise of this honor among manufacturers and mechanics is really valuable, apart from the comfort of a "conscience void of offense." The prosperity of some of the most extensive manufacturers has been assured, and is maintained simply by the exercise of this honor. We could name a number, both in this country and Europe, which has not depended specially on the monopoly of patents, nor upon any secrets in their business, but on the excellence of workmanship and absolute value of their productions for their fame, which is world-wide. And we could mention mechanics by name who never aspired to the position of proprietors or employers, yet whose loss would be felt far beyond the limits of the establishment in which they are employed or its immediate connections. These are mechanics *par excellence*, whose opinions are decrees, whose honor is unimpeachable, and whose monuments, apart from the admiration of their fellows, are their works.

INUTILITY OF FORTS OF MASONRY.

The recent destruction of Fort Lafayette at one of the entrances of New York harbor, by fire, leaving only the blackened walls remaining, affords an opportunity of judging of the value of such structures for coast defense. Here was no battering of the structure by hostile shot, no shattering by hostile shell; but a simple accident, such as might occur in any dwelling or storehouse, left the defense, so-called, in a few hours a perfect wreck. Indeed, but a few minutes sufficed to render it untenable, the flames driving the last sentinel from his post. If a spark from the chimney of a casemate could so easily and quickly kindle a fire that stopped its ravages only when there was nothing left for the flames to feed upon, and which left the entire structure only a mass of useless ruins, what would be the value of such a defense against the exploding shells of a hostile ship? The fort would prove only a funeral pyre for its garrison.

Masses of masonry, either of brick or stone, are useless against the artillery and projectiles now in use. This was sufficiently proved in the Crimean war, and received many exemplifications during our late civil war. Fort Sumter, after being knocked into a dust heap, was more formidable than when under Anderson it frowned upon the rebel batteries of Charleston. Heaps of rubbish and mounds of earth and sand proved during the war to be more effectual defenses than the best specimens of engineering skill when built of granite, bricks, and mortar. The day of stone forts has passed. If forts are to be built they must be either of sand or earth, affording merely protection to men and guns from the direct fire of the enemy, or of iron, containing their garrisons in a shell, proof against the heaviest shot. But even these are limited in their usefulness for purposes of offense. If located at the entrance of a harbor the train of their guns is limited, and every advantage is in the hands of the enemy with ships at his command. A fort presents a fixed and usually a large target at which the guns of the enemy's ships may practice at will, while those of the fort can reply only when the enemy chooses to offer an opportunity, and then the target is a comparatively small one which is continually shifting its position and offering no satisfactory mark for the gunner.

If stationary forts are to be constructed at all, they should be places entirely inclosed so that dropping shot or shells could no more reach the interior than direct shot. They should also be bomb and shot proof, of material impenetrable to any projectile yet known. That this can be measurably accomplished is susceptible of theoretical proof and even practical demonstration. A system similar to that illustrated in No. 26 Vol. XIX SCIENTIFIC AMERICAN would seem to be greatly preferable to that on which millions are wasted every year.

But we believe that a system of floating, movable batteries would cost less in the first instance, be kept in repair for less, and be vastly more effective as harbor and coast defenses than the most elaborate system of fixed forts and batteries at present in use. Some such system, we are confident, will yet supersede the present inefficient and cumbersome method of national defense.

ABUSE OF THE FRANKING PRIVILEGE AGAIN.

We have frequently called attention to the abuse growing out of the franking privilege. The people now heavily taxed have a right to complain, and it is the duty of the press to expose the rascality which helps to carry up the cost of our mail service several millions beyond its actual receipts. If members of Congress knowingly allow others to use their franked envelopes to promote private schemes, then we say that they are *particeps criminis* in cheating Uncle Sam out of his just dues.

It is evident, that so long as a stamped frank is recognized as valid by the Post Office authorities, there can be no difficulty in reproducing the frank of any member of either House of Congress, the only expense being the cost of cutting the *fac-simile* of his signature

The only safe and proper method of guarding against frauds and abuses of this sort is to abolish franking altogether.

We have before us several envelopes covering the pamphlet of a Patent Agency at Washington bearing the stamped frank of Hon. John A. Logan, M. C. We have a letter from a gentleman in Germany in which he orders the SCIENTIFIC AMERICAN. It reaches us under the frank of Hon. J. M. Broomall, M. C. The *Sun* says the frank of Hon. John Lynch is used to pass bags full of New York papers through the mail. It is said that Hon. Demas Barnes franks circulars advertising his plantation bitters. And so it goes on. The people ought to grumble against such abuses until they are stopped; and we hope Senator Ramsay and others who can assist to do so will secure the passage of some bill to put a stop to this iniquity at once.

AERIAL INHABITANTS.

Most people have little idea of what the air we breathe contains. This ocean of mixed oxygen and nitrogen at the bottom of which we mortals flounder about, contains more than is dreamed of in their philosophy. The old spelling book exercises, "Birds live in the air." "Fish live in the sea," would be the substance of their replies, if questioned as to the living things which inhabit air and ocean. But the air is the home of immense numbers of living things which the unaided eye connot perceive, as well as the feathered and insect races. This vital fluid, without which we cannot ordinarily live five minutes, is literally crowded with life; life in an embryotic state it is true, but none the less life on that account.

An egg is a living thing; if you touch your tongue to the ends of a newly laid egg, you will find that one end is quite warm, while the other may be quite cold. So long as that heat remains the egg is alive—an organized being—capable under favorable circumstances of development into a bird of the species which deposited it. When that vital spark of heat is gone the egg is dead and will immediately decay. The seeds of plants are analogous to the eggs of birds, although after they are dead and incapable of germination, they will not decay so rapidly.

There is another class of germs of a still lower order than vegetable seeds. These are minute granules, parts of flowerless plants, which perform the functions of seeds, called spores. A good example of spores is to be found upon the under sides of the fronds of ferns, at the proper season. Spores are not so highly organized as the seeds of flowering plants, but they contain a vitality which, although of a lower type, is longer retained. In fact it is not improbable that some of them retain their power of germination for ages, only waiting for favorable circumstances to become developed into complete growth.

The air has been ascertained to be full of such germs, which, blown about by winds, lodged in crevices of stones in high buildings and tall cliffs, taken into the stomachs of animals with their food or inhaled with their breath, beaten to the earth with rains to rise again in the form of impalpable dust, at length find a proper nidus in which they speedily develope into maturity.

Some of these when breathed or otherwise taken into the system pass into the blood and produce disease. A large class of diseases are now attributed to this cause. Among them is the "Fever and Ague," the pestilence of new and low lands. This disease has lately been attributed by good authority to the presence of microscopic algea in the blood.

So plentiful are these germs existing in innumerable forms and variety in the atmosphere, that Dr's. Smith and Dancer, of Manchester, England, found that there was a quarter of a million spores in a single drop of distilled water which had been agitated in contact with the common air of that locality in a bottle. What myriads upon myriads of these tiny beings must be precipitated upon the earth during a storm of rain.

The microscope, that "wonderful eye which science has bestowed upon mankind" reveals to us these curious facts; and what its ultimate effect upon the sciences at large and medicine in particular, is to be, it is impossible to predict. The telescope is penetrating deeper and deeper into the celestial vault, and constantly telling us new wonders of the starry universe. The microscope on the contrary is dragging to light minute existences that have lain hidden for ages, and is tracing their influences upon the health of mankind. The army of workers with this most fascinating and instructive instrument is daily increasing, and a flood of light is beginning to pour upon many things hitherto most mysterious.

NAVIGATION OF THE MISSISSIPPI—PROPOSALS FOR ITS IMPROVEMENT.

The Mississippi and its tributaries constitute the great natural thoroughfare for the central portions of North America. The importance of improving its navigation and developing the facilities it affords, has been often the subject of thought and discussion since the general settlement by the whites of the one million two hundred thousand square miles which it drains. No other system of rivers can compare with it in extent or in the natural advantages afforded for extended and profitable traffic. It is not a matter of surprise then that in this age of stupendous enterprises, the improvement of these rivers should have attracted renewed attention from the engineering talent of the country. Such being the case, it may not be amiss, before discussing the plans proposed for this purpose, to say something of the peculiarities of the river itself.

The Mississippi is, in round numbers, three thousand miles in length from its source to its mouth, and is navigable at present from its mouth to the Falls of St. Anthony, about two thousand two hundred miles. Above these falls it is again navigable. The Arkansas and Red rivers emptying into it are each navigable for more than one thousand miles. The Missouri, its principal western tributary, is navigable to a point nearly four thousand miles by water from the Gulf of Mexico. Its large eastern tributaries, the Ohio, Tennessee, and Cumberland rivers give two thousand miles or so additional scope for steamers; while the total number of branches, large and small, towards its mouth, which are to a greater or less extent navigable, has been estimated at not less than fifteen hundred.

The lower plain through which the Mississippi flows, extending from the mouth of the Ohio to the Gulf, is about five hundred miles in length and of varying breadth, say from thirty to one hundred and fifty miles, including the great delta at its mouth. The delta is in all its parts nearly on a level with the water in the river when at its lowest point, and in consequence a system of dykes has been found requisite to prevent inundation. In the low water of summer the current towards the mouth of the river is extremely sluggish, an average fall of about eight inches per mile being all that is estimated for the lower plain through which it flows. It could hardly be otherwise under these circumstances that the course of the river over this plain should be very crooked, and its channels should be very changeable. Add to this the fact that the entire system embraces many tracts of sandy country and timber land and it will be easily understood how bars are constantly forming and shifting and "snags" are constantly drifting down the current to obstruct navigation.

How to relieve navigation from these embarrassments and at the same time to protect the low lands from the dangers of inundation, constitutes an intricate problem and one which will probably never be solved except by repeated experiment. The clearing up and removal of timber along the banks of the principle stream and its affluents, will gradually lessen the trouble arising from "snags," but the sediment poured into the river by the Missouri and other rivers and the periodical freshets remain. Some of the convolutions in the course of this river are so great that a distance of twenty-five to thirty miles by water only makes an air-line headway of a mile or two.

Some cuttings have been attempted to straighten the channel in such cases as the above but we believe the result has generally been that the succeeding freshets have wholly or partially filled up the channels thus formed, and the obstinate waters have either selected an entirely new bed or have returned to the old one. True these works were very imperfect in their nature and could hardly be expected to be durable; but there are doubtless difficulties to be surmounted in making permanent improvements in the Mississippi channel arising from the general instability of its banks, that are hardly appreciated by engineers who have not given special attention to the subject.

A plan has been recently laid before the Louisville Board of Trade, recommended by the New Orleans Academy of Sciences, which it is claimed meets the exigencies of the case; embracing, first, the proper direction to be given to walls or jetties for controlling the action of flowing water; and, second, a material for the construction of these walls or jetties, which can be conveniently handled, and which water cannot move or undermine. The first part of this plan depending upon the principle of reflection for the direction of currents, it is claimed can be readily applied by the exercise of proper judgment in constructing the jetties at the necessary angles to the currents intended to be controlled. In regard to the second part of the plan it was represented to the board that Manico's caisson is the best material for the construction of these jetties. These caissons are the invention of Lieut. Manico, of the Royal Marines of Great Britain, the engineer in charge of the construction of the breakwaters and other sea works of England, and are now used exclusively for such works on its coasts. Their construction and the method of placing them in position were described to the board as follows: "They are usually constructed of a latticed frame of wood or iron filled with loose stones of any kind; and for the convenience of being carried in barges, and handled with the crane, they are only one yard square. They are made sufficiently strong to bear the weight of from 1,200 to 2,000 pounds of stone, and to be craned or dumped down to form walls or obstructions upon the lines marked by the engineers for breakwaters, jetties, the foundations of lighthouses and forts, or any subaqueous works in seas or rivers. They are used exclusively in England for such purposes, and they are especially useful in all water currents, and indispensably necessary in bottoms of sand and mud, like those of our harbors and great rivers where piling and planking will not answer. Their great excellence consists not only in the convenience of their form for transportation, and handling for engineering purposes, and their cheapness, but in their stability to resist the undermining power of water. Their latticed form gives them the property of the snow shoe formed by the savage of plaited splits, and which prevents his foot from slipping or sinking in the snow; or like the knotted and webbed foot of the duck, which the Creator has formed for standing or walking on the mud and sand. They will not sink upon a sand bar and no power can drive them into it.

"The work done by the aid of these caissons is very simply and quickly performed. The lines for the jetties to protect a caving bank, or remove a bar, or shift or deepen a channel are 'staked off' by the engineer, and the barges of caissons are unloaded upon these lines and the work is done. The water completes the structure, and by its deposits makes a solid wall of the whole. No matter how they are thrown in a current, they can never be removed by the water. Every interstice between the loose stones is filled with sand and clay. Chemical action takes place in the compacted mass, and the whole becomes a conglomerate which will endure to the end of time."

In opposition to the claims of this plan may be placed the statement of General Roberts, of the U. S. A., made at the last meeting of the Connecticut Academy of Sciences, in which he attempted to show that the system of confining the flood-waters of the Mississippi river in one narrow channel by dyking, is obstructing the creative laws of delta bottoms and basins, and working the most serious evil by emptying into the Gulf of Mexico the delta-forming material that would, if the waters were left free, spread themselves over the low marshes and swamps, and in time raise them up to higher levels, by the cumulative process of delta deposit, and create cotton lands.

His plan is to introduce a system of waste weirs that should create artificial rivers and carry all the flood waters into the swamps, morasses, bayous, etc., of the Mississippi basin. He also proposes a system of engineering for the waters of the lakes, using them as reservoirs for the regulation of minimum low water navigation.

Without pretending to decide finally upon the relative merits of these schemes, we repeat that experiment alone will determine the value of either. To attempt to carry out either of them without previous trial of their individual workings would be extreme folly. It would be well, we think, for the Government to employ some engineers of established reputation to devote their time and efforts to experimental solution of this problem, and to feel the way as it were to a practical method. We do not believe the man lives who can devise in his study a system that will fulfill all the conditions of the problem, but we do not by any means on that account hold that a solution is impossible. If ever obtained, however, it will be by practical attempts upon the fickle banks themselves and not upon drawing paper.

WHAT IS FUSEL OIL?

The new York dailies, since the report of analytical chemists of the Board of Excise has been made, are asking the question, What is fusel oil? Some have also made a feeble attempt to answer the question which is thus propounded. The query has arisen from the fact that the report above alluded to states that out of thirty-two samples of Bourbon and brandy obtained from the liquor dealers of this city all but four contained fusel oil. One daily gives vent to its feelings in the following:

"Is it after all such a frightful thing? Dunglison describes it as an acrid, volatile oil, formed in the manufacture of potato brandy, and which is not easily separable from it; and another authority says it accompanies ordinary alcohol in its production from potatoes and grain. Dunglison also says that its chemical constitution is analogous to that of alcohol, and that, in small doses, it is highly stimulating—acting like narcotics in general; while, in large doses, it destroys the mucous membrane of the stomach. The same authority also designates it as 'potato oil,' 'grain oil,' 'corn spirit oil,' 'amylic alcohol,' and 'hydrated oxide of amyle.' Some medical men have considered that in the use of whisky by consumptives, fusel oil was the effective element—having the tendency to retard the processes of decay in the tissues of the lungs. But there is no question of the ruinous effects of the fusel oil liquor sold in New York."

In regard to the effects of fusel oil upon the human system we can do no better than to quote the "United States Dispensatory," which says: "Amylic alcohol (fusel oil), as shown by experiments on inferior animals, is an active irritant poison." If that is not sufficiently definite to satisfy anxious and thirsty inquirers we shall not attempt to make it more so. Of course it may be taken like other poisons diluted with water and common alcohol, as it is found in the compounds doled out by honest and conscientious rumsellers without danger of immediate death or anything more serious than "redness of eyes," temporary madness of brain, and now and then a touch of *delirium tremens*, until the coats of the stomach and the nervous system succumb to continued and prolonged attacks, and another wreck is cast upon the shores of life. But it is, nevertheless, a poison, *an active irritant poison*, upon good authority. How it gets into the liquor is of little consequence. The report says it *is* there, and we say let it alone and it won't poison you.

THE NEW FRENCH GASLIGHT.

Messrs. Ball, Black & Co. have illuminated the show windows of their splendid store in Broadway with the Bourbouze light. Its peculiar brilliance and beauty nightly attract a crowd of admiring spectators. So brilliant and pure is this light that the ordinary gaslights look like spots of sickly and ghastly yellow when placed between the eye and the pure white illumination of the Bourbouze burners. The light is as steady as the sun. The closest examination cannot detect the least tremor. We tried it with a sheet of white paper corrugated, and inclined so that portions should be thrown into shadow, thus magnifying any motion that might be imperceptible to the unaided eye, but could not detect any motion whatever. Equal parts of oxygen and common street gas are driven simultaneously upon a pencil of magnesia; this is all there is of mechanism of this wonderful light, which literally throws all other lights at all adapted to general use into the shade. In point of cost, when lights of equal intensities are used, the new light is so much cheaper that we should fear to be suspected of exaggeration should we make a statement of it. We are told that Messrs. Ball & Black's establishment is the first that has adopted the Bourbouze light on this continent. A full description of it will be found on pages 185, and 200 Vol. XVIII. of the Scientific American.

We were recently shown a chain of brass, with hook and solid links, said to have been cast in a sand mold.

REMINISCENCES OF TRAVEL IN SPAIN.

NO. V.

An anonymous correspondent, who signs himself "A Spaniard" complains of some of our strictures upon Spanish manners. We can only say that whatever we have written upon this subject is not only true, but our statements are borne out by other travelers and writers who have visited Spain. The habits and customs of a people are free to be observed and commented upon by all travelers, and in the preparation of our reminiscences of Spanish travel we have had neither motive nor purpose to do the slightest injustice to the people of that afflicted country; and if some of our statements have seemed singular even to a native Spaniard, we can only account for it by the fact of his long residence in this country, where life, untrammeled by usages of hoary antiquity, appears more new, fresh, and vigorous.

There is one other phase of Spanish character which we propose to present, and in thus closing our sketches of European travel, it is with the hope that Spain, which has so grand a history, with so much undeveloped wealth, may, even though it be through revolution, once more arise to greatness and substantial prosperity.

THE GREAT NATIONAL SPORTS—A BULL FIGHT.

The national sports of a people are true indexes of their character and civilization, and it is therefore difficult to believe that Spain is the only Christianized nation in the world which tolerates the cruel and inhuman practices of bull fights and cock fights.

It is commonly said that you must not quit Spain without seeing a bull fight, the great national sport. We had read about this heroic spectacle, and being naturally averse to cruelty in every form, we entered upon the business with considerable trepidation. But after all there is nothing like seeing of what stuff the people are made in order to properly appreciate their character. We wanted to see the whole thing or nothing, and to make the affair as respectable as possible in our own eyes, we joined a party of Americans and proceeded to visit the Plaza de Toros (Place of Bulls) the evening previous to the fight, for the purpose of inspecting the pens where the animals were kept. These pens, within the inclosure, are about fifteen feet square, and are provided with galleries, where the tormentors practice the *humane* sport of spearing the bulls, in order to get them into a towering rage before they are let through the dark narrow passage way communicating with the arena. Within the building there is also a hospital, provided with apparatus and medicines, in case any of the tormentors should chance to be injured, and in order to impart to the spectacle a serio-dramatic interest and solemnity, there is also an altar, where they kneel and kiss the crucifix before engaging in their work; the effect being heightened by the presence of a priest* to administer the consolations of religion in the event of any of them being mortally wounded. A most touching and beautiful adjunct to be sure.

The next morning, being the occasion of a popular religious festival, the whole city was astir, and in the afternoon the crowd began to wend its way towards the Plaza de Toros. The building resembles an ancient coliseum, built of stone, and furnished with several tiers of stone seats, above which are inclosed boxes for the higher classes. There is also an inclosed box emblazoned with the royal arms, and appropriated to the use of the royal family. We should judge that 15,000 spectators might be accommodated with seats. The arena is surrounded by a heavy plank barrier, about six feet high, to protect the spectators, and over which the tormentors leap when hotly pursued by the infuriated beast.

The performance was announced to begin at three o'clock in the afternoon, and an armed guard of handsomely mounted men were stationed about the Plaza to preserve order. The crowd inside, consisting of men, women, and children, must have numbered ten thousand, and aside from slight manifestations of impatience, behaved very orderly. The band performed an overture and the performers entered. There were several men in costume called *picadors*, mounted upon miserable old horses, of the same class used to draw fish wagons about our streets. The *picadors* have their legs incased to ward off the thrusts of the bull; and following them was a team of three mules in fancy harness, dragging a whiffletree and chains, accompanied by *bandarillos*, who flaunt the red cloaks, also several men leading bloodhounds. We were satisfied at this point that we were not going to like the thing at all, but the ring being speedily cleared, a blast of the trumpet signalized that the beast was coming; and sure enough, in he plunged—a noble animal he was, too. After rushing wildly around, as if anxious to escape, he plunged headlong at one of the mounted *picadors*, who could offer no resistance, and in a moment he was thrown from his poor old horse, and the animal was soon beyond the need of a veterinary surgeon. After three horses had been killed, and the signal given, the red cloak flaunters had the bull to themselves. He pursued them with considerable fury for a while, but soon began to show signs of fatigue. In the meantime, by a most adroit movement, barbed arrows were thrown into his neck, two being lodged at the same moment, followed by others, until six or eight of these ugly weapons were firmly planted; the effect of which was to arouse the animal to a final desperate struggle. The next professional tormentor who enters the arena to share the honors of the occasion is the *matador*, dressed like a horseman in the circus, and whose duty it is to kill the bull—which is most skillfully done by thrusting a rapier into his neck, back of the horns, which, if well done, causes almost instant death. After this manner four bulls were tormented to death, and eleven horses were killed; each of the dead animals being dragged outside by the mules upon a keen jump,

* This information was given to me by a trustworthy local guide, who had no motive to misrepresent the facts.

there to be gazed at by an admiring crowd of dirty urchins, who could not raise money enough to get inside.

It is considered very heroic when a horse has been disemboweled if the *picador* can rally him for a ride about the arena, with his entrails protruding from the wound. This latter spectacle always excites great applause from the spectators who occupy the lower range of seats. One of the bulls, a fine orange color, from Andalusia, leaped the barrier seven times, and turned upon his pursuers with astonishing vigor. This same animal killed six horses before he fell under the sharp prick of the rapier. The last bull of the four showed no fight—he refused to attack the horses, and seemed to look imploringly around upon the people as if to say, "can it be possible that in this city of Madrid, the capital of Spain, which professes to be Christian, such awful cruelty is permitted," but he was not to be let off; the programme called for the slaughter of four bulls, therefore he must die; and four large bloodhounds were let loose upon him, when the fight became somewhat spirited, until they had fastened their fangs into his flesh, and held him fast when the *matador* terminated his life with the rapier.

The performance wound up with the introduction of four young bulls let in, in succession, with balls on their horns, to be worried by the crowd. There would have been some amusement in this but for the shocking sights which had preceded it. There is nothing whatever in this spectacle that deserves to be called a fight. It is simply a cruel method of torturing to death a few bulls—and old worn-out horses.

The whole exhibition lasted two hours and a half, and seemed to afford infinite satisfaction to the crowd of natives who were present. It was bad enough, we found, to once witness such a scene, but what shall be said of the people who cherish it as the great national sport.

It is, however, no more than just to say that the higher orders of society are beginning to look with disfavor upon bullfighting. Such brutalizing spectacles are now encouraged chiefly by the lower classes, with the few strangers who witness them from motives of pure curiosity. Having witnessed this, the chief sport of Spain, which appears to have kept pace with the progress of the nation, we concluded to give the minor sport of cock-fighting the cold shoulder; and were glad to get out of Madrid as early as possible the next morning.

Some English writer has said that when he visited a Spanish bull fight, he felt as though the clock of time had been turned back eighteen hundred years.

OBITUARY.

Ichabod Washburn, "Deacon Washburn" as he was known, of the firm of Washburn & Moen, Worcester, Mass., died on the 30th of December last, having been identified with the manufacture of machinery in this country for nearly half a century. He was of old Puritan stock, and the writer was one of his first apprentices, when it was the style to make the youngest apprentice a member of the "master's" family. The honesty, integrity, and business capacity of Mr. Washburn are not more vividly brought to mind than his kindness to, and carefulness of all who came under his roof or were confided to his protection.

He became first established in business as one of the firm of Washburn & Goddard, successors of Capt. John Earle in Worcester, Mass., the first builder of wool carding machinery in that State.

"Deacon" Washburn is held in remembrance by many mechanics who received their first mechanical education under him, and apart from these living monuments of his fidelity to duty and his conscientiousness as an employer and the head of a family, he will be held in grateful remembrance by those who are destined to enjoy and improve by his gift to the Worcester County Institute of Industrial Science, to which he donated a brick machine shop, completely equipped, and $50,000 as working capital, and a fund of $200,000, the proceeds of which are to be used for the purposes of the institution.

In all the relations of life, employer, father, husband, friend, and citizen, he was an example worthy of imitation. His loss will be felt far beyond the limits of the city he honored by his generosity.

The Deepest Coalpit in England.

A correspondent of the London *Telegraph* has been down the great coalpit at Wigan, and writes a long account of what he saw and heard, from which we extract the following interesting details: "It is very difficult to realize the enormous value of Wigan underground. Looking at the plans of the mines which we mean to inspect to-day, we see that between the surface and the deepest point to which the sinkers have reached, there have been no fewer than twelve workable seams of coal. These include the great seam of cannel. The seams are classed in five different series. First there is the Ince series, consisting of four seams—the 'yard' seam, at a depth of eighty-four yards; the 'four feet' seam, one hundred and thirty-four yards below the surface; the 'seven-feet' seam, twenty-six yards lower; and the 'furnace' seam, at a distance of one hundred and eighty-six yards from the surface. With the exception of that which was named last, all these seams are exhausted. Below them come the Pemberton series, with a five-feet seam, at a depth of two hundred and seventy yards, and a four feet seam twenty-five yards beneath. Then there is the Wigan series, with its five feet, four feet, and nine feet seams; the first of which is four hundred and forty-five, the second four hundred and sixty-six, and the third four hundred and ninety-five yards below the surface. Lower still, at a depth of six hundred yards, is the famous cannel seam, and now the men are going even below that; they have indeed sunk the shaft to the yard seam of the Orrell series, which is six hundred and seventy-three yards below the surface; and are now, night after night, pushing their way to the fiery and dangerous Arley seam, which is here more than eight hundred yards below ground, although at Hindley they have reached the same coal at a depth of three hundred and twenty yards. There are about six hundred and fifty men employed at these mines—the Rosebridge Collieries. Just now the times are rather bad for colliers. They have not been known to be worse at any time during the last thirty years.

"After chatting awhile with the manager and his son, we made ready for a descent. We do this by doffing the clothing we ordinarily wear, and donning in its stead a very rough miner's dress. Then we (the manager's son and the writer) walk out, and, calling at the lamp room, provide ourselves with lamps, which are somewhat better that the ordinary 'Davy.'

"It is necessary to prepare the nerves for a shock. We are going down to the Cannel Mine, a depth of six hundred yards, and the big engine will throw us that distance in less than a minute. At a signal there is, as it were, a sudden withdrawal of the bottom of the cage beneath our feet, and a rapid falling through dark space; then there is as sudden a check, and we feel, not only as if we had regained our footing, but as if we were being thrust back again as rapidly as we had been before falling. Before time is allowed to analyse the sensations we have experienced, the cage touches the bottom, and we stumble out half dizzy into the eye of the pit.

"Before we leave the pit eye we have our lamps lit, and then turn to take a stroll into the workings. We are not long in reaching a little cabin, into which we step, and while sitting there we are told some particulars respecting life in the pit. When the men come to work they obtain their lamps, already lit, but unlocked, at the pit bank. Then they descend, and at the pit eye the lamps are examined and locked. They are again examined as the men enter the particular district of the mine in which they may be employed. Every day the fireman examines the clothes of each miner, to prevent the introduction of pipes and matches. The law is observed very strictly. If a man is found to have the means of striking a light he is sent before a magistrate, and either fined or imprisoned. But such a discovery is rarely made at Rosebridge. The authority of the manager is regarded, and he himself is personally respected by the men; and throughout a large colliery district these mines are noted for the admirable system of working adopted, and for the skill and wisdom engaged in their management.

"From talk about matters in general, we, still sitting in this cabin, six hundred yards below the surface of the earth, turn to what is more personal, and I learn that my guide has had his dangers and his narrow escapes, as all men must have who have to do with the getting of coal. Once he was in at an explosion, and of course ran for his life. The subtle choke damp, that palpable white mist, was swifter than himself, and floating all about him, so numbed his senses that he sat down, and felt as if lulled to a gentle, delicious sleep. Consciousness was fast passing from him, when his brother, stronger than himself, dragged him rapidly to the pit eye, and saved his life. My friend thinks that choke-damp is the easiest and nicest possible way of dying. There is no pain—there is simply a going to sleep, which you have neither the wish nor the power to prevent."

Exchange of Skill for Labor---China and the United States.

The Shanghai *News-Letter* suggests the outline of a plan by which China and America may enter upon a system of exchanges on a grand scale for their common benefit. The outline is given by a respected missionary in the north of China, where there is a plethora of labor and a dearth of skill; and where experience has convinced him that an exchange would be advantageous for both countries. America needs labor; China needs skill. China can furnish the first; America the second; and both would be benefited by the furnishing. He would pour into each of the Western and Southern States a million of laborers, men who by virtue of patient, industrious, and imitative habits are prepared to obey, to follow, and to execute; and would accept in return the larger brain, superior education, and stronger will which qualify Americans to originate, plan, and command. "Let them come to China," he says, "and fill the land with railroads, steamboats, and telegraphs. Let them develop her vast mines of coal, iron, gold, silver, copper, and lead. Let them light her cities with gas and supply them with water. Let them become physicians, teachers, and preachers. Let them create for her an army and navy, and command them for the good of the Chinese nation," etc., etc. By a proper distribution of brain and muscle, and a good understanding, the missionary anticipates the time when the empire and the republic will hold the destinies of the world.

Editorial Summary.

The South African Gold Fields.—The Philadelphia *Ledger* says, the South African gold fields are to be visited by an exploring party, composed of certain well known travelers in Africa, and of assistants skilled in mining gold in California. A photographer will be attached to the party. The expedition will be absent for over a year, and will visit regions where no travelers have as yet been. Mr. Baines, one of the company, has already visited the Transval region, and describes the operations of the native goldsmiths as follows: They use, he says, a broken earthern pot for a furnace, and a small goat skin for bellows. The crucibles are made from the nests of the mason wasps, and the metal is cast into ingots five or six inches long by half an inch square. The ingots are made into bars be the use of a hammer on a small anvil, weighing three or four pounds. The natives use blowpipes made out of the section of a gun barrel.

The New State Dam at Cohoes.—This work is rapidly progressing. It is to be fifteen feet higher than the old structure, and stands twelve feet further down the river. It is supposed the increased hight will prevent the hitherto frequent drifting over and wreck of boats during the freshets to which the Mohawk is liable. Four hundred feet of the dam are already completed and one pier. The total length will be sixteen hundred and forty feet. Its width at the bottom is eighteen feet, and at the top ten feet. Its hight varies from fourteen to twenty feet. The whole structure is of granite.

An adaptation of the semaphore signal post to street traffic is now the subject of experiment in London, the object being to assist the police of that city in preventing the concentration of vehicles at crossings when stoppages occur. The use of the signal is to warn approaching vehicles against coming too near, and thus enabling the officers to make a diffused or general stoppage some distance from the crossing rather than the usual jam and confusion now common in such cases. Something of the kind is also greatly needed in New York.

The *European Mail* says the little Prince Theodore has got out of the channel of gossip, and few know where he is and how he is being brought up. The young Abyssinian is at school at Bonchurch, in the Isle of Wight, and turns out with the boys—a very dark speck on their line of white faces. The expression of the lad's face is good, and his eyes are such as might serve for a chapter on "dark orbs" for anyone in writing a novel. He is under the charge of Captain Speedy, who is bringing him up kindly and carefully.

The largest kitchen in the world is that of Liebig's Extract of Meat Company's establishment at Fray Bentos, on the river Uruguay, South America. The building covers an area of 20,000 square feet. In one hall there are four meat cutters, which can dispose of 200 bullocks each per hour. There are 12 digesters in which the meat is boiled by steam. They can hold altogether 144,000 pounds of beef. About 80 oxen per hour are actually slaughtered for this immense establishment.

Parade of the New York Letter Carriers.—On the morning of the 30th December, the letter carriers of New York city, arrayed in the new uniform of the department, paraded through the streets to the number of about two hundred. Our rural friends may form some idea of the extent of the postoffice business here when it is known that it takes the entire time of over two hundred men to deliver the mails, exclusive of the large amount of matter taken from the boxes.

Disastrous Fire in Lynn.—The thriving and busy city of Lynn, Mass., has received a severe blow in the disastrous fire on Christmas night. It was the most serious conflagration ever experienced by that town, and although it will not seriously affect its chief industry, the manufacture of boots and shoes, it throws 600 hands out of employment in the dead of winter, and inflicts severe loss upon many prominent business men.

The steam roller for leveling and smoothing newly made or recently repaired roads just introduced in Liverpool, seemed at first to be a great success. It seems, however, that its use has resulted in serious injury to the network of gas and water pipes underlying the streets, and its weight will have to be reduced or its use discontinued.

A German savant has put forth a singular and novel theory to account for the decay of the trees in the gardens and promenades of Berlin as well as in other large European cities. He attributes this decay to the tremulous motion of the ground, which prevents the perfect adherence of the soil to the roots necessary to the absorption of nourishing juices.

The whole of the capital required for the laying of the new French Atlantic cable has been subscribed and the first instalments paid in. Four hundred and sixty miles of cable are completed and the work is progressing rapidly. The Great Eastern is fitted out and was to commence receiving the cable in the earlier part of January.

Prof. Marsh, of Yale College, is said to have discovered in the tertiary deposits of Nebraska the minutest fossil horse yet obtained. It is only two two feet high, although full grown, as the character of the bones fully indicates. This makes the seventeenth species of fossil horse discovered on this continent.

The improvement made in the art of watchmaking, and the present approach to perfection are shown by the fact that in 1862 the average deviation of the Neufchatel chronometer was 1·61 seconds per day; but one was recently finished and tested which gave only ·164 of a second variation in twenty-four hours.

The longest artillery range on record, namely, 10,300 yards, was lately attained at Shoeburyness by Mr. Whitworth's 9-inch muzzle loader gun of 14 tuns firing a shot of 250 lbs. with a charge of 50 lbs. This range is 225 yards over that of the 7-inch Lynall Thomas gun, which in 1861 ranged 10,075 yards.

The American sewing machine has crossed the Alps, and has made its appearance in the chief cities of Italy. It is reported that there is a lively competition going on among the dealers in Florence. No other people in Europe more need the introduction of labor-saving machinery than the Italians.

It is stated that the Mont Cenis Tunnel lacks but little more than two miles of completion.

Correspondence.

The Editors are not responsible for the Opinions expressed by their Correspondents.

Propulsion of Vessels.

MESSRS. EDITORS:—Although it is admitted by all engineers that there is yet room for improvement in our present system of paddle and screw, yet very few are aware of the really immense disparity between the amount of steam consumed in the engine and that actually utilized in propulsion. The fact being, that if it were possible to utilize all the steam that passes into the engine in actually propelling a vessel, it can be shown that a saving of fully two thirds or three fourths would be effected—this statement is based on the following facts, viz.: Two horses can propel a loaded canal boat of two hundred tuns, at a rate of two miles per hour. Two-horse power of steam is equal to the power of two actual horses. Hence, if two-horse power of steam were fully utilized, this, and an allowance of ten per cent additional for friction, would be sufficient to propel same boat the same speed as two horses would.

The resistance of water in a canal is one third greater than that of deep rivers or more open waters; and the resistance of a canal boat, having no lines favorable to speed, is greater than the resistance of a well built schooner of same tunnage; therefore, it cannot be disputed, that if two-horse power of steam, plus ten per cent, can propel a loaded canal boat of two hundred tuns, at the rate of two miles per hour, the same power applied to a two hundred tun schooner, having good lines, and being in open water, should give a speed of two and a half miles per hour. Resistance increasing as the square of the velocity, it is easy to calculate power required to propel a two hundred tun boat, at any required speed. For example, to go ten miles per hour, or four times the velocity, evidently requires sixteen times the power. Therefore, $2\frac{1}{10}\times16=33\frac{6}{10}$ horse power, to drive two hundred tuns ten miles. Although the resistance does not increase in exact proportion to increased tunnage, it will be safe to calculate the amount required to drive any larger vessel, by taking the two hundred tun boat as a basis, and multiply the horse power for any required speed, by exact increase in tunnage. By this method it will be found easy to calculate power required to drive any given boat at any given speed. For instance, if all steam were utilized, it would be possible to drive boats of the following tunnage at following rates, with horse power of high pressure or low pressure, respectively, as follows:

200	tun	boat,	10	miles,	$33\frac{6}{10}$	high	press.,	$22\frac{4}{10}$	low press.
1000	"	"	10	"	168	"	"	112	" "
1000	"	"	20	"	672	"	"	448	" "
3000	"	"	20	"	2016	"	"	1332	" "

By comparing these figures with amount of *actual* horse power consumed in vessels at present, there will be great disparity. To invent a system capable of utilizing all steam consumed, it is simply necessary to know the primary laws or conditions of propulsion.

From a series of actual experiments made on a one hundred tun boat, the writer is enabled to construct the following hypothesis, viz.: That propulsion is produced by repulsion, that the one cannot exist without the other; hence they are coexistent, and the perfection of propulsion logically and practically depends upon perfection of repulsion; that, therefore, "slip" is but another name for imperfect repulsion; that propulsion is simply a question of power and comparative resistances—a greater and a less; and that perfect propulsion can only be produced by so applying the power to the body to be moved as to overcome the resistance in line of propulsion, without overcoming resistance, in opposite direction, or that of repulsion.

The foregoing hypothesis applies alike to the propulsion of all animate and inanimate nature, and will stand the most rigid logical or practical test as applied to a boat. It will be admitted that the area of immersed cross section, represents the resistance of propulsion, and the area of two buckets of a paddle represents resistance of repulsion. Hence it follows, that to produce perfect propulsion, it is necessary so to apply the power as to overcome a greater resistance, without overcoming a less. To do this, and adapt the means of doing so to any boat, in the simplest and best manner possible, is to construct a propelling apparatus capable of utilizing all the steam, and hence effect the immense saving of sixty to seventy-five per cent. With this end in view, the writer has invented a propelling apparatus, that he trusts will accomplish the desired result, as follows:

A horizontal engine is attached, by proper links, to a crank motion, at a point as near as possible to the center of an axis; a pair of piston propellers are attached by proper links to the points of a pair of vertical dynamic levers, most distant from same axis, the axis is swung athwart the boat, and works in proper journals. The engine being set in motion, puts the piston propellers in motion the cylinders in which the piston propellers work being open at one end, two proper holes or parts in the boat admitting the water to propelling face of pistons. These pistons impinge on the water on one side only, and are so arranged as to work in a vacuum on the other; so that they make propelling stroke by pressure of steam on the engine, and are brought back to original position by means of pressure of water alone. The resistance of the small area of water at the propellers being, by means of proper use of dynamic lever, made virtually greater than that of the larger area of immersed cross-section, it is evident (from the fixed law, that power applied to overcome to unequal resistances of necessity overcomes the least) that the water forming resistance of boat's motion can give way without displacing water at propellers, and, consequently, that the boat can be propelled by this means without "slip;" and it is also evident there can be no lift water, hence the economy. So that every pound of steam is actually utilized in propelling vessels, minus the friction, which will be less than ten per cent.

It will be found, the shorter the crank at which power is applied, and the longer the arms of the lever, to which propellers are attached, the greater the economy—for this dynamic leverage is the vital principle of my invention, the form of propellers used being that simply best mechanically adapted for impinging on the water, on one side only, and are, as is well known, worthless as economical propellers, of themselves, otherwise applied. The philosophy of this use of the dynamic lever is, simply, that by its means, power is applied as near as possible to the axis, because the axis represents the actual point of impact, or the true point of resistance of motion in a boat, and as far away as possible from point of resistance of propellers, which is the actual fulcrum; and by this means the water at propellers is much more difficult to displace than the resistance of boats' motion, which was to be done.

In addition to its great economy in fuel, and cost and weight of machinery required, this system presents many other advantages over paddle and screw—namely, great simplicity of machinery—hence less wear and tear, and much better protection from the action of rough seas, or the obstruction of ice, weeds, logs, etc., common to inland navigation, and its special adaptability for shallow rivers and gunboats.

I hope, at an early date, to lay before your readers drawings and more explicit details of my invention. F. K. P.

New York city.

Quadrature of the Circle.

MESSRS. EDITORS:—I am surprised that the *London Building News*, from which you republished an article under the above heading (page 375 of your last volume), is not better posted in regard to English investigations and London publications. The article states, that later researches brought the number expressing the ratio of the diameter of the circumference to 127 decimals. Now this is exceedingly old news, as later researches went much further. M. de Lagny, in France, found this in 1682, and published the 127 decimals in the "Memoires de l'Academie," in the year 1719; after that, we find in the library of Radcliff, Oxford, 155 decimals; and we find, further, that Dr. Rutherford, of Woolwich, presented a calculation of 200 figures to the Royal Society, London. However, it was, unfortunately, found out, that all his decimals, added to the 155 of Oxford, were wrong. Perhaps he was confident that nobody would take the pains to persuade him of error; this was, however, done by Dr. Clausen, of Dorpat, who found 250 decimals, and Mr. Shanks, of Durham, 315. This stirred Dr. Rutherford up, and he, in his turn, tried to find errors, but he found the figures all correct; and he extended them to 350 decimals. Mr. Shanks appears to have become jealous, and carried them to 527 decimals. Mr. Rutherford, wishing again to ascertain if they were correct, found them so to 411 decimals, and then gave it up. Mr. Shanks did not give it up, but went again to calculating, till he had obtained 607 decimals, and he published the result of his calculations in the "Contributions to Mathematics," London, 1653.

There we find the curious, famous, and, at the same time, useless decimal fraction of 607 decimal places, representing the relation of the diameter and circumference of a circle so near to the truth, that the difference, with the absolute ratio, is smaller than the strongest imagination possibly can conceive. We call it also useless, as, for the most delicate calculations, 10 or 12 decimal figures are amply sufficient.

Never has any continuous fraction been carried so far. For instance, no body ever had, till the present day, the patience to calculate $\sqrt{2}$ or $\sqrt{3}$, even to 100 decimal figures; we must, therefore, conclude that the relation between the diameter and circumference of a circle is numerically better known, at present, than many other quantities which are daily used.

We give here the beginning of this fraction for curiosity's sake: Diameter = 1; circumference is 3·14159 26535 89793 23846 26433 83279 50288 41971 69399 37510 + . . . , etc., 507 more decimal figures. This decimal fraction is not and cannot be repeating or periodical, but changes the order of its figures infinitely.

P. H. VANDER WEYDE, M.D.

New York, city.

Air Bubbles in Ice.

MESSRS. EDITORS:—In the SCIENTIFIC AMERICAN of Nov. 25th, I see the theory of C. D. Sutton, on the specific gravity of ice, which is lessened, as he says, by the retention of air bubbles in its substance. For at least twenty years I maintained the same theory with considerable energy and then from force of experiments, gave it up and sought other reasons for the phenomenon. It is now a good season of the year for him or others to try that kind of experiments. Let him grind ice to an impalpable powder and put it in water at 32° Fah. and then stir the mixture well, and if it or any part of it sink, it will strengthen his theory, and if it all should float he must look for other reasons. My experience has been that it all swims, and I gave up attributing the low specific gravity of ice to the air contained in it.

The Creator so in best wisdom ordered that the arrangements of the particles of water under congelation, should so stand apart as to cause ice invariably to float, so that rivers might continue, during long freezes, to vent their waters, and not gorge up, overflow, and destroy all the property along their banks, which would inevitably be the case if ice sank to the bottom as formed. Ice in a muddy running stream, will in a few days of warm weather, sink to the bottom by reason of the earth attached to it. I have ridden scores of miles on Lake Erie, when the ice was eighteen inches thick. At the distance of five or six miles apart, I found cracks in the ice running from the shore square off into the lake. These cracks, if I remember right, were about the width of one foot of shrinkage, for each mile of unbroken distance! I know that I had to course along these cracks until I came to a bend, or crook that threw the crack up and down the lake, where I could get across! This was proof to me that ice, like other solids, contracts after congelation is finished. JOHN S. WILLIAMS.

Cincinnati, Ohio.

Steam on Canals.

MESSRS. EDITORS:—What can you tell us about steam on canals, about boats constructed for cheap unloading of which you have one running in New York harbor, etc.? How do the English canals afford to pay dividends with 50-tun boats towed by steam, etc.? Can the expense of a skilled engineer be saved by adopting Loper's or other caloric engines for canal barges? In short, won't you wake upon the subject of modernizing canals and their motive power, by towage either by tug or locomotive, but not by submerged wires, which don't answer? NAVIGATION.

Philadelphia, Pa.

[We have published a number of articles on this subject, which may be found in previous numbers of the SCIENTIFIC AMERICAN. We have no confidence in the use of hot air engines for towing purposes. The conditions of canal navigation in England and in this country are so different that no conclusion based on the facts of either would be applicable to the other.—EDS.

Chrome Iron for Lapidaries' Wheels.

MESSRS EDITORS:—I see the new alloy of iron and chromium mentioned in your admirable paper, and I would ask of some of your valued correspondents, who I hope will favor me with a speedy reply, whether a lapidary's slitting wheel for jaspers, agates, and the like, could not be made from it? It cuts glass as well as the diamond, and I think might possibly take the place of the soft iron wheel fed with diamond dust, which is so extravagantly dear and so often shamefully adulterated. I think a wheel of this kind would answer for all the softer stones and pebbles, and prove a great boon especially to amateurs. Can any one tell me what genuine diamond powder can be bought for in America? MEDICUS.

Ensworth, Hants, England.

The Effect of Glaciers on the American Continent.

Proffessor Agassiz said some interesting things concerning his pet glacial theory at the Amherst agricultural meeting, recently. He declared that all the materials on which agricultural processes depend are decomposed rocks, not so much rocks that underlie the soil, but those on the surface and brought from considerable distances and ground to powder by the rasp of the glacier. Ice, all over the continent, is the agent that has ground out more soil than all other agencies together. The penetration of water into rocks, frost, running water, and baking suns have done something, but the glacier more. In a former age the whole United States was covered with ice several thousand feet thick, and this ice, moving from north to south by the attraction of tropical warmth, or pressing weight of ice and snow behind, ground the rocks over which it passed into the paste we call the soil. These masses of ice can be tracked as surely as game is tracked by the hunter. He had made a study of them in this country as far South as Alabama, but had observed the same phenomenon particularly in Italy, where, among the Alps, glaciers are now in progress. The stones and rocks ground and polished by the glaciers can easily be distinguished from those scratched by running water. The angular boulders found in meadows and the terraces on our rivers not now reached by water, can be accounted for only in this way. He urged a new survey of the surface geology of the State, as a help to understanding its constituent elements, and paid a high tribute to the memory of the late President Hitchcock.

Adulterated Liquors.

The New York *World* has been doing the country a service by some investigations into the quality of liquors sold at the different bars in this city. A large number of samples of brandy sold at from thirty to fifty cents a glass, and of whisky sold at from twenty to thirty cents per glass, were examined and found to be genuine in only two instances. If such be the case with liquors sold at the best places, what must be the character of the fluids retailed at the low grog shops where whisky can be obtained for from five to ten cents a glass. In this connection it may be remarked that some specimens of brandy pronounced by experts under oath in a recent revenue case to be genuine and worth twelve dollars a gallon in gold, were afterward found to have been manufactured in Brooklyn, and to contain not one particle of genuine liquor. How shall the sale of these poisons be stopped? By each and all refusing to touch, taste, or handle the filthy compounds.

The practice of using ardent spirits is exerting a very malign influence upon all classes in this country, and although we do not believe that mechanics as a class are more addicted to the practice than others, still a word of warning will not be out of place to them at this time. The waste of money, time, and worst of all, the ruin of mental and moral power which follows a career of dissipation, is sad enough and has been repeatedly and forcibly placed before every person in the civilized world. Nothing can restore what is lost in this way and we once again appeal to the noble army of mechanics in America to join in the suppression of the practice. Mechanics will you do it? Any one of you can commence the work in the establishment to which you belong, and we shall be most happy to announce in our columns the success you meet with in the good work if communicated to us.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

SCYTHES.—Charles E. Griffin, Roseville, Ill.—This invention consists in the application of a weight to the outer end of a scythe swath, to serve as a counterpoise for the same and thereby greatly facilitate and lessen the labor of mowing.

ANTI-FRICTION BOX.—Jeremiah McIlvain, Churchville, Md.—This invention relates to a new and improved box for the shafting of machinery, and it has for its object the reduction of friction.

COTTON SEED PLANTERS.—A. J. Going, Clinton, La.—This invention relates to a new, simple, and useful device for agitating cotton seed in the hoppers of cotton seed planters, so as to insure the separation of the seed one from the other, and thereby prevent the clogging or chocking up of the hopper and effect a proper distribution of the seed from the same.

SCREW PEG FOR BOOTS AND SHOES.—J. M. Estabrook, Milford, Mass.—The object of this invention is to facilitate the attachment of soles to the uppers of boots and shoes, and consists in the use of screw or notched pegs, which can by means of hammers be forced through the leather instead of being turned into the same as heretofore made.

ELASTIC LANYARD—J. E. Jones, Wiretown, N. J.—This invention has for its object the construction of an elastic lanyard by which the stays of a ship's rigging can be most conveniently connected with the dead eyes or some other fixed part of the vessel, the lanyard being elastic so that the rigging will be in some degree yielding. The straining of the mast, as well as that of the rigging, will thus be most advantageously avoided.

POTATO WASHER.—L. B. Sherwin, Hyde Park, Vt.—This invention relates to a new and improved method of washing potatoes, and other articles, and it consists in agitating the potatoes in the vessel in which they are placed by revolving a horizontal bar or agitator with inclined sides or blades on the bottom of the vessel.

DUMPING CART.—Joseph H. C. Applegate, Bridgeton, N. J.—This invention relates to an improvement in the method of dumping cart bodies, and it consists in attaching to the front of a cart a catch of novel construction which is operated from the rear end of the cart.

MEDICAL COMPOUND.—J. M. Hughes, Menomonee, Wis.—This invention consists in a compound of matter, which as an external application is advantageous in treating many complaints in cattle.

WINDOW FRAMES.—Samuel Myers, Hogestown, Pa.—This invention has for its object to improve the construction of window frames so that the sashes may be easily and conveniently removed without its being necessary to remove the parting bead, which is usually a troublesome operation, frequently breaking the bead, injuring the paint, and defacing the frame.

WATER REGULATOR FOR PAPER PULP MACHINES.—David Hunter, North Bennington, Vt.—The object of this invention is to produce an automatic attachment to paper pulp machines for regulating the flow of the water which enters the machine so as to prevent the overflow of the water and the consequent loss of pulp. It also consists in the use of a float by which the valves controlling the water supply are held open or closed according to the hight of water in the tub.

SLATE-RULING MACHINE.—John H. French, Albany, N. Y.—This invention relates to a new machine for ruling slates, of that class in which the lines are formed by scratching the surface of the slate with a pointed or sharp instrument. It consists chiefly in arranging a series of sharpened or pointed tools in one head, and in drawing them at once in the required direction across the slate, or in moving the slate over them, so that by one motion of the slate or tool a whole series of parallel lines can at once be produced.

RAILROAD TICKETS.—H. E. Alexander, New York city.—This invention relates to improvements in tickets for use upon railroads, steamboats, and conveyances, for passengers, but is particularly adapted for street cars or other vehicles where a fixed rate of fare is to be collected, the object of which is to prevent fraud or embezzlement on the part of those who collect the fare.

ROOFING.—Philip A. Brown, Indianapolis, Ind.—This invention consists in forming roofing from clay of any suitable kind, in molds of peculiar form, into blocks, so shaped in sections as to be readily joined together by lapped joints, and form a waterproof roof composed mainly of one thickness of material.

TOOL HOLDER.—Charles H. Reid, Danbury, Conn.—The object of this invention is to provide a simple, convenient, and effective stock or tool holder for machinists' use, and which is available both as a tool holder for lathes and planing machines, and also for holding a boring tool for such shallow work as is capable of being bored out in the chuck of a lathe.

CAR COUPLING.—H. W. Boifeuillet, Savannah, Ga.—This invention has for its object to furnish an improved car coupling which shall be so constructed and arranged as to be self-coupling, and so as to be adjustable to support the link at any desired elevation to enter the bumper of the adjacent car when the cars are run together.

MOWING MACHINE.—F. A. Geisler, Bristol, R. I.—This invention consists, first, in certain improvements in the arrangement of the main shoe and the cutter bar; second, in the arrangement of means for raising the shoe and bar off the ground; third, in a method of readily gearing and ungearing the cutter operating mechanism; fourth, an improved arrangement of the finger bar and the guard fingers; and fifth, in the arrangement of a mold board at the outer end of the finger bar, for throwing the fallen grass away from the uncut grass.

WASH BOILERS.—H. P. Bemiss, Milan, Ohio.—This invention relates to improvements in that class of wash boilers wherein currents of water are caused to flow from bottom to top and *vice versa*. It also consists in an arrangement of the same designed to be more effectual in producing the said flow.

CULTIVATORS.—J. W. Jessop, Harveysburgh, Ohio.—This invention has for its object to furnish an improved cultivator, which shall be so constructed and arranged that it may be easily adjusted for use, to cultivate corn or cover wheat, as may be desired, and which shall at the same time be simple in construction and effective in operation.

MACHINE FOR MAKING PAPER BOXES.—William Gates and David J. Lloyd Frankfort, N. Y., and Samuel Miller, South Hammond, N. Y.—This invention relates to a new and improved machine for making paper boxes, such as are of square or rectangular form in their transverse sections. The invention is an improvement on a machine for the same purpose patented by R. L. Hawes, April 24, 1855, and the object of the present invention is to obviate several difficulties attending the operation of the original machine, a practical use of which for a number of years having suggested a number of improvements.

FAUCET CLAMP FOR PLUMBER'S USE.—James Elliott, New York city.—This invention relates to a new and improved clamp designed to facilitate the securing or soldering of faucets in lead pipes, and also forming the connections of branch pipes to a main pipe.

DOOR FASTENER.—J. H. McElroy and J. H. Holley, Warwick, N. Y.—The object of this invention is to provide a means of fastening doors from the inside and is intended as a fastening for sleeping rooms so that burglars may not enter without forcing the door and alarming the occupant of the room.

PROPELLER.—Henry F. Roberts, Pittsburgh Pa.—The object of this invention is to provide a substantial and easily operating apparatus for propelling vessels, so constructed that its action can be readily reversed without reversing the action of the engine or motive power.

HORSE HAY FORK.—John S. Yinger, Manchester, Pa.—The object of this invention is to provide for public use a horse having the pivoted jaws so constructed and operating that they can readily be opened and closed to receive or discharge the hay.

SEPARATOR FOR THRESHERS.—Tobias Crumling, Cross Roads, Pa.—This invention is intended for an attachment to a threshing machine and has for its object to separate straw from grain after both have passed through a thresher. It consists of the common form of straw cutters that are composed of alternate vibrating, reciprocating beam, operated by crank shafts, in combination with a reciprocating winnowing board, and a series of suspended fingers, between said beams, for the purpose of preventing the escape of straw in the wrong direction.

PILL MAKING MACHINE.—Thomas Bushby, Manchester, England.—This invention consists in constructing a pill making machine, to which the mass or substance from which the pills are formed is supplied in a layer or sheet and fed in beneath a reciprocating knife, which cuts the strip into sheets or bars. These bars or strips then fall down between a segmental grooved stationary plate and a grooved roller, by which they are formed into pills.

WEATHER STRIP.—Charles Bean, Ionia, Mich.—In this invention a rubber strip is attached along the middle of the edge of a door or window, by means of a clamping rod which presses one edge of the rubber strip into a groove in the door or window prepared for the purpose. The clamping rod is fastened in place by screws, and its outer edge is sunk below the surface of the edge of the door, leaving a recess into which the projecting edge of the rubber folds back, when the door is closed.

MOTIVE POWER.—H. Crumlisk, Keokuk, Iowa.—This invention relates to a new method of making the power obtained from steam, available, and consists broadly in the employment of a Giffard injector in connection with a wheel, the arrangement being such, that the latter is caused to revolve by the action of the former.

HOSE.—Edward L. Perry, New York city.—This invention consists in constructing the ends of rubber hose of the proper size and form internally to be stretched over the ends of metallic coupling joints on the nozzles of fire plugs, and providing the said ends externally with rings or other suitable fastenings which may be forced over the said ends after they have been so stretched on the said parts, and thereby press the yielding material of the hose into the said threads or grooves of the said parts making water tight joints; the said ends of the hose being tapered to cause the said rings or fastenings to more effectually produce tight joints. It also consists in constructing the nozzle for the hose in one piece and of the same material of which the hose is composed.

SLEIGH ATTACHMENT TO WHEELED VEHICLES.—Joseph Stonebanks, College Point, N. Y.—The object of this invention is to produce a simple device, whereby carriages, wagons, and all other kinks of wheeled vehicles, even street cars, can be readily converted into sleighs or sleds, so that such vehicles can be used on snow as well as on the ground, as may be required. The invention consists in fastening flanged runners to the wheels, said runners having grooved spring holders, by means of which they are secured to the fellies and prevented from turning.

MACHINE FOR MAKING NUTS.—Ferdinand Rheydt, Chicago, Ill.—The object of this invention is to construct a machine on which screw-nut blanks can be shaped on and cut from prismatic bars, which have already the requisite hexagonal, octagonal, or other desired cross-section of the nuts to be made. The tedious and laborious process of forming the nuts between dies is hereby dispensed with and neater work produced.

CHAIR SEAT.—George Buckel, Detroit, Mich.—This invention relates to a new chair seat, which is so arranged as to be of the most convenient form and easily made. The invention consists in producing a semi-cylindrical seat of tape lines, that are crossed and interwoven so as to form a substantial fabric.

HOT AIR OVEN.—Mathias Schlegel, St. Jacob, Ill.—The object of this invention is to produce a hot air oven in which the largest possible amount of cold air is heated by the products of combustion, so that proportionately more heat than usual is produced by an equal amount of fuel. The invention consists in such an arrangement of smoke and air channels and conduits that the desired object is obtained by a very simple apparatus.

FURNACE FOR SMELTING AND REFINING STEEL.—Alois Thoma, New York city.—This invention relates to a new furnace for smelting steel and iron and for producing all kinds of cast-steel and other metal. The invention consists in the construction of a new apparatus for feeding the material to be smelted into the furnace, also in a new manner of arranging and operating the receptacle for the steel or iron. This recepticle is one solid open pan, which forms the bottom of the smelting oven, and which is, by means of vertical screws, supported and up and down adjustable.

PORTABLE FENCES.—C. S. Coolidge and J. A. Rollins, Jersey Mills, Pa.—This invention relates to portable fences and consists chiefly in a new manner of joining the pannels to the uprights or posts.

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85,277.—PILL-MAKING MACHINE.—Thomas Bushby, Manchester, England. Antedated December 17, 1868.
85,278.—STEAM PORT OF STEAM ENGINE.—Hampton R. Camfield (assignor to himself, John H. Fitz Simmons, and George Boyd), Susquehanna Depot, Pa.
85,279.—DERRICK.—Angus Campbell, Downieville, Cal.
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85,289.—STEAM ENGINE EXHAUST VALVE.—Thomas S. Davis, Jersey City, N. J. Antedated December 23, 1868.
85,290.—SHUTTER FASTENER.—Le Grand Dodge, Syracuse, N. Y.
85,291.—CONCRETE BLOCK MACHINE.—Lewis Dodge and Lewis J. Magnusson, Chicago, Ill.
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85,304.—FOUNDATION FOR RAILROAD TRACKS.—James E. Halsey, New York, assignor to himself, Morris H. Smith, and Samuel F. Noyes, Brooklyn, N. Y.
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85,307.—BREAKING THE SURGE ON HARNESS OR VEHICLES.—Francis P. Hart (assignor to himself and Samuel Kencagy), Strasburg, Pa.
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85,309.—COCK FOR WATER PIPES.—William Johnson, Philadelphia, Pa.
85,310.—BUT HINGE.—John W. Jordan, Lexington, Va.
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85,315.—Washing Machine.—John Leib, Akron, Ohio.

85,316.—Shingle.—John Lewis, New York city.

85,317.—Stone-quarrying Machine.—Curtis O. Luce and Cyrel W. Green, Brandon, assignors to themselves and Cyrenius M. Willard, Castleton, Vt.

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85,322.—Hydraulic Pressure Regulator.— Theodore J. McGowan, Cincinnati, Ohio.

85,323.—Carriage Spring.—John M. Miller, Cincinnati, Ohio.

85,324.—Corn and Cotton Plow.—James W. Milroy, Galveston, Ind. (assignor to himself and S. B. Shaner, Xenia, Ohio.

85,325.—Grain Cleaner.—Joseph Montgomery, Baltimore, Md. Antedated December 22, 1868.

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85,336.—Machine for Making Rings.—John Siddons, Rochester, N. Y. Antedated Dec. 17, 1868.

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85,350.—Revolving Fire-Arm.—John Adams, the Strand, England. Patented in England, July 28, 1866.

85,351.—Railroad Ticket.—H. E. Alexander, New York city.

85,352.—Door Bell.—William Allport, New Britain, Conn.

85,353.—Dumping Cart.—J H. C. Applegate, Bridgeton, N. J.

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85,355.—Washing and Wringing Machine.—Eli Bartholomew, Cleveland, Ohio.

85,356.—Device for Operating Window Sash.—Fred. Baumgartner, Brooklyn, N. Y. Antedated Dec. 17, 1868.

85,357.—Railway Chair.—G. W. R. Bayley, Algiers, La.

85,358.—Wash Boiler.—H. P. Bemiss, Milan, Ohio.

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85,360.—Fence Post.—Richard E. Bowen, Colden, N. Y.

85,361.—Furniture Protector.—George F. Boyden, Providence, R. I.

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85,379.—Cotton Seed Planter.—A. J. Going, Clinton, La.

85,380.—Scythe.—Chas. E. Griffin, Roseville, Ill.

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85,415.—Hoisting Machine.—William C. Williamson, Philadelphia, Pa.

85,416.—Horse Hay Fork.—John S. Yinger, Manchester township, Pa.

85,417.—Saw.—Emanuel Andrews, Williamsport, Pa.

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85,428.—Drive Wheel.—William Burditt and George H. Burditt, Boston, Mass.

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85,473.—Pole for Horse Cars.—Timothy Pendergast, St. Louis, Mo.

85,474.—Farm Gate.—Albert J. Potter, Omaha, Nebraska.

85,475.—Apparatus for Feeding Cloth to Printing Machines.—Elisha O. Potter, Pawtucket, R. I.

85,476.—Water Elevator.—John T. Raferty, Eldara, Ill.

85,477.—Beer Cooler.—Thomas L. Rankin, New Richmond, Ohio, and Charles W. Grassmuck, Peru, Ill.

85,478.—Nail-plate Feeder.—Daniel Reed, Birmingham, Conn. Antedated December 24, 1868.

85,479.—Gate.—Nelson Rue, Harrodsburg, Ky.

85,480.—Hoop Skirt Clasp.—M. Samuels, New York city.

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85,494.—Magazine Firearm.—Frederick Vetterlin, Neuhausen, Switzerland.

85,495.—Manufacture of Spectacle Bows.—Henry Want and John Lundgren, New Haven, Conn.

85,496.—Gang Plow.—Timothy U. Webb, Springfield, Ill. Antedated December 22, 1868.

85,497.—Reversible Latch.— Eli Whitney, New Haven, Conn.

85,498.—Machine for Making Wire Hooks.—R. S. Willard, Franklin, Vt.

85,499.—Clothes Dryer.—Daniel Witt, Hubbardston, Mass.

85,500.—Hand Shears.—Charles Witte, Brooklyn, N. Y.

85,501.—Velocipede.—Sylvester A. Wood, Manitowoc, Wis.

85,502.—Ruffled Trimming.— Emma C. Wooster, New York city.

REISSUES.

67,483.—Gang Plow.—Dated August 6, 1867; reissue 3,244. Robert Baxter, French Camp, Cal.

73,494.—Breech-loading Firearm.— Dated January 21, 1868; reissue 3,245.—Francis E. Boyd and P. Shelton Tyler, Boston, Mass.

32,236.—Loom.—Dated April 30, 1861; reissue 3,246.—George Crompton, Worcester, Mass., assignee, by mesne assignments, of John Shinn.

73,328.—Machine for Sewing Carpet Linings.—Dated February 11, 1868; reissue 3,247. Joel F. Fales, Walpole, Mass.

37,778.—Cooking Stove.—Dated Feprnary 24, 1863; reissue 24, 1863; reissue 3,248. Augusta P. Stiles, Rochester, N. Y., assignee, by mesne assignments, of David L. Stiles.

52,121.—Process for Refining Iron and Steel.—Dated January 23, 1866; reissue 3,249. First National Refined Iron and Steel Manufacturing Company (assignees of John Absterdam), New York city.

DESIGNS.

3,298.—Badge.—N. P. Chipman and William T. Collins, Washington, D. C.

3,299.—Show Case.—John H. Fraser, New York city.

3,300.—Handle for a Fork or Spoon.—Henry H. Hayden, New York city, assignor to Holmes, Booth, and Haydens, Waterbury, Conn.

3,301.—Machine Frame or Housing.—Francis D. Pastorius, Philadelphia, Pa.

3,302.—Spoon or Fork Handle.—Henry G. Reed (assignor to Reed and Barton), Taunton, Mass.

3,303.—Key Tag.—Arthur Stafford, Brooklyn, N. Y.

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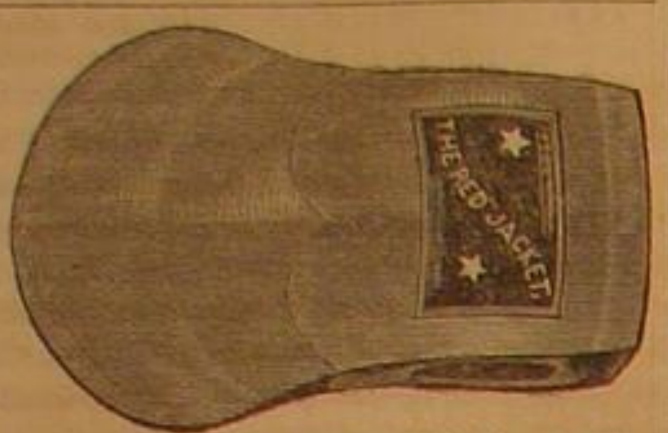

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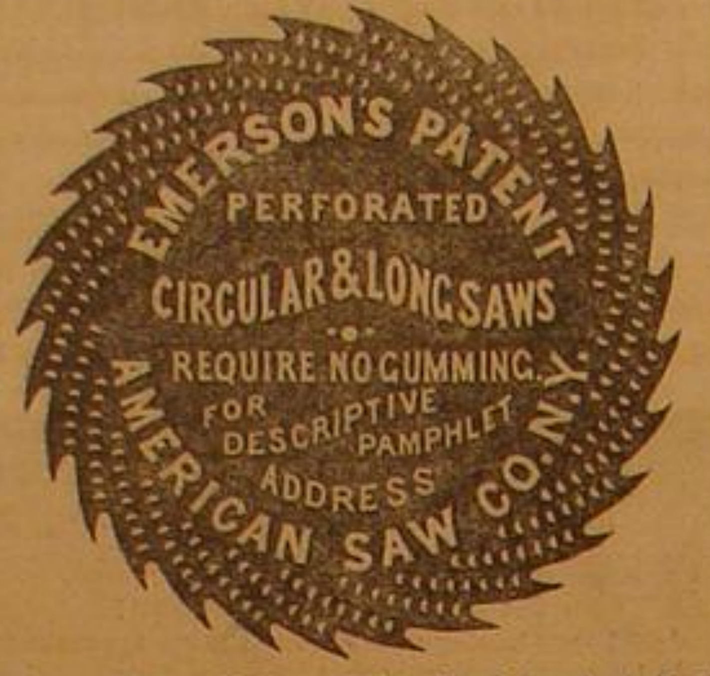

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For 1869.

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The Editors are assisted by many of the Ablest Writers and having access to all the leading Scientific and Mechanical Journals of Europe, the columns of the SCIENTIFIC AMERICAN will be constantly enriched with the choicest information which they afford. In addition to contributions from able and popular writers, popular Lectures on Science will also be published; and it will be the constant study of the Editors to present all subjects relating to the Arts and Sciences in PLAIN, PRACTICAL, AND POPULAR language, so that all may profit and understand.

The SCIENTIFIC AMERICAN is Independent of sect or party, and its columns are therefore kept free from mere partisan questions. Nevertheless, its opinions upon all questions of public utility will be freely expressed. It would be impossible, within the limits of a prospectus, to specify the wide range of subjects which make up the yearly contents of the SCIENTIFIC AMERICAN; a few only can be indicated, such as

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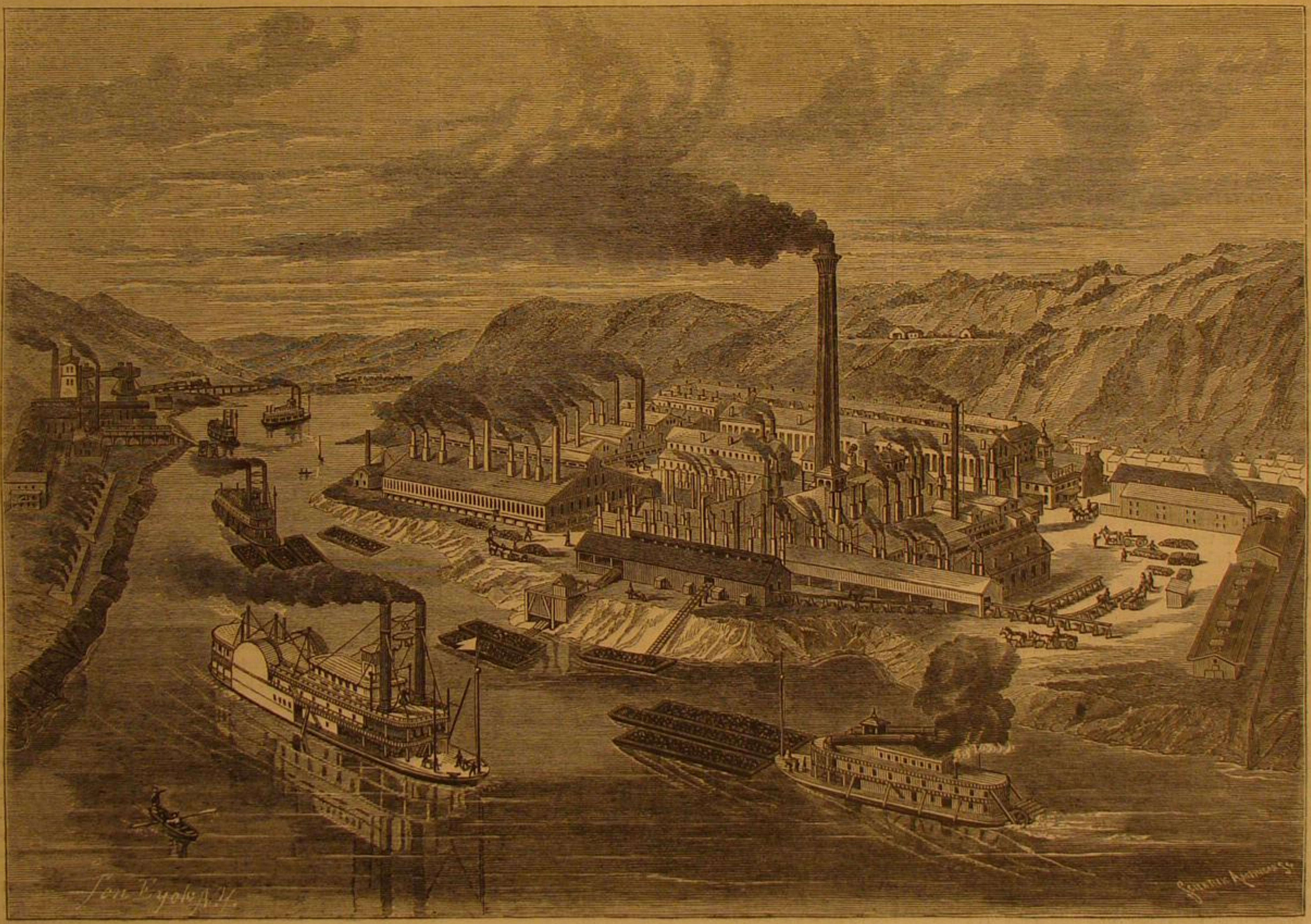
Vol. XX.---No. 4. [NEW SERIES.] | NEW YORK, JANUARY 23, 1869. | $3 per Annum [IN ADVANCE.]

AMERICAN IRON AND STEEL.---PITTSBURGH, THE IRON CITY.



IRON MILLS OF JONES & LAUGHLINS, PITTSBURGH, PA.

As an example of American enterprise and pluck, as well as of inventive genius, the iron industry of this country is more conspicuous than any other to which our country owes its greatness. Doubtless the agricultural interest of the United States, absorbing as it does the labor of the greatest number and annually yielding a product of much greater money value than any other, deserves to be considered *the* industry *par excellence* of North America; but it is an occupation to which men without capital, other than sound health and an average intellect may aspire with almost the assurance of success. Good, cheap, and fertile lands are within the reach of any who desire to occupy them. Home and foreign demand creates a good and steady market for all agricultural products. These facts coupled with—until recently—almost entire freedom from the taxation which so burdens European farmers, have made the occupation of farming in this country certainly remunerative, and one that could be entered upon by comparatively inexperienced men. The ease with which new lands could be obtained to replace those exhausted by a system of drafts without deposits, has made farming almost solely a process of ploughing, sowing, and reaping, to be discontinued in one locality and repeated in another as soon as the reaping was found to be disproportionately easy. From the nature of the case it required no fostering care from the Government. It could, and it can for a century to come, take care of itself.

With the manufacturing interests of the country the case has been far different. A few are indeed accessible to men of small means, and involving only a comparatively small amount of skilled labor, may be considered as exceptions to the general rule. Of these the manufacture of lumber is a notable example. But manufacturing in general requires large capital, of both money and brains, in its conduct, and skilled, and therefore in this country expensive labor in its performance. Skilled labor will remain expensive labor in the United States so long as farmers can afford to pay for green hands, more than skilled laborers can get in Europe, and "glad to get them at that," thus preventing any glut of the labor market. We are glad to be able to say to-day, that notwithstanding the tide of immigration which is constantly setting toward our shores, there is no prospect of a glut of labor.

But this state of things while it exhibits the vitality of the Government, and the extent of our National resources, is at present—as it has been in the past—a source of great and unnecessary embarrassment to the manufacturing interests of the country. It has impoverished proprietors, and had it not been for the agricultural growth which our unoccupied territory has permitted, it would have ere this reduced the American laborer now happy in the possession of a comfortable home, a family well clothed, housed, fed, and educated, to the condition of the English operative whose only ambition is to stolidly and stupidly perform his daily task, and whose highest idea of enjoyment is, at its close, for a brief hour to smother and drown his feelings of wretchedness in tobacco smoke and beer at a pothouse.

We have said the embarrassments to which American manufacturers have been forced to submit are unnecessary. It will be easy to demonstrate this. They have arisen from competion with the cheap labor of Europe. It has always been in the power of the general Government, to put a stop to such competition, by a protective tariff. In failing to do this, or by only very partially protecting some of her most important industrial interests, the Government has committed a grave but not irreparable blunder, as we may attempt to show in a subsequent article. We have only alluded to this point in the present article because it has an important bearing upon the subject in hand. No American industry of like magnitude has suffered so much from the want of proper protection as the iron manufacture. Should gold return to par to-day and remain there, the production of fine grade irons here would nearly or quite cease, because the labor involved in their manufacture is so large an element of cost, that competition with foreign iron of like grade would be rendered impossible. It is now possible only by reason of the unstable condition of the gold market. The present financial condition of things cannot last always. The time is coming when either by the resumption of specie payment or from other inevitable causes, disaster will take the place of prosperity, and stagnation will reign where now all is life and activity, unless timely precautions are taken.

Let us look briefly at the progress of the iron industry, as illustrated by the operations at Pittsburgh, the Iron City, to which our attention has been specially called by a recent visit. We were once amused by a comic picture of General Grant, as he appeared on the balcony of a Western hotel, in response to a serenade. A pair of military boots surmounted by a cloud of smoke, constituted the portrait. Substitute for the boots the water front on the Monongahela river, crowded with a fleet of grimy coal barges, with a few sternwheel steamboats scudding about among them, having their smoke pipes thrown back to avoid the bridges, like the ears of a frightened rabbit, and you have an accurate description of the best view of Pittsburgh obtainable during a week's stay at that busy place. The smoke is not so dense however that you cannot walk through it, if your courage, and disregard of soiled linen, are sufficient for the attempt. Plunging in then boldly, and traveling in any direction, you shall not fail to meet with something interesting. Anon through the dense veil of smoke you will hear the thud of a steam hammer; and presently a dim glow which intensifies as you approach, announces the proximity of some large iron or steel works. Or suddenly you chance upon an army of workmen with their long iron tubes, each having a glowing ball at its extremity, which by their dextrous manipulations becomes successively a balloon, a cylinder, a pane of glass, a goblet, or a fruit jar. This is one of the numerous glass works with which the city abounds, and of which mention shall be made in a future number Here is the enormous foundery where the heaviest guns ever made in this country, are cast, by a method with which our readers are already familiar. Passing down Smithfield street and crossing a fine suspension bridge over the Monongahela, you enter what is called Birmingham. Along this side of the river as well as on the Pittsburgh side, is a forest of chimneys which by day and by night vomit forth lurid flames, and smoke so dense that the air is constantly filled with black snowflakes. These get in your eyes, in your nose, ears, and mouth; and on your shirtfront. Your complexion will shortly be some shades darker, but we promise you reward for all these personal discomforts before we return. Entering a horse car we find the inevitable smut, but we are quickly conveyed to our special destination. Before we get there we will tell you where we are going, and why we are going thither. We are bound for the iron mills of Messrs. Jones and Laughlins, the largest establishment of its kind in the United States.

Stepping from the car we enter the office, and in response to the announcement of our visit a member of the firm promptly and cordially gives us welcome, and offers his escort during our tour of inspection.

First as being something out of the general run, and therefore of greater interest, we are shown into the cold rolling mill and machine shops of the establishment. In this shop is made the celebrated Patent Cold Rolled Shafting, for which this firm is so justly famed. The process of manufacturing this shafting is so peculiar and the results so remarkable, that we are sure our readers will be eager for the details. We must be as brief as possible however, as there is very much more of interest to see and describe.

The iron is first rolled hot—a very fine quality only being employed for the purpose—into round bars exceeding in diameter the required size of the shaft from $\frac{1}{16}$ to $\frac{1}{8}$ of an inch. These bars are next plunged into a warm bath of diluted sulphuric acid to remove the scale. They are removed from this bath and immediately plunged into a hot bath of lime water to neutralize the acid. A third cleansing bath of hot water and a thorough rubbing with pumice stone, prepare the bars for the cold rolling process. The baths are heated with steam in order to facilitate the reactions, and also to impart heat enough to the bars to dry them instantaneously when taken out of the cleansing bath, and thus prevent rusting. The bars are next passed through a train of chilled iron rollers, differing from the ordinary rollers only in their greater size and more perfect construction. During this process the rollers are gradually let down to the diminished size of the bars, the latter being constantly turned about by the workmen so as to be uniformly condensed and formed until they will exactly fit Whitworth's Manchester Standard Gage Rings of the desired size. By this operation the bars are considerably lengthened and a most exquisite finish is imparted to them. So far as we have seen, no lathe finished shafting can compare with them in beauty of finish or uniformity of size throughout the entire length. Shafts selected promiscuously from a stock on hand in the A. B. Taylor Printing Press and Machine Co.'s Works, were tested on one occasion by Dr. Pratt of Providence, at the Fair of the American Institute in New York, and found to vary only by one thousandth of an inch from perfect uniformity. No less surprising is the perfectly rounded form attained by this method. In this respect they are fully equal to the finest turned shafting.

It was currently supposed previous to the introduction of this method, that the quality of the iron would be injured by rolling it cold. In its incipiency the process met with derision and almost universal skepticism and opposition, both from eminent engineers and men who although not eminent as theorists, were entitled to respect from their long practical experience. Messrs. Jones and Laughlins had the sagacity to perceive the seeds of truth in the proposed system, and to their timely aid and indomitable pluck, combined with the persistence rendered possible by large capital, it owes its success.

Our opinions as to the merits of the cold rolling process are sustained by the following tests. In 1860 a large number of specimens were submitted to Maj. Wm. Wade, of the U. S. Ordnance Department, who subjected them to rigid comparative tests with the same quality of iron rolled while hot, of which we give the following summary of average results extracted from his report:

SUMMARY

	Iron rolled while Hot.	Iron rolled while Cold.	Ratio of Increase by Cold Rolling.	Average rate per cent. of increase
TRANSVERSE—Bars supported at both ends, load applied in the middle, distance between the supports, 30 inches. Weight, which gives a permanent set of one-tenth of an inch, viz.: 1½ in. square bars	3,100	10,700	3,451	162½
Round bars, 2 in. diam.	5,200	11,100	2,134	
Round bars, 2¼ "	6,800	15,600	2,294	
TORSION—Weight, which gives a permanent set of one deg., applied at 25 in. from center of bars. Round bars, 1½ in. diameter, and 9 in. between the clamps	750	1,725	2,300	130
COMPRESSION—Weight, which gives a depression, and a permanent set of one-hundredth of an inch, to columns 1½ in. long and ⅝ in. diameter	13,000	34,000	2,615	161½
Weight, which bends, and gives a permanent set, to columns 8 in. long and ⅝ in. diameter, viz.: Puddled iron	21,000	31,000	1,476	64
Charcoal bloom iron	20,500	37,000	1,804	
TENSION—Weight per square inch, which caused rods ⅝ in. diam. to stretch and take a permanent set, viz.: Puddled iron	37,250	68,427	1,837	95
Charcoal bloom iron	42,439	87,396	2,059	
Weight per square inch, at which the same rods broke, viz.: Puddled iron	55,760	83,156	1,491	72
Charcoal bloom iron	50,927	99,336	1,950	
HARDNESS—Weight required to produce equal indentations	5,000	7,500	1,500	50

Indentations made by equal weights, in the center, and near the edges of the fresh-cut ends of the bars, were equal; showing that the iron was as hard in the center of the bars as elsewhere.

The following results were obtained by Fairbairn, from whose report the following summaries are extracted:

FIRST SUMMARY

Condition of Bar.	Tensile strength, per sq. inch: In lbs.	Tensile strength, per sq. inch: In tuns.	Elongat'n of 10 in.: in inches.	Ratio of strength, the black bar being taken at 1,000.....
Black bar from rolls	60,746	27,119	2,620	1,037
Bar turned down to 1 inch diameter	58,628	26,178	2,000	1,000
Bar rolled cold to 1 inch diameter	88,230	39,388	0,079	1,505

"The first bar was broken in the condition in which it came from the iron manufacturer; the second was a similar bar turned in the lathe; and the third had been subjected to the process of cold rolling.

"It is obvious that the effect of the consolidation in the last case was to increase the strength of the bar in the ratio of 10 to 15.

SECOND SUMMARY

	Condition of Bar.	Breaking w'ht of bar in lbs.	Breaking weight, per sq. inch: In lbs.	Breaking weight, per sq. inch: In tuns.	Strength, the untouch'd bar being unity.
1	Untouched (black)	50,346	58,628	26,178	1,000
3	Rolled cold	69,295	88,230	39,388	1,505
4	Turned	47,710	60,746	27,119	1,036

"In the above summary it will be observed that the effect of consolidation by the process of cold rolling, is to increase the tensile powers of resistance from 26·17 tuns per square inch to 39·38, being in the ratio of 1:1·5, one-half increase of strength gained by the new process of cold rolling."

John P. Whipple, Chief Engineer of the U. S. Navy, obtained results fully as favorable in his experiments upon iron plates prepared by the cold rolling process, and one by one the skeptics have been converted to the new faith, and have made profession before the world. But tests of the kind above described would still be insufficient to warrant success unless actual and continued trial could be added. Practical tests will only convince practical men, tests that appeal to the eye of experience. There is no lack of such tests. The shafting has been used by the A. & W. Sprague Manufacturing Co., of Providence, in their various mills, and after using it four years their opinion of its merits is shown by an order of 6,000 feet for their new mill in Augusta, Maine. It has been ordered after a test of six years for the Harmony Mills by Mr. Johnson, their accomplished Superintendent, a man whose judgment in all matters connected with his profession is of the highest character; the U. S. Flax Co., of Central Falls, R. I.; the Great Falls Manufacturing Co., of Great Falls, Mass.; the Chicago, Rock Island, and Pacific R. R., for their new shops at Chicago; the Champion Machine Works, Springfield, Ohio; the Buckeye Mower and Reaper Works, at Akron, Ohio; Government Printing Office and Printing Bureau of the Treasury Department, at Washington, and many others which we forbear to name.

But among the most striking evidences of the superior quality of the cold-rolled iron, is the success it has met with in the manufacture of finger-bars for reapers. It has almost entirely superseded the use of steel for this purpose. Messrs. Jones and Laughlins made this year seventy thousand of these bars, and have already on their books orders for sixty thousand next year, which they are confident will be increased before the close of the year to one hundred thousand. These bars can be depended upon for uniform strength, which is not the case with steel finger bars, and have given so much satisfaction that not a single complaint has ever been made of their giving out, or of any trouble in drilling them. In short a steel cutter-bar is now rarely to be met with in this country.

If the reader will now look at our illustration of the works we are describing, he will see that we have tarried too long at this train of polished rollers, and that in order to glance at the remainder of the works we must economize our time and space to the utmost. Stopping then only long enough to admire the proportions of the 375-horse power engine, which drives these ponderous rollers, and only pausing to note that the tools in the other parts of the shop are of the most perfect construction, from designs made by the able mechanics who superintend the different departments of the works, we move forward. Just as we are leaving the shop the foreman calls our attention to a fly wheel just out of the sand, 10 feet in diameter and weighing 10 tuns, cast in the foundery of the works, and which as an example of accurate molding we have never seen excelled. The extreme variation of the rim from the round does not exceed 1-16 of an inch. The wheel is designed for the main driving wheel in the new nail factory which the firm have now nearly completed, and will be used without turning, the face being ground smooth after it is mounted.

Passing rapidly through the new nail factory, 166 feet by 65 feet, and two stories in height, capable of accommodating from 60 to 100 machines, not yet quite ready for occupation; a blacksmith shop 40 feet by 75 feet containing 8 fires, a 600-pound steam hammer, steam engine, fan, shears, and saw; the foundery 125 feet by 85 feet with an air furnace and two cupolas having a melting capacity of 50 tuns, in which all the machinery for their mills, furnaces, and machine shop are cast; a pattern shop and carpenter shop, 40 feet by 140 feet; we enter next into a building, 130 feet by 280 feet, known as the "New Mill."

Here our attention is immediately arrested by the absence of gearing, the entire mill with the exception of a single train of rollers, being driven by belts alone. The train alluded to is attached to the 18 inch shaft of the ponderous fly wheel of a 600-horse power engine. This fly wheel is 25 feet in diameter and weighs 40 tuns. The face of the rim is 68 inches broad, and carries two immense belts, each 32 inches in width and 140 feet in length, and by them propels the main line of shafting. Although all the usual work is going on in the mill, we find that we can converse without effort. A question as to the practical economy of the belts elicits the fact that, while the firm have another mill of nearly equal capacity driven by gearing, which getting out of order frequently causes annoyance and delay, this mill although it has been running for five years, has never lost a belt, except one which was destroyed while off the pulley, by the carelessness of an employé. The boldness, originality and disregard of precedent shown by the firm in their developement of the cold rolling process, is very prominently shown in the outfit of this shop. We were told that everyone who saw the plans before its completion predicted its utter failure. "It never had, and it never could be done," "Who ever heard of a rolling mill being driven by belts." The croakers are however effectually silenced; it is a *fait accompli*.

The fly-wheel is made in sixteen segments, bolted together. The arms are dovetailed to the rim, and are keyed to it and the spider with oakum, which has been found superior to any other material, as it remains perfectly firm, and never gives trouble by working loose. The oakum is driven in as in the process of caulking, and as this wheel was too large at the time of its construction to be faced, by turning, an important advantage was gained by the use of the oakum in trueing the segments.

Beside the train of rollers already alluded to, this mill contains two sheet mills, one 12-inch train, and three 8-inch trains, for merchant iron. The building also contains the most improved appliances for shearing sheets, and cutting bar iron into suitable lengths for market, among which is a powerful steam saw attached to the shaft of a rotary engine, which, although it makes somewhat extravagant demands for steam, passes through a bar of iron, as though it were a pine shingle.

We have hitherto been too busy to notice a network of railways, which connect all the shops with each other, and the coal mines of the company, situated back of the works, from which the coal is dug, and run down by means of an inclined plane directly to the furnaces at our feet. These railways are over our heads, and passing back and forth in every direction, are made the means of transporting materials from mill to mill, as well as of bringing coal direct from the mines, the entrance to which is marked by the small building on the side of the mountain, back of the main works, and, from which the railroad can be plainly seen in our engraving, descending to the forest of chimneys below. Notwithstanding these facilities for transportation, and the fact that every pound of ore, coal, and limestone, needed in these works, is brought by rail or river to the company's very furnace doors, some conception may be formed of the magnitude of their business, when we add, that they find it requisite to employ beside these facilities sixty able-bodied horses in the immediate vicinity of their mills.

We pass now to what the company call their "Old Mill," a building 325 feet long by 185 feet in breadth. This contains a bar mill, plate mill, nail mill, and forges. It covers an area of 60,125 feet. Here, also, are the fifty-five puddling and boiling furnaces, from some of which constantly issue glowing and scintillating masses to be successively squeezed, rolled, and manipulated until they are transformed into long, lithe, and flaming tongues, which shoot out at you from the rollers in impotent spite. Most of our readers are posted on the subject of iron manufacture. Possibly, some of them may never have had an opportunity of witnessing it. To them, we say, never miss the opportunity when it offers. There is nothing in the whole range of industry which affords a scene of such weird fascination.

Out of this and into a storehouse 375 feet long by 30 feet wide, containing clay for fire bricks, and other materials, and an inclined railway running down to the river, plainly shown in the sketch, to receive and transport pig metal, ore, and other materials to and from the barges at the landing. Thence into an annealing house 60 by 20 feet, for sheet iron, where the sheets are annealed by inclosing them in boxes of cast iron, made air-tight by luting to prevent oxidization, subjecting them to a nearly white heat for from twenty-four to thirty-six hours, and allowing them to cool gradually. Each box and its charge weighs about fifteen tuns. From thence, into a carpenter's shop and pattern rooms, 40 by 140 feet, with the usual appliances. From thence to the large and commodious stable for the accommodation of the sixty horses above alluded to, provided with a steam-engine and mill to grind their fodder. From thence to the spike and bolt factory, 50 by 125 feet, containing, four railroad spike, two ship spike, and two bolt machines, which together with other appliances situated in other parts of the works, for making fish bars and bolts, are capable of turning out daily 2,500 complete joints. From thence to the nail factory, where stand the grim little monsters, which can eat more iron without injury to their digestion than any other machines of their size in existence.

We now suppose our tour concluded, and thanking our polite conductor for his attention, we are surprised by a request to accompany him to the remainder of the works on the opposite side of the river. The "remainder" proves to be a number of blast furnaces, in themselves, quite a respectable establishment, as the reader can see by referring to the engraving where they are shown at the top of the picture; the Monongahela with its never remitting burden of coal barges floating serenely on between them and the principal works, to shortly mingle its muddy waters with the limpid waves of the Allegheny.

Turning to look back as we crossed the bridge on our return, the lurid fires along the opposite bank of the river belching forth from the chimneys, now hidden in the gray dusk of evening, and lighting up the volumes of dense smoke, illuminated them with tints of blood red, purple, pinkish, and reddish grays, of the richest and most brilliant character. The lights reflected in the water below and broken up by the swells caused by the passing boats, combined to produced a scene of variable and indescribable beauty.

The works of Messrs. Jones and Laughlins cover seventeen acres of ground, and give employment to 2,500 hands. They contain twenty-five engines, aggregating 2,750-horse powers, and their capacity is one hundred and twenty-five tuns per day. The steam for these engines is generated in thirty double-flue boilers, the waste heat from the furnaces being largely utilized for that purpose. They are a good example of the rapid growth of American manufactures, when circumstances do not oblige them to compete with European labor; and as a representative of the numerous similar, though smaller works in and around Pittsburgh, they are the best that could be selected. Their specialty, the cold rolled iron, is an example of remarkable success achieved against the ruling of all precedent. Although for a given weight its cost is somewhat greater than the more common turned shafting, its superior strength permits the use of lighter lines, while its greater rigidity admits a less number of hangers, and, consequently, less friction and less current expense for lubrication. These advantages will be found to more than counterbalance the increased cost per tun of this shafting. For piston rods it is unequaled by any other material, and is rapidly coming into general use for that purpose. It is completely fitted out with improved patent coupling and hangers, fully described and illustrated on page, 305 Vol. XVII. of the SCIENTIFIC AMERICAN. Our space forbids us to attempt at this time, further description of the industries of the "Iron City." We shall at a future time refer to some of them again. Ere we close this article, we wish to give expression to the hope that our Government will soon see the wisdom of protecting its iron interests, thereby securing to it permanent and uniform prosperity, rather than a fitful and spasmodic progress, the result of a vacillating and indefinite policy which enriches speculators by the destruction of legitimate and healthy business, and the depression of honest toil.

THE AFRICAN INTERIOR.

LECTURE BY P. B. DU CHAILLU.

The tenth and concluding lecture of the Parker Fraternity course was delivered lately in the Music Hall, Boston, by P. B. Du Chaillu, the celebrated African explorer. Prof. Du Chaillu related the story of his explorations in the interior of Africa to the large audience in attendance in a very easy and entertaining manner, and held the closest attention of his hearers throughout the entire lecture. His adventures with the natives and gorillas were told with a dry humor, which frequently created a hearty laugh, and the slight foreign accent of the speaker, though it made some of the proper names unintelligible, added not a little to the pleasure of those who listened to his words.

Until within a few years, he said, there was an immense tract of country in Africa, extending from the west coast far into the interior, which had never been explored. Livingstone and other travelers had made extensive explorations in the eastern portion of that country, but of the western portion little was known. For the purpose of learning something of it and its inhabitants, while he was yet only nineteen years old, he started from New York in a schooner with that aim in view, and remained in Africa four and a half years. His explorations demonstrated the fact that the interior of Africa is an immense forest, which, it is estimated, is 1,800 miles in length and about 700 miles in breadth. Some of the trees are of gigantic size, being from two to three hundred feet high, and from twenty to twenty-five feet in diameter. Under these tall trees other trees grow, and beneath these again there is an immense jungle, which, in many places, it is almost impossible for man to penetrate. In many places he and his followers were obliged to follow in the paths made by the elephants in going from one village to another. It rains very much in the interior, and it is estimated that 300 inches of rain fall in a year's time. The heat during the months of March and April, which are the hottest months, was tremendous, the thermometer indicating 149½ degrees; and in July and August, when the coldest weather was experienced, the mercury fell to 70 degrees. The nights are warm, averaging from 85 to 90 degrees during the rainy season, which begins in September and ends in May. In the far interior there is no dry season whatever. As he advanced into the country the land grew higher and higher, and some of the mountains seen were from ten to twelve thousand feet in hight. The inhabitants are scattered, and divided into a great number of tribes, and miles and miles were often traveled without meeting a single human being, hearing the chatter of a monkey, or the singing of a bird; nothing broke the silence of the grandest solitude. In his travels he had hunger and starvation always before him, and he did not exaggerate, he said, in stating that during 65 out of the 365 days in a year he was without food. The climate was very unhealthy; the decay of the vegetation in the forest caused him to have fever after fever, but he had a stout heart, and kept on as best he could. There are no beasts of burden found in the interior, the work is all done by the women, while the men sit around at their ease and smoke. Neither are the wild beasts of the north and south of Africa to be found here; everything he discovered was new—beasts, birds, and insects were unlike any that had been seen before. He discovered thirty-three new tribes of men; north of the equator there were gorillas, and south of the equator dwarfs from 3 feet 8 inches to 4 feet 6 inches in hight.

After speaking thus in a general way of the country, the lecturer related his personal adventures among the different tribes with which he was brought in contact, beginning with his arrival on the west coast.

Polygamy, slavery, and witchcraft he found were the three great institutions of the country; the more wives a man has the better off he is, and the older a man becomes the more wives he wants, and the younger he wants them to be. The tribes are divided into clans, the clans into families, and each head of a family is chief of a village. The first king he met gave him three of his sons to accompany him on his travels; they went with him to the next tribe, about eighty miles in the interior, the king of which wanted him to remain with his tribe permanently. As an inducement to stay he brought out over eight hundred of his prettiest women and girls for the visitor to choose a wife from. Professor Du Chaillu gave as an excuse to escape from this that if he took one the others would be jealous. The elders of the tribe consulted about his answer, finally agreed he was right, and told him to take the whole of them. This frightened him, and he had to make a tremendous speech to get out of it. The king also gave him three sons, and a large number of followers, men and women, and he continued his travels into the interior. After going up a river about two hundred miles he took to the land, and his difficulties increased in number and extent. In the next village he entered he found every man in it drunk. They have four or five kinds of intoxicating liquors; they get tipsy on palm wine, on a drink made of wild honey and water, also a drink made of bananas and water; and the juice of the sugar cane fermented. The inhabitants of the village had never seen a white man before, and there was great excitement when he arrived. It was near the village that he first saw a gorilla; two were seen together, but they were females, and fled at his approach.

After traveling as far as the the third range of mountains he encountered a very warlike tribe called the Fans. The men dress in the skins of wild animals, and are very powerful; they are cannibals, and have their teeth sharpened to a point. They also were much surprised at seeing a white man; they thought his boots were his feet, and did not know how to account for feet being black and his face white. All about the village poles were stuck up, on the tops of which were the skulls of those who had been captured in battle, and whose bodies had been eaten. The village was laid out with one great street only; that, and the houses, which were made of the barks of trees, were kept quite clean. In three days after his arrival he was allowed to see the king, to whom he made numerous presents, among which was a looking-glass, which caused great excitement when first seen by the natives. He came very near getting into trouble with this people by refusing to eat some food prepared by the king's wife; he was afraid to eat it, he said, for he didn't know that a man's head had not been boiled in that very pot, and he thought he would not relish the gravy at all. By giving the woman some beads, however, he succeeded in averting the danger which threatened. The Fans were the most intelligent negroes he met; they were very good iron workers, and their war weapons were very formidable. But he found among them the worst form of cannibalism. They are not allowed to eat the members of their own families, but they give the corpse to another family, which assures them that it will return the compliment when any of its members die. His encounter with the first male gorilla he saw, was well described by the speaker, and also several subsequent encounters.

The professor exhibited several pictures of the gorilla to the audience, and gave a full description of the animal, pointing out the resemblance between it and man, and also the qualities in which they differ. On returning to America he brought with him, he said, more than one thousand stuffed quadrupeds, twenty-one gorillas, and no end of birds and insects.

Valuable National Statistics.

We have before us the Report of the Special Commissioner of Revenue, Hon. David A. Wells, which is thoroughly characteristic of the fidelity and ability of its author. From the mass of valuable matter it contains we extract the following interesting items:

"From July 1, 1865, to Dec. 1, 1868, 1,000,000 natives of foreign countries have sought a permanent home in the United States. The specie they brought with them is set down at $80 per head, or $80,000,000 in all; while their value to the country, as producers, is estimated at $500 per head, or $500,000,000 in all; making a grand total of $580,000,000 which has been added from this source to the wealth of the country.

The increase of cotton manufactures has been, since 1865, 32 per cent, and the amount of capital invested in the woolen manufacture is more than three-fold now what it was in 1860.

The production of pig iron for 1868 was $1,550,000 tuns, showing a steady annual increase since 1863 of about 8 per cent.

The export of petroleum for 1868 was 95,000,000 gallons.

The amount of anthracite coal mined in 1868 was 13,500,000 tuns.

The crop of Indian corn was, in 1859, 830,000,000 bushels; in 1868, 1,100,000,000 bushels.

The cotton crop for 1868-9 is estimated at 2,780,000 bales.

The tobacco crop for 1867 was 250,000,000 pounds.

Two thousand five hundred miles of new railroad were built in the United States in 1868, making the number of miles now in existence in the country over 40,000. The total value of merchandise annually carried over these roads is $7,273,000,000. Six thousand miles of new telegraph wires have been put up during the past year.

Nearly all the individual States materially reduced their debts in 1868.

From these and similar facts, the Commissioner concludes that our national wealth as a whole is increasing. He reckons, however, a number of influences adverse to our real prosperity. He goes into elaborate calculations to show that while the cost of living has increased, since 1860, 78 per cent, wages have increased only from 50 to 70 per cent. As an illustration of the general principle, he shows that the wages, which, in 1860, would purchase a barrel and a half of flour, now purchases only a barrel and a quarter. Hence, the laboring population are really not as well off as they were.

In regard to the customs, duties, and internal revenue taxes, the Commissioner favors a greater simplification, and a reduction in the number of taxes imposed. He mentions a number of articles, such as salt, lumber, iron, and coal, on which the taxes and duties should be made as light as possible, in order to favor the industry of the country.

Of the national finances the Commissioner speaks at some length, and gives figures to show that with proper economy our national debt can be reduced by $100,000,000 before the close of the next fiscal year, June 30, 1870.

In regard to the tariff, he advocates the imposition of duties with a view to income only, and severely condemns the protectionist policy, which has so many advocates, as exceedingly detrimental to American industry. He concludes by saying:

With these feelings and convictions he would therefore prove untrue to his trust did he not here enter his most earnest protest against any further general increase of the tariff, but would on the contrary recommend

1. An enlargement of the free list.

2. A reduction of some rates of duty, and as an exception an increase of a few others with a view to the increase of the revenue.

3. A reduction of some rates of duty with a view to an absolute abatement, on the simple ground that the reduction of a duty is the reduction of a tax, and that the most efficient method of protecting home industry is by the removal of obstacles in the form of taxes.

4. The conversion to the utmost possible extent of the present *ad valorem* duties into specifics, as the only practicable method of insuring certainty and equality in the assessment of duties and the prevention of undervaluations, and the abrogation of the privilege which enables returning tourists to import free of duty an amount of goods corresponding to their real or supposed social position.

NEWS FOR MECHANICS.

A daily cotemporary informs us that "a method recently suggested for increasing the strength of metal tubes subjected to great expansive forces, as cannon, cylinders of hydraulic presses, etc., consists in heating the cylinder and coating it with a layer of copper and tin, or of pure tin. By means of a machine, strong iron or steel wire, previously coated with the same substance, is wound around the cylinder in a continuous spiral, the turns in close contact, and several layers being made one above the other, the cylinder being kept hot all the time, so that the wire remains in a flexible condition. Iron rings may be placed outside the spiral wrappings, and an extraordinary degree of strength imparted, so as almost to obviate the usual dangers consequent upon bursting."

Most workers in iron would prefer a course diametrically opposite to that indicated in the paragraph above quoted. We do not refer to the efficiency of "copper and tin" or "pure tin" as a strengthener to iron cylinders, but to the method of overlaying the cylinder of iron with layers of "iron or steel wire previously coated with the same substance," that is, copper or tin or their amalgams. In regard, however, to the first statement it might be asked why, if a coating of tin or a composition of tin and copper possesses such remarkable strengthening properties when applied to the outside of iron cannons, and such resisting properties to expansive force, guns and the cylinders of hydraulic presses are not composed wholly of them.

But the heating of the iron cylinder while being covered with successive layers of wire will strike those who have ever strengthened either iron or wood by a hoop shrunk on as, at least, a novel idea.

Winter Railroad Building in Minnesota.

A correspondent of the St. Paul *Press* gives the following account of the progress of the St. Paul and Pacific Railway:

About the end of summer, and after the road was completed to Crow River, the Pacific Company let the contract for grading, bridging, etc., of their road through the remaining portion of the "Big Woods"—thirty-five miles—to Colonel A. DeGraff. Arriving at Crow River, I met the construction train, which soon landed me ten miles west of the Crow River station. The work on this section shows that it "cost money" to clear and grade the track; and, also, considering the miserable rainy weather which has prevailed most of the time since commencing it, the fact is clearly demonstrated that the company, contractors, and all concerned, deserve great credit for their driving energy.

The Pacific folks do not intend to stop work during the winter. De Graff is driving ahead on the grading and bridging. He has hands employed on every section clear through to the prairie, now twenty-four miles from the head of the track. Cutting through these immense hills renders this about the most costly work on any road in the State; but this "heavy work," protected as it is by the thick growth of timber from the winds and storms of the prairie region, enables all hands to do their labor without suffering.

The bridging and track laying follow directly upon the heels of the completed grading. The last bolt is scarcely driven in the superstructure of a bridge before the sturdy strokes of track layers are heard driving home the spikes.

Some estimate of the cost of building this road through the woods may be arrived at by the fact that on the next mile to be finished there are five bridges—one of them five hundred feet long, requiring in their construction one million feet of timber and lumber. The timbers are framed at Minneapolis and St. Anthony, and taken to their station as needed.

Photographic Relief Engraving.

A method of producing an engraving in relief for printing with the common press is described in a recent London journal. The process consists in taking a perfectly clean and well polished plate of copper, and blackening it by application of a solution of sulphuret of potassium, or sulphuret of ammonium, and afterwards washing and drying it. The surface is then coated to a depth of about one-thirtieth (1-30) of an inch with a mixture of resin, wax, and white lead, which, when dry, is carefully leveled and smoothed off. The surface is then sensitized, and a photograph made of the figure to be reproduced. The dark lines or points are then to be taken out with an etching tool down to the blackened copper, until the entire pattern is seen in black on a white ground. The surface is then coated with finely pulverized plumbago, and the excess brushed off, after which the plate is suspended in an acidulated solution of sulphate of copper, connected with a battery, and metallic copper of suitable thickness is deposited on the engraved pattern. Should the engraving be very open anywhere, the resinous coating is thickened by applying melted wax with a fine brush, with the usual precautions.

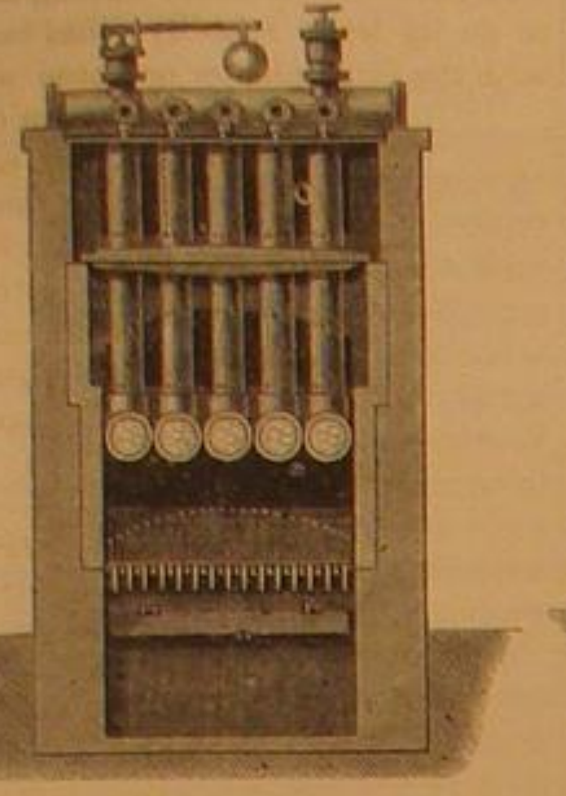
When the deposit is sufficiently thick, the wax layer is melted off, and the electrotype laid on a plane surface, and backed up by fusible type metal, which is smoothed off by a stereotype plane, and then mounted in the usual manner on wood, so as to be of type hight.

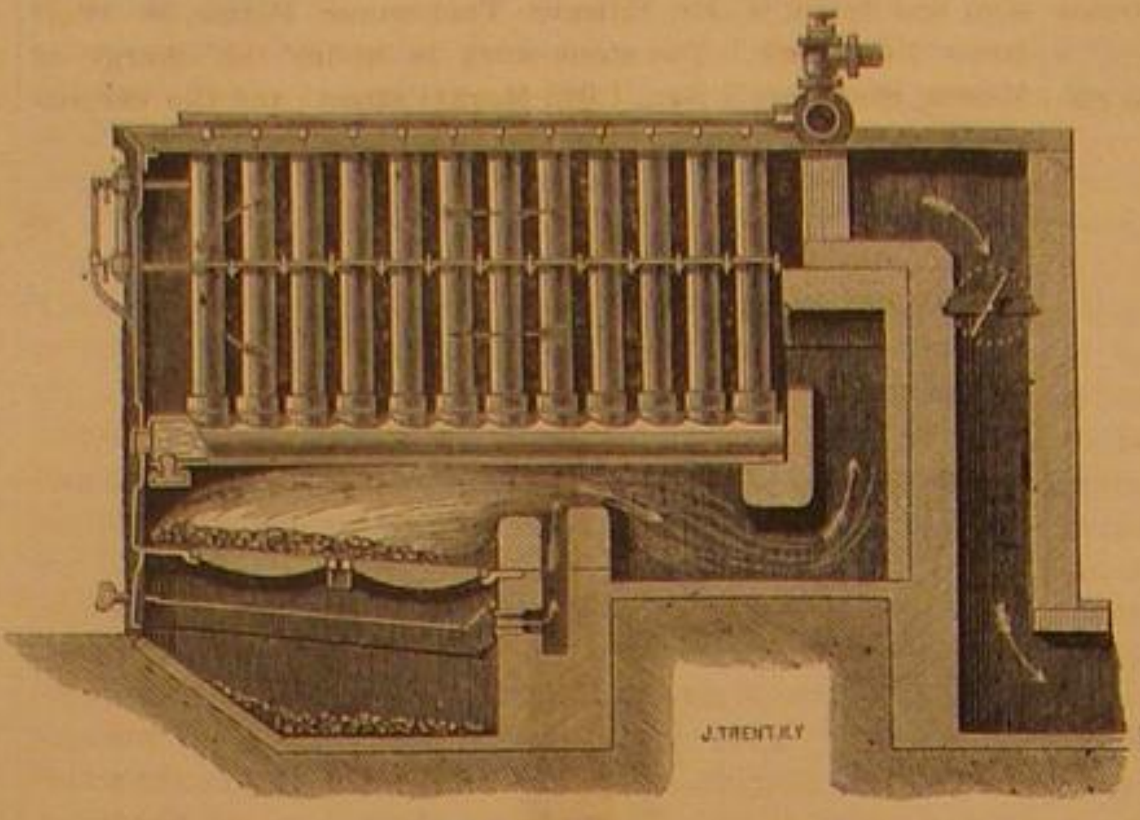
THERE is no element of machinery that has not its counter type in the structure of plants and animals.

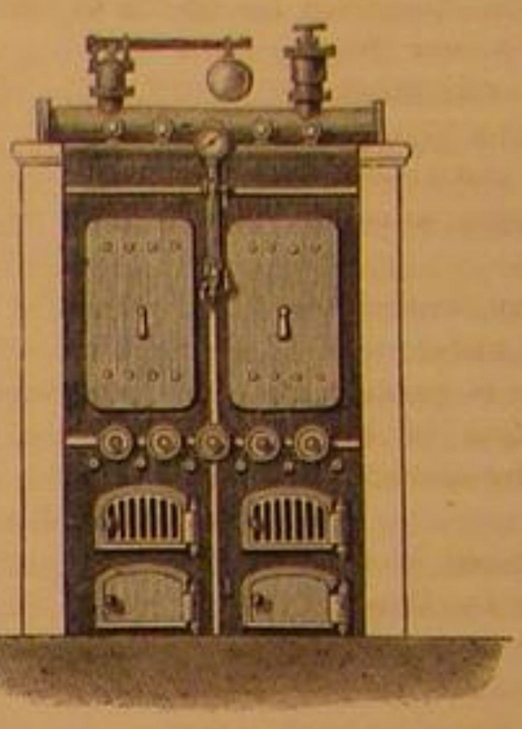
Improved Sectional Boiler.

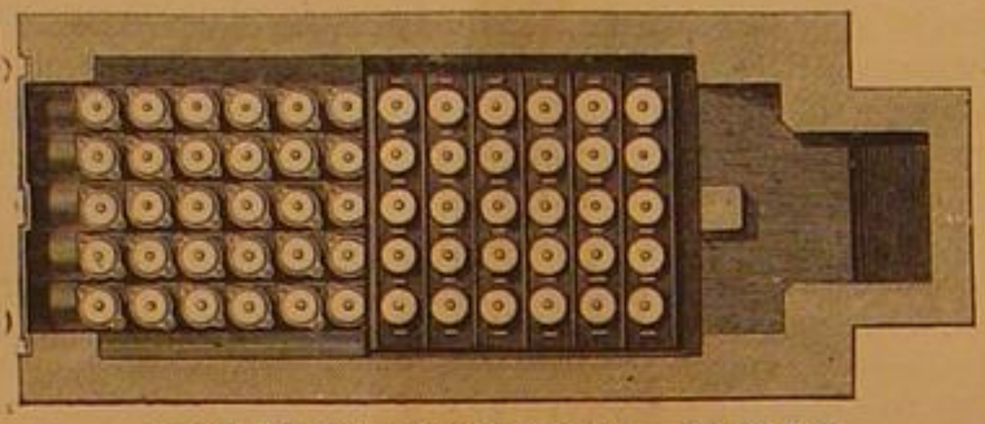
So numerous are boiler explosi ns, and so terrible are their effects, that we are coming to regard them with the same dread that is inspired by earthquakes in countries where they are frequent. Thousands of valuable lives in innumerable manufacturing establishments are constantly exposed to the dangers of these explosions. Our public streets are by no means safe from this danger. Few in the crowds thronging the thoroughfares of large cities are conscious of the number of volcanoes in the form of steam boilers that underlie the sidewalks over which they pass. So imminent are these dangers that whoever shall effectually guard against them may fairly claim that he has done the world a service.

The design of Howard's sectional boiler, illustrated in the accompanying engravings—which has been successfully introduced and extensively used in England during the last three years—is to furnish a steam boiler which shall be perfectly safe from explosion, very economical in fuel, durable, easily transported, simple in all its parts, occupying small space, and in which the circulation of water shall be active and uniform.









HOWARD'S SECTIONAL BOILER.

This boiler is built up of horizontal and vertical tubes, the latter of wrought iron, seven inches, and the former of cast iron, ten inches in diameter, and so connected as not to be strained by any inequalities of expansion. Within each vertical tube is a smaller tube, which causes and directs the circulation of the water, thereby preventing any incrustation, the cause of destruction of so many boilers.

By openings through the feed pipe to the horizontal tubes. closed by removable caps, those tubes are accessible tq a scraper for cleaning. Through the doors in the boiler front the soot is easily removed from the outer surfaces of the tubes, and thus by easy methods both the inner and outer surfaces of the boiler are kept clean.

The fire impinges at right angles upon most of the heating surfaces, thus delivering the heat most effectually to the water and steam, and causing the greatest evaporation of water for a given quantity of fuel.

The tubes are proved by the manufacturer separately before placing in the sections. The sections, when completed, are tested with a pressure of 500 pounds to the square inch, but are capable of sustaining a much higher pressure. Yet should one of them give way, no dangerous explosion would ensue, the most to be apprehended would be the discharge of a moderate quantity of water and steam into the fire chamber.

Any tube may be readily removed and another set in its place, rendering repairs easy and inexpensive.

Being made in sections it may be transported by mules or other convenient methods, over difficult roads and to places inaccessible to other boilers. It will pass through ordinary windows or doors, not necessitating any removal of or injury to walls, to place it in position. Three men are sufficient to handle the heaviest parts.

The range of water level being great, any point may be selected in the vertical tubes as the water line, the steam space above which, is subjected to the drying action of the current of heated gases passing to the chimney, and the steam may be dried or superheated to any desirable extent.

The American patents for this boiler were obtained through the Scientific American Patent Agency.

A 30-horse power boiler in daily use may be seen at the works of Morris, Tasker & Co., Philadelphia.

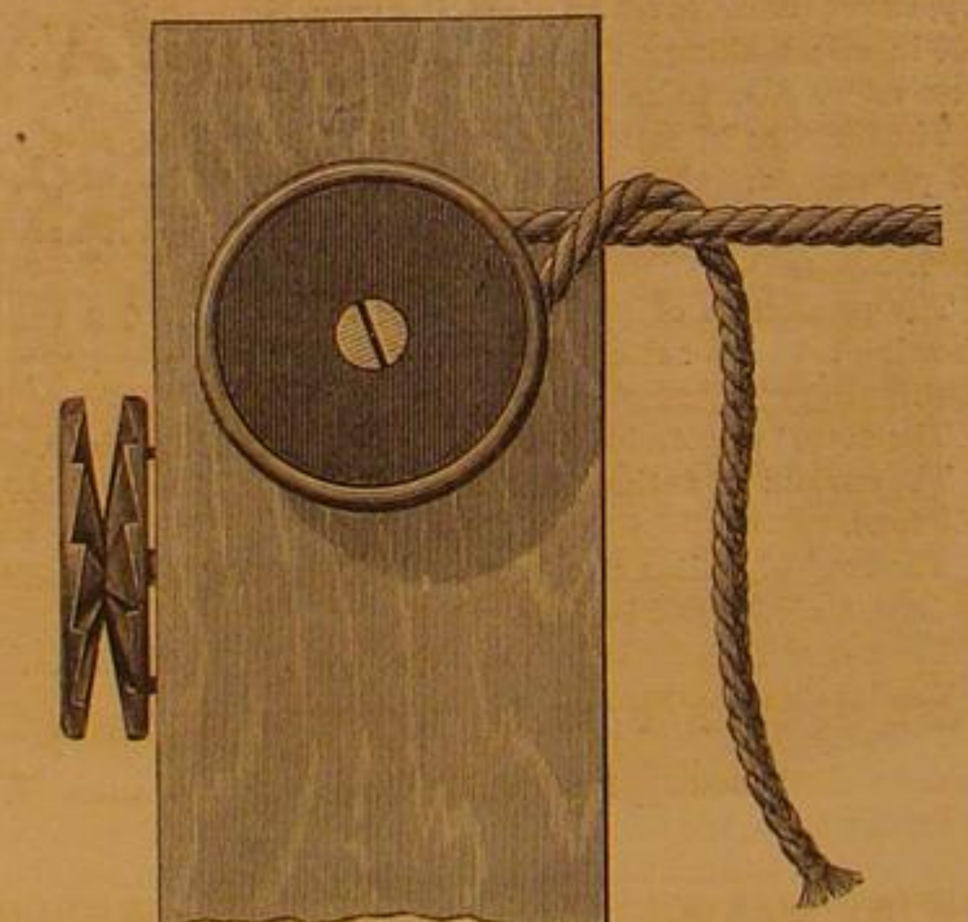
Full models and drawings may be seen, and full information obtained at the office of Austin & Germain, 37 Park Row, New York.

Wanted---A Pipe Light.

The London *Grocer* says: There are several puzzles that have agitated the inventive genius of mankind, from the discovery of perpetual motion down to—what shall we say?—well, pipe lights! That there are some things upon which much patience and skill have been wasted, during years and even centuries, is not remarkable. The philoso; her's stone has, perhaps, had its day, but we ventnre to think, not the pipe light. This s:roke of successful genius is in the womb of the future, and its birth will be hailed with immense satisfaction by a large crowd of admiring smokers. The fact is simply this: that no system of pipe-ligh'ing which has hitherto le:n discovered is really all that can be desired. The qualities nec·essary to perfection in this apparently t ifling article of commerce are portability, cleanliness, safety, easy ignition, freedom from odor, to be unaffected by damp, and capable of being lighted in a gale of wind, if need be. Perhaps there are other essential points, but the foregoing are the main features to be borne in view by the coming inventor. There are shoals of fusees and lights of all sorts already in existence, some exceedingly good and clever in their way, but they have objectionable qualities sufficient to counterbalance any advantages they may possess in other respects. Take the ordinary vesta, for instance. It is neat, portable, and when well made ignites easily; but they cannot be put loose in the pocket, nor can they be used out of doors. On the other hand, the fusee may be lighted out of doors, and will go off like an overcharged firework, to the imminent danger of your eyes and fingers. Indoors its smell is most abominable, or if scented, as some of them are, enough to suffocate a regiment of marines. There is another description of cigar light which attaches itself most pertinaciously to one's clothes, and leaves its mark in the broadcloth in the shape of a small round hole. It would be easy to fill a dozen columns with a description of the merits and demerits of the exceedingly numerous catalogue of candidat:s fo: public favor, but there is room yet for the pipe light which shall be unobjectionable and useful in the drawing room, in the railway carriage, on board ship, or when riding on horseback through a thunderstorm.

M'MASTER'S PATENT CLOTHES LINE HOLDER.

The utility, neatness, and simplicity of the device shown in the engraving are too apparent to require any extended explanation. It consists of two cast iron disks secured together and to the post or side of a building by a screw or bolt passing through the center. The one shown on the left exhibits the form of the inner faces, which are radially corrugated or scored, and inclined toward the center. The line is simply passed once around the holder, as seen, and the strain on the line



serves to hold it firmly, the greater the strain the firmer the hold. To release the line all that is necessary is to give a slight pull on the reverse side, when the line is loosened at once. The device may be made of any size to suit any diameter of rope, although one size will suit several sizes of lines. Its cost is trifling, and it can be attached or detached readily, being held by a single screw. It is intended as a support for any portion of the line as well as for securing the ends.

Patented through the Scientific American Patent Agency, Oct. 13, 1868, by D. W. C. McMaster, Southboro, Mass., who will furnish any further information, or orders may be addressed to Bent, Goodnow & Co., Boston, Mass.

Archeological.

The *Pall Mall Gazette* thus describes some interesting relics discovered near Hildesheim, in the old Kingdom of Hanover. "The relics were dis:overed in some excavations made by a soldier on a piece of land purchased for a shooting ground by the military authorities. A few things were, as usual, abs:racted and disposed of in the first moments of surprise, but the colonel of the regiment was soon on the spot to prevent further mischief. At first, it was thought that the objects found belonged to the sixteenth or seventeenth century, and the name of Benvenuto Cellini rose to everybody's lips. Soon, however, an inscription, found at the bottom of a vase, reading L. MALL. BOCCI. PIIII. III., put the inquirers on the scent of a certain Florentine silversmith, Bocci, of whom some fifteenth century writer is said to make mention. Bu': hese and similar notions were soon dispelled by Professor Wieseler, the famous archeologist, who at once declared all these treasures to be unquestionably antique. Inscriptions, at present to the number of twenty-four, found on the objects, disposed of the last shadow of a doubt. All the articles are in silver, partly gilt, the reliefs being throughout in raised work. The feet, handles, etc., are in antique fashion, wrought separately, and affixed to the vessels by some tarry substance. Among the more remarkable objects, in the official list are the following: 1. Remnants of a (cast) tripod, its three feet ending in claws, its ornamentation consisting of three hermetic figures of the small-bearded Bacchus. 2. A bill shaped crater about half a meter high, full of the most finished (chiefly erotic) ornamentations. 3–6. Four handsome cups, with inscriptions, having magnificent haut-reliefs inside, representing Minerva, full figure, sitting upon a rock, with ægis and helmet; the owl, and an olive crown at her sides; further, a bust of Kybele, with mural crown and tym pans; a Deus Lunus, with a Phrygian star-emblazoned cap, behind him a crescent; a bust of the boy Hercules strangling the two serpents, of rare artistic feeling and truth. 17–20. Three saucepans with ornamented and inscribed handles, 1 lb. 314·6 gr. 38–40. Three bell-shaped cups, with handles and feet. The reliefs upon these are spoken of, both as regards composi tion and execution, as simply perfect.

The number of the figures representing the masks of Pans, Titans, Satyrs, old and young, male and female, is perfectly astounding. 48. Cup, with feet and handles, on gold ground, with delicate relief in silver, thyrsus staves, fruit garlands, etc., etc. 49–54. Six feet of vessels with inscriptions such as L. MI. BOCHI. PI. XVI., etc., together with a number of minor objects, fragments, etc. The mere value of this *trouvaille*, at the price of old silver is estimated at far above the 3000 thalers which had been the first guess. Everything points to a concealment of this table service in the Augustan age, but the details have yet to be ascertained."

Immense Engines---Pittsburgh Working for St. Louis.

At the Fort Pitt Foundery, in this city, says the Pittsburgh *Evening Chronicle*, the engines, boilers, and castings for the new St. Louis water works are now in process of construction. The work was commenced in June last, and has been pushed on rapidly, but such is the amount of labor to be done, a half year yet may be required to finish the work. The engines are the largest ever made in this city, and it is stated that the bids ranged from $350,000 to $500,000, a number of Eastern firms being among the competitors. Two of the engines are low-surface, and the other two are high-surface, and all are low-pressure engines. By them the water for the city is to be thrown one hundred and fifty-five feet above the level of the river to the main reservoir. The two low surface engines are on what is called the Cornish style, directly connected without beams or fly wheels, and are used to throw the water from the river to the settling reservoir, and from these, the high-surface engines take it up to the distributing reservoir, from which it is distributed through the city. The high-surface engines have beams and fly wheels, and are made after a pattern similar to those used in other water works. Two of the engines are eighty-five inch cylinders, and ten inch stroke, and two are sixty-five inch cylinders and twelve foot stroke. The boilers will be about four hundred horse power. A large amount of heavy castings have been shipped to St. Louis, and the contractors have much more than kept up with the men at work on the reservoirs.

Bad for the Royal Astronomical Society.

The announcement has just been made to the Royal Astronomical Society of England of the discovery, by means of the spectroscope, of a hitherto unknown envelope of gaseous matter surrounding that body, of a thickness of seven or eight thousand miles. Its precise composition has not yet been determined, but will, probably, before long be ascertained. At the same time, Mr. Huggins, who has made so many important discoveries in reference to the composition of the heavenly bodies, by means of the spectroscope, presented a communication, stating that at least one comet contains carbon in a state of ignition.—*Sun*.

We were aware that gas in considerable volume was occasionally given off at meetings of scientific(?) societies, but we had no idea of its amount. A thickness of seven or eight thousand miles, we think, would swamp even the Royal Astronomical Society of England. A halo of twice that thickness, however, could not add to the glory of our scientific societies, or detract from their effulgence. Possibly, however, the sun is referred to. If so, we should be sorry that the *Sun*, that "shines for all," should suffer the fate of any astronomical society, whether royal or common.

NEW METALLIC THERMOMETER.—Mr. John Browning recently exhibited a new metallic self-registering thermometer, made for the Astronomer Royal. It consists of a long compound metallic bar, which acts upon two indicators of aluminum about six inches long. The latter move over two dials, one of which registers the maximum, the other the minimum temperature·

WEST SPRUCE ST. BAPTIST CHURCH, PHILADELPHIA.

We give herewith a view, plan, and description of the new Venetian-Gothic Baptist church, now building at the northwest corner of Broad and Spruce streets, Philadelphia, extracted from "Sloan's Architectural Review and Builders' Journal," published by Claxton, Remsen, & Haffelfinger, 819 and 821 Market street of the same city. We consider it a most beautiful and chaste design.

In this edifice the architect says, in effect, "he has not confined himself to the rules of any particular period, or the special development of the style in any region;" but the church has been designed "in the spirit of early Gothic," with a tendency toward the Venetian, the latter evinced mainly in the use of different kinds and colors of stone in the exterior walls.

The walls are of stone, that used for the facing being serpentine, from Chester county, Pennsylvania, with Ohio "Clough" stone dressings.

The church will have a high-pitched open-timbered roof, slated, and finished with an ornamental iron cresting, as can be seen in our illustration.

The plan is cruciform, consisting of a nave and transepts, with aisles; and a tower and spire. The nave is parallel to Broad street, and the full length of the lot, 120 feet. The width of the church at the transept is 70 feet.

The principal entrance is through the tower, which stands on the Broad street side of the church, and, in connection with the transept gable, will make that the principal façade; although the fronts on each street are to be equally well finished.

The plan is somewhat unusual, in having the lecture-room and Sunday-school in front of the audience-room, instead of behind it; and in substituting for the usual partition an ornamental screen of plate glass framed in carved tracery of black walnut, which can be opened and closed at pleasure; so that the church, lecture-room, and school can be thrown into one grand auditorium, or be used separately.

The most striking feature of the interior, however, will be the Baptistry, at the head of the nave, behind the pulpit, built of polished marble, and inclosed with a lofty tabernacle of carved walnut, having gates of wrought metal-work, richly illuminated.

Behind the Baptistry, will rise a chancel window, 19 feet broad, and over 36 feet high, enriched with stone tracery; and filled with stained glass, to be imported from the celebrated stained glass works at Munich, Germany. The leading subject of the painted glass will be the baptism of our Saviour in the river Jordan, by St. John. The other windows will also be filled with stained glass.

The organ will be placed in a gallery in one of the transepts.

The church has sittings on the main floor for over six hundred persons, and with the lecture-room, school, and galleries, about double that number.

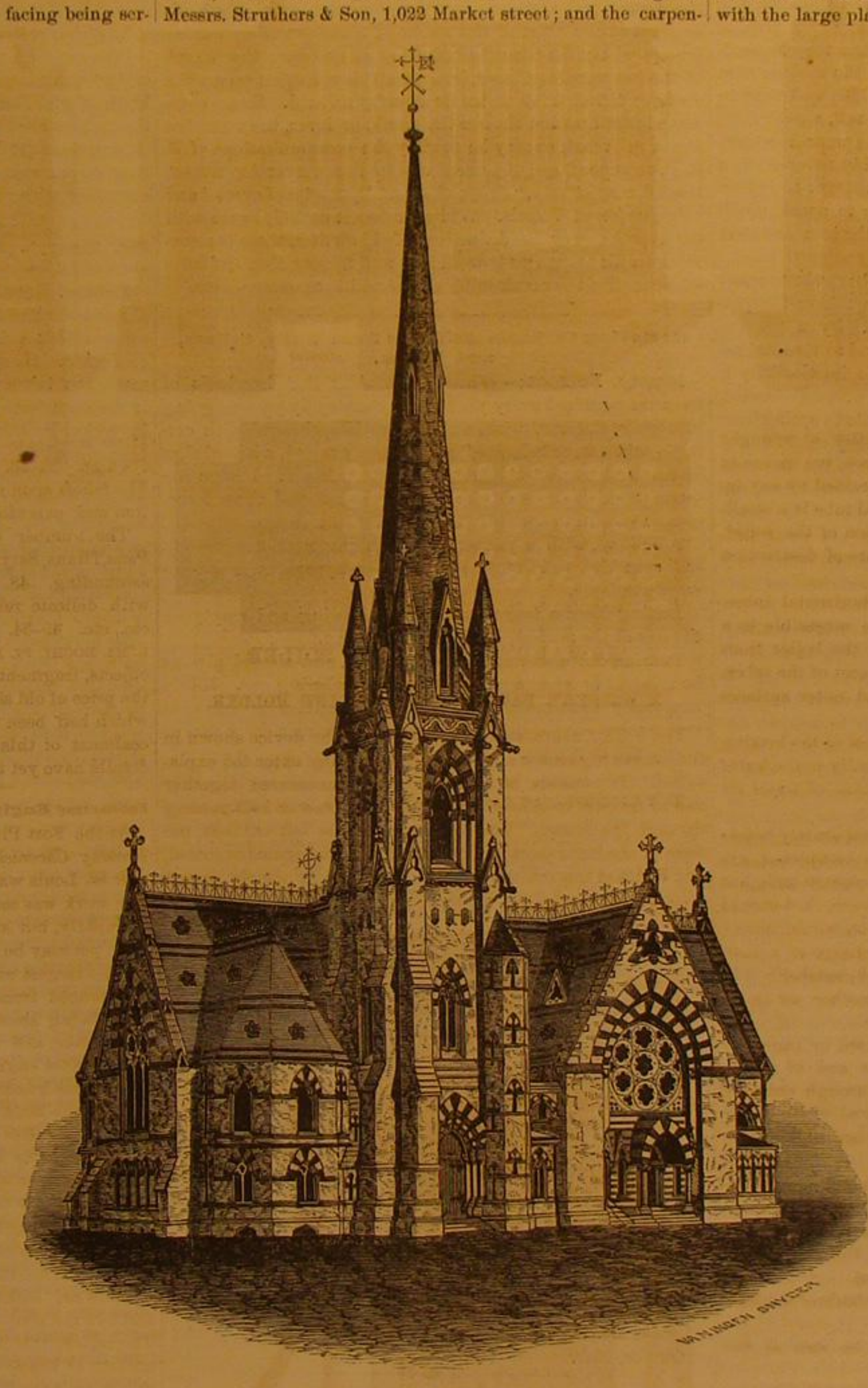
The tower measures 30 feet at the base, across the buttresses; will be finished with crocketed gablets in its four faces; and have angle turrets, enriched with carvings. It will be surmounted by a spire banded with color, its upper portion enriched with crockets. The highest point will be somewhat over two hundred feet from the pavement. A turret staircase is carried up at one angle, and finished with an arcade having polished granite shaftlets surmounted by a stone coping. The belfry arches will be left open. Above the belfry is a clock chamber.

The lower entrance will be enriched with four shafts of polished granite, red and black, placed alternately. Their daffodils of spring, the bending grain of summer, the fruits of autumn, and the ice-laden branches of winter. Above their foliage, this text: "While the earth remaineth, seed time and harvest, and cold and heat, and summer and winter, and day and night, shall not cease."

The exterior of various points is enriched with carvings, all different, but all appropriate. Those, for example, on the transept gable, facing the east, though like the rest, in themselves different, are all identical in their symbolism. Beneath a cross, which finishes the apex of this gable, is carved, enriched with foliage, the words, "Agnus Dei;" and following them, at intervals, similarly carved, the words, "Lux," "Dux," "Lex," "Rex," "Alpha" and "Omega;" and, below, the text, "Blessed are all they that trust in Him;" while around the great arch, spanning the porch and rose window above it are seen carved the rose, the lily, the wheat, the vine, the lion, the crown, and the star, symbols which need no translation to those who know the blessings of a trust in him, who is "The Lamb of God," "The Light of the World," "Our Leader," "Our King," "The Alpha and the Omega," "The Rose of Sharon," and "The Lily of the Valley," "The Bread of Life," "The True Vine," "The Lion of the tribe of Judah," "The Crown of Glory," and "The Bright and Morning Star."

Below the window, a band of foliage is carried across the archway, and bears the text, "He shall feed his flock like a shepherd." Below it again, on each side of the porch, are carved, on gablets bearing the symbols of the four Evangelists, the words, "We are his Witnesses;" while the porch itself, adorned with polished pillars of porphyry, whose capitals are carved with olives and palm branches, shelters, under the overhanging arch of its door, a group in relief—a "Christus Consolator," and the inclosing text, "Come unto me, all ye that labor and are heavy laden; and I will give you rest."

The architect of this noble structure, which is destined to form one of the most attractive ornaments of the Quaker City, and an important addition to the Church Architecture of this country, which has of late been greatly enriched in design and finish, is Mr. Edward Tuckerman Potter, 56 Wall street, New York. The stone work is under the charge of Messrs. Struthers & Son, 1,022 Market street; and the carpenter work in the hands of Mr. Catanach, 1,345 Lombard street, all of Philadelphia.



WEST SPRUCE STREET BAPTIST CHURCH.

A New and Cheap Form of Constant Battery.

M. J. Ney has recently communicated to the Paris Academy the description of a new and cheap form of constant battery, which it it should prove as constant as the author asserts, will be hailed as a valuable acquisition by all electricians, but more especially by those who devote themselves to electro-gilding or other forms of galvanoplasty.

To these, according to M. Ney, the new element which he proposes will prove perfectly constant, of a simple and cheap construction, and exempt from all perturbation. It consists, first, of a vessel filled with a solution of sal-ammoniac, in which plunges a plate of amalgamated zinc; second, of a porous vessel filled with native carbonate of copper (malachite or azurite), in which plunges a plate of copper.

To maintain the power of this battery it is sufficient to add from time to time a few crystals of sal-ammoniac. When the battery is to be used for telegraphy in the country or on a field of battle, etc., its transport may be facilitated by substituting, for the solution of hydrochlorate of ammonia, sand which is saturated with a solution of this salt. As long as the circuit is open the carbonate of copper is not acted on by the solution of sal-ammoniac, but as soon as the circuit is closed, this salt appears to be decomposed into ammonia and hydrochloric acid, the latter flows to the zinc plate, the ammonia acts on the carbonate of copper, which becomes soluble and its reduction sets up a secondary current of the force of one of Daniell's elements.

Unginned Cotton for Manufacturers' Use.

An esteemed correspondent, Mr. S. D. Morgan, of Nashville, Tenn., calls our attention to a great advantage to be gained by the manufacturer of cotton goods in taking his cotton "in the seed," or before being ginned and tightly compressed in bales. By ginning his own cotton the manufacturer makes a great saving, not only in that of the weight of the baling and rope used in covering the bales, but almost as much in having his cotton in the very best possible condition for carding,and if his gin be of the right sort, he has no short cotton or "flyings." The ordinary plantation gin is made with comparatively small diametered saws, having a very rapid motion in order to do its work speedily—that being the chief desideratum with the large planter or those who gin for toll. This very rapid motion of the saws jerks the cotton off the seed, and consequently either cuts or breaks the fiber. A gin constructed for the manufacturer has very large saws, very fine teeth (as many as 14 to 15 to the inch of circumference). The saw with a slow and regular motion pulls each fiber out by the rootwithout breaking it in the least.

Refining Iron Without Puddling.

We recently noticed a new process on trial at Pittsburgh for making iron direct from the ore. The following additional particulars we clip from the Cleveland *Herald*.

"We referred a day or two ago to the excitement produced among iron manufacturers by the great discovery of a means of dispensing with puddling, now in practical operation at the Shoenberger Junta Works, in Pittsburgh. On inquiry of Morrison Foster, Esq., of this city, the agent of the company, he explains that the process consists simply in combining, mechanically, oxides of iron with melted crude metal. If the mixture is thoroughly effected,the result is instantly a malleable iron superior to the best puddled balls. It is then only necessary to heat it as blooms are heated, and put it through the machinery, to produce the best quality of horse-shoe bars from materials which, if puddled,would yield only common iron, and at much less cost than puddled iron. The method employed at the Shoenberger Works is to take the melted metal direct from the blast furnace (they have two large stacks) and run into a large kettle of a capacity of five tuns. From thence it is poured, in a stream about a foot wide, into a circular trough twelve inches wide and ten inches deep, revolving on a radius of seven feet, or fourteen feet diameter. Pulverized iron ore, Lake Superior, Champlain, or Iron Mountain,is used as the converting agent. The ore descends from a hopper into the revolving trough, and covers the melted metal as fast as it is poured in. The continuous revolutions of the trough produce alternate thin layers of hot metal and raw ore, and effect the combination in a very satisfactory manner. The machinery which accomplishes this is moved by steam and hydraulic power, and is so well planned that one man, standing with hishand on valve-levers, can manage the whole operation. When the trough is full, and before the iron cools, it is broken up into slabs of suitable size for the heating furnace."

Narrow Gage Railway.

In constructing a new local railway between Manchester and Didsbury in Great Britain, a gage of three and one-half feet is proposed, as answering all the requirements of the line as well as the usual four feet eight and one-half inches width, and costing, with the rolling stock, one-third less. Railways of this guage, it is said, have been adopted in Queensland, Ceylon, Belgium, and Norway, with satisfactory results. The locomotives to be used will weigh fifteen tuns, and their speed be limited to twenty-five miles per hour. The carriages will be like our street cars, twenty feet long, six feet wide and six and one-half feet high inside, and will accommodate twelve passengers on each side, giving over thirty cubic feet of space to each.

Hoosac Tunnel.—The contract for the more speedy completion of this great work has at last been closed. The contract stipulated that one million of the five millions dollars to be paid for the work is to be withheld until its completion, and required bonds to the extent of a half million of dollars. The latter clause has been modified however so as to require the contractors to perform work to the extent of half a million dollars before they receive any payment thereon.

Keene, N. H., is going into the business of quarrying and sawing marble.

Correspondence.

The Editors are not responsible for the Opinions expressed by their Correspondents.

Combination Rail.

Messrs. Editors:—Permit me to offer a suggestion in your columns on the subject of wooden railways. I believe a track may be laid for locomotives as superior to iron rails as the Nicolson pavement is superior to cobble stones. What the world wants is not only a safe, but a noiseless road. For the one, the strength of iron is needed; for the other, wood possesses peculiar advantages. My suggestion is to combine them, and this is the plan: Construct the roadway in all respects as now, but let the rail be made as follows:

This represents an end view or cross action of the combination rail; A being of wood and B of iron, of whatever dimensions may be needed for security. It is obvious that a tough wooden rail of say six inches in width and four in depth, supported on three sides by an iron rail, would form an elastic medium for car wheels, while the wear from friction, distributed over a larger surface, would be reduced. The elasticity might be further increased by a layer of rubber under the wood, and this would take up, so to speak, much of that jar and concussion which so weaken the iron and steel rails.

But the question at once occurs, Can wood be made to stand the pressure of a moving train of cars? Just here the progress of chemical science comes to our aid. By a process, familiar to your readers, wood is now prepared so that its texture is nearly as tough as that of iron, while its elasticity is not greatly, if at all impaired. Wooden rails, properly treated, would be impervious to water, and so not liable to spring from exposure to the weather, while in durability they would doubtless exceed that of iron, making due allowance for the comparative cost. The plan contemplates a permanent iron rail of the form shown, which need not be renewed for many years. The wood may be replaced as fast as worn out with great facility, being bolted or secured to the rail below with countersunk heads. It should project at least half an inch above the iron.

Such a rail, it seems to me, would secure the highest safety, since if the iron breaks short off (and the liability to such an accident would be greatly reduced by the wooden bearing) the latter affords a bridge across the fracture; while if the wood fails from any cause, the iron flanges remain to support the wheels. But the desideratum of a noiseless track is to be especially urged on behalf of the traveling public, and to obtain this no substance seems so well adapted as wood.

If railways can be constructed of wood alone for light locomotives at low speed (as proposed in a late No. of the Scientific American), why not of wood and iron for heavy trains at high speed? Yours respectfully, F. H. Webb.

Hudson, N. Y.

"One More Unfortunate"---The Crank and its Improvers.

Messrs. Editors.—Suppose a steam engine of eight-inch bore, twenty-four inches stroke and eighty pounds pressure of steam (fifty square inches area) and one hundred revolutions per minute; what number of square inches of piston area will equal the power of this engine, under the same pressure, if applied the entire circle of the crank, with the same force that the piston has with the crank at the point of half stroke, at the same number of revolutions per minute? I propose to apply the steam of any boiler under any pressure to the circle of the crank and continue the same power six-sevenths of all the way around. Yours, just subscribed for the paper. J. W. H.

[Possibly the very last sentence in the foregoing communication is the excuse of the writer for his not singular but hardly creditable inquiry. If he had been a constant subscriber and reader of the Scientific American he would not have attempted to enter upon a path which has proved so unremunerative and unsatisfactory to others whose failures have been recorded in our columns. Our correspondent imagines a rotary engine, but a more perfect one than has yet been constructed. The steam—and its direction—must in his engine follow the progress of the crank and impinge on it, or its connections, with equal force at every point in its revolution. Does he not see that this cannot be done with the crank? And if the crank is discarded from the reciprocating engine he must employ a device to take its place. What is this device?

If he retains the crank and proposes to apply the same pressure to it that it has when on the point of half stroke, *ergo* to transmit the same power through the whole revolution, or six-sevenths as he says, must not his boiler revolve with the crank, or the cylinder with reciprocating piston, and, necessarily the crank be discarded? Obviously; then his idea is to substitute for the reciprocating engine a rotary one. When he succeeds in constructing an engine of this character that works as economically and perfectly as the ordinary steam engine we shall take pleasure in giving it a very favorable notice in our columns.

In our experience as a practical engineer and our observations as mechanical editor of this paper we have seen a number of attempts to supersede the reciprocating engine and the crank. We cannot recall one that was economically successful. The best effort we ever witnessed was that of the then superintendent of Woodruff and Beach's establishment in Hartford, Conn., an engineer of recognised and undoubted ability, who built a rotary engine of elegant form and smooth action. It was employed, for a time, to drive the large machine shop of the concern while the other machine, an engine of forty H. P. was being repaired, It performed the work admirably, but used more steam and consequently fuel than the old style reciprocating engine. Undoubtedly there are cases where a good rotary would be preferable to a reciprocating or stroke engine, as where room for the engine is scant and fuel is cheap.

As to superseding the crank we do not believe it has yet been done, and, contrary to the ideas of some good engineers, we do not believe it will be done. The "loss of power in the use of the crank" which is so much talked about, we do not believe exists. We conceive it to be as much of a bugbear and having as little foundation in fact, as the fears of engineers when locomotives were first introduced that the wheels would not sufficiently grip the rails to induce propulsion. This imaginary difficulty—wholly imaginary—occasioned much study, trouble, and experiment which was useless so far as directed to the removal of a difficulty that never existed. The pressure of the steam on the piston—and consequently on the crank—is as great at one point of the stroke of a reciprocating engine (except where the steam is cut off) as at another; the length of the leverage is reduced, but when this reduction occurs the distance traveled by piston is equally reduced. Some engineers insist that the shorter the crank, or lever, the more the power delivered, as may be seen by the communications of F. R. P. on pages 2 and 44 present volume Scientific American, headed, respectively, "Propulsion and Dynamical Levers" and "Propulsion of Vessels." While we do not entirely agree with the hypotheses or the deductions of this writer, there is something in his argument it would be well for our Don Quixotes who conceive the crank to be a windmill to consider.—Eds.

Removing Carbonic Acid Gas from Wells, Cellars, and Wines.

Messrs. Editors:—When we consider that hundreds of lives are sacrificed every year in our country by persons going into wells, cisterns, wine, and beer cellars, charged with carbonic acid gas, or "damps," as commonly called, a knowledge of the best remedies should be well diffused. I have frequently had to descend into such wells, and find three remedies successful in speedily freeing them of this gas.

A bellows, with a rubber hose reaching near the bottom, will soon blow out the gas; but such an apparatus is not always available.

Letting down a large bucket, and drawing and emptying the gas at the surface, is the next best plan.

Pouring down water is a good remedy, and should always be resorted to when a person falls from inhaling gas. Life is frequently thus saved. Burning combustibles is not only tedious, but creates litter and smoke that remain for hours to annoy the workman.

Two men spent one day in "burning" out a well, from which I removed the gas afterward in one hour by pumping up water, and allowing it to fall in a spray to the bottom again. This well was filled with gas from within ten inches of the top down forty-four feet. Wine and beer cellars should be constructed in a porous soil, or have a drain at the bottom for the gas to run down. Where the drain is impracticable, a blower should be arranged. Never enter a well until a lighted lantern has been sent down; and if it is extinguished, the well is unsafe—no one could live in it. This gas accumulates in cavities in the earth, and being much heavier than air, finds its way through crevices into wells. I knew one case where the gas poured down upon two men, some twenty feet below where it forced its way into the well being dug, and killed the men almost instantly.

Pure air is of much more importance to our well being than we as a mass fully realize. The laundry frequently causes sickness, by contaminating the air we breathe with the filth of clothing being cleansed, especially such as is charged with the excrements of children and the sick. Carbolic acid is a cheap and perfect remedy. A few drops placed in a tub full of the most filthy clothing, will destroy all smell, without rendering any injury to clothing. For disinfecting vaults, etc., it is a sure remedy. Placed in a sick room, in a saucer of water, it prevents the spread of contagion. G.

Omaha, Neb.

Steam Power---From a Late London Paper.

Messrs. Editors:—I copy the following from *Niles Register*, of Dec. 9, 1815, under the above caption:

An important improvement has recently been made in the construction of steam engines (?) by which no more than one twentieth part of the coal consumed in an engine of 20-horse power or any other required power becomes necessary. The construction is as follows: A furnace holding about a peck of coals, is made movable into a large iron vessel and has a flange, which, when introduced into the vessel closes the opening in that part; in an instant the air is rarified, the expanded air passes through a pipe and presses upon the piston of a pump, and produces in this a motion of about four feet; the rod of the piston then becomes the moving power of the furnace backwards and forwards; and this is effected about sixty times in a minute. Suppose the air to be rarified about three times, there will then be an excess of two atmospheres equal to the pressure of 30 lbs. to the square inch. The expansion being uniform, there is no danger from explosion; the construction being simple, the expense is comparatively small.

I don't wish to criticise the mechanical difficulties in the above, but copy it to show that there is "nothing new under the sun"—that the caloric engine or at least its principle is old. Yet I submit that there are to-day many supposed inventions which are patented that are far more absurd and impracticable than that. F. W. B.

Good Agricultural Machinery.

Messrs. Editors:—In your issue of December 16th, I noticed an article headed "Poor Mechanical Work on Agricultural Machinery" which I think does great injustice to a large class of manufacturers in this country. For while there may be some manufacturers who roughly turn their shafts and do not bore the boxes of their machines, I know from personal knowledge that a great many take the utmost pains to turn their shafts round and smooth, many using the standard gages for all their work, and the very best material the market affords. I now have charge of a reaper and mower establishment and such is the precision of work that our machines can be taken apart and the pieces piled up indiscriminately and machines afterward assembled, like a Springfield musket, from the pile.

What do you say to cut gearing, turned bolts, bored boxes, the boxes fitted with the same care as brasses in an engine connecting rod. I can show you an establisment, building thousands of reapers in this style annually, and can assure you that some if not all our implement makers are building something which deserves the name of machine because of the workmanship displayed in its construction alone. I hope you will correct the error into which you have evidently fallen. Fulton.

Lewisburg, Pa.

[We are glad to hear of an establishment where such excellent work is put upon agricultural machines. We already knew of such, but if some of the specimens we have seen in the market are to be considered examples of agricultural machines, we must dissent from the conviction of "Fulton" that most of our agricultural implement makers are equally conscientious with those of his acquaintance.—Eds.

Mr. Emery's Papers on the Best Mode of Testing Steam Engines.

Messrs. Editors:—I have read this series of papers with a great deal of interest. But I wish to take exceptions to some of his points, particularly so far as the indicator is concerned. He speaks of, and indorses the Richards' instrument, but takes pains to inform us that the instrument used in the experiments was one of the best of that kind, and made by Elliott Brothers, of London. The instrument might have been a good one, and well adjusted, but I have not found it infallible. Within a few months a professional engineer of my acquaintance, being in London, had an instrument made to order by the Messrs. Elliott Brothers, and he supposed he had got a first-class instrument in every way. Being in the way of using the instrument myself, I examined it critically, with a view that if I found it superior to the American to order a pair for my own use.

In the general construction I found nothing wrong, but on putting a paper on the cylinder, making the atmospheric line, then that perpendicular to it, I found it not at right angles at the base by about one sixteenth of an inch in three inches; and this instrument was made to order for a professional engineer by the Messrs. Elliott Brothers, of London, and was new, and never had been used. I then subjected an American made instrument to the same test, that had been used, and found it practically correct in that respect.

While we are on the subject of the instrument, I might as well mention that I saw an instrument used by the United States Steam Expansion Experimenters, one of Elliott Brother's, of London. This I did not prove by the above test, but I did make some other tests to find if it was in working order—if anything like correct results could be obtained from it. I found it exceedingly foul; if I raised or depressed the piston it would not come back to zero. It had evidently been oiled with an inferior oil that, to use an expression of the engine room, "gummed." If this was the veritable Elliott instrument, the discrepancies and want of confidence in the instrument, discovered by the experimenters, are easily accounted for. That it might be "tardy" in its movements, I readily grant, and that the increase of speed, as a matter of course, would show by its tardiness.

Mr. Emery makes the broad assertion that the indicator is defective, inasmuch as it "takes no account of the friction of the engine." If I did not personally know that Mr. Emery had had practical experience as an engineer, I should say that he had never seen an indicator, nor knew anything about it. It is true, in a subsequent article, he makes a show of qualifing the above point, but sadly fails to satisfy any one. 'Tis true also, that as you increase resistance, and the consequent increment of power applied to the engine, the friction increases; this the veriest tryo in engineering knows, and also knows that the indicator does "take account of it"—every part of it—and represents it in the diagram. True, it does not separately from the resistance of the machinery, for the best reason in the world, because the friction is incident to, and a part of that resistance. F. W. Bacon.

New York city.

The New French Gaslight.

Messrs. Editors:—In your last number of the Scientific American, under the title of "The New French Gaslight," I read an account of the experiments of Ball, Black & Co.

You commit therein an error in stating that the lights are those of the Bourbouze process. In my capacity as representative of the technical part of the invention of the system which has been put in use, I wish to correct you and to call your attention to this important fact. The light which you have seen for a few days past at Ball, Black & Co.'s, is produced according to the process of Tessie du Motay and Marechal, that is to say, it is the Drummond light rendered practical by means of an economical process of making oxygen gas and the use of appropriate burners.

It is owing to the desire of Professor Doremus that the firm allowed the experiment for the purpose of testing the value of the light. E. Schwartzweber.

117 East 23d street, New York city.

It is announced that a German chemist has discovered a method of converting wood spirit into spirit of wine. The details are not yet made public, but the discovery if really made is an important one.

BUREAU OF NAVAL ENGINEERING---SOME HARD FACTS.

Hon. W. D. Kelley, from the Committee on Naval Affairs, reported a bill, which passed the House, providing that the position of Chief of the Bureau of Steam Engineering of the Navy may hereafter be filled by a civilian; in other words, that the selection shall not be confined to naval engineers. Judge Kelley enforced the measure by stating that there was no branch of science in which more progress has been made within the last quarter of a century than that of engineering. The science of engineering, and the tools and appliances used by engineers or in the construction of steam engines, have probably improved more rapidly than any other department of science or the useful arts. The engineer corps of the navy is necessarily a small one. The number of chief engineers is but fifty-two. There are many men of mark in that corps, but the field of their operations is circumscribed. There is a much wider field for the development of engineering skill and judgment in the general civil service of the country, in the development of our mechanical and material resources, and in the wide field of the steam commercial marine. The committee believe that the Government should have access, in selecting an engineer-in-chief, to this wider field of experience and study than the navy, with its formulas, and, to use a popular phrase, red tape affords. It is not believed by the Naval Committee that our navy exhibits the highest character of engineering. Reports come to us from line officers on every station, and other observers, that our vessels move by steam alone, while those of other nations, with more adequate steam apparatus, resort to their sails while cruising on stations, and thus save the fuel ours consume, and the wear and tear of machinery they are undergoing. Line officers report to us from every station that our vessels, when they move impelled by our style of engines, move only to look at the sterns of competing vessels—even of those of the little South American States which have navies.

We have a ship said to be the fleetest on the ocean—the Wampanoag—but which cannot carry her own fuel for a month, together with food for the competent number of officers and men for the same time. So much of her room is taken up by engines, coal bunkers, fire room, &c., that the officers in command of what is boasted of as the fleetest ship in the world are compelled to occupy quarters less commodious than are allowed on ordinary merchant ships moved by steam. It is possible that in selecting some future Stephenson or Ericsson an additional office may be created; but if he shall give us a navy which, when on stations, doing merely watch duty, can move as the ships of other navies do, under sail—which, when merely making formal cruises, can, as other vessels do, move under sail—you will find that he will save each day to the treasury of the country more than the annual salary of the engineer-in-chief of the navy.

Judge Kelley charged that within the last two years our engineer corps have been buying out old machine shops and converting the machine shops of our navy yards into old junk shops; that at the Philadelphia navy yard, under the shadow of the shops of the most celebrated tool makers in the country, they have purchased, within eighteen months, tools that were superannuated twenty years ago; that they have bought tools such as cannot be found in any modern workshops in the United States or Europe; that they have paid $20,000 for three superannuated or worn-out tools which any practical engineer in the country would swear would not be worth in a machine shop the space they occupy, if the proprietors had the means of buying adequate tools; that they have paid for the scrap iron, which still retains the general form of machines, more money than would have bought new tools in Philadelphia, Newark, Providence, Worcester, or at any other point in the country at which tools for the manufacture of steam enginery are made; that if members would go to the navy yard at Portsmouth they will find there, boxed up under sheds, for which the Government has no use, and which, though bought more than eighteen months ago, have not been set up, old tools bought from an engine manufactory which was being abandoned, not because the proprietor was giving up the business, but because he had bought a new shop, and it was better for him to sell his old tools to the engineer department of the United States Navy than to remove them to his new shop near by the old one. For the Philadelphia yard they have bought a planer after eleven years' use, part of the time in Philadelphia, part in St. Louis, and part in New York, where it was bought for $6,600, when they could have bought a new one of the manufacturers of such tools for $6,000. So, eleven years of use, transportation about the country, and repairing damage, made that old tool worth to the engineers of the navy ten per cent more than a first-class new tool fresh from the shop of its makers or their rivals in business.

Such is the substance of the pointed speech made by Judge Kelley in support of the proposition of the Naval Committee. Had it been carried out at the beginning of the war, millions might have been saved to the country. Let us now lock up the barn, even though the horse may have been stolen.

THE HEATON-BESSEMER CORRESPONDENCE.

Messrs. Bessemer and Heaton are carrying on a lively correspondence in the various English scientific papers in regard to the relative merits of the processes which bear their names. Even the London *Times* has opened its columns to this correspondence, which is becoming rather spicy. Mr. Bessemer charges that the so-called steel manufactured by the Heaton process is not steel at all. He says:

In the Heaton process nitrate of soda mixed with sand is employed to genetrate the necessary amount of oxygen gas for decarburizing the pig iron, instead of employing the cheap gaseous oxygen of the atmosphere. Now, whenever solid substances are converted into gas, a vast amount of heat is absorbed and rendered latent; hence in the Heaton process so much heat is abstracted from the metal in generating oxygen gas by the decomposition of nitrate of soda that the metal solidifies while in a state of mechanical admixture with the sand and soda, and thus, instead of obtaining fluid cast steel by his process, Mr. Heaton obtains only a lump of spongy, porous metal, intermixed throughout with slags and scoria, and having the general characteristics and properties of ordinary puddled iron or puddled steel, but which is only obtained at a cost (for nitrate of soda) of more than double that of the ordinary puddling process.

The crude lump of metal obtained by the nitrate process may be hammered and rolled into bars, and be used as ordinary puddled iron or puddled steel, materials which, from their nature and physical properties, are entirely distinct from, and can never compete with cast steel. It is true that, in common with puddled iron of every description, Mr. Heaton's crude metal may be made into cast steel by resorting to the old and costly Sheffield process of melting in crucibles, a process which consumes about 3 1-2 tuns of coke for every tun of metal so melted, and with the additional cost of wages, crucibles, etc., this melting process alone costs from £5 to £6 per tun. Hence, although Mr. Heaton starts with a cheap pig iron, giving him an advantage of 20s. to 30s. per tun over the cost of the Bessemer raw material, he nevertheless employs for the conversion of one tun of pig iron (according to Dr. Millar's report) no less than 270 lbs. of nitrate of soda, which, at the present market price of 15s. per cwt., is equal to 36s. on the tun of crude iron, thus bringing up the cost of the materials employed in making one tun of crude steel by the Heaton process several shillings per tun above the cost of the high-class iron used in the Bessemer process; and when we add to the cost of the Heaton crude steel the additional cost of £5 to £6 per tun for melting, I think it will become as clear to the general public as it has long been to all practical steel makers, that the Heaton process can in no way compete with the cast steel at present in the market, either in price or quality.

To whom Mr. Heaton makes answer substantially, that the plant of his process costs next to nothing compared with that of Mr. Bessemer; that the whole of Mr. Bessemer's statement are unsustained by facts or theory; that steel made by his process can be melted in a Siemens' or other furnace, and run into ingots as good as any Bessemer steel; and very much cheaper, which he claims is what hurts Mr. Bessemer; in proof of which statements he refers to a certified cost sheet, and puts in a final shot by inviting Mr. Bessemer to call at the works where the Heaton process is now in operation and witness the tests applied to the products of the Heaton process.

The ironmasters on both sides the Atlantic will read this correspondence with interest, and await further developments before forming judgment upon the case.

MANUFACTURING, MINING, AND RAILROAD ITEMS.

The editor of the Chicago *Railway Review* says: "We had occasion to pass over the Michigan Central Railroad during the recent storms, which caused so much delay on many roads. The trains were of course behind time; but, in grateful contrast to the condition of passengers in the pre-Pullman-hotel-car-age, where one ran imminent risk of doubly dying—by cold and starvation—we found everybody in common with ourselves, patient over a delay in which the elements alone (and not man) were hostile. In goes far to reconcile one, to even so serious a matter as delay in business and failure to make connections, to find one's breakfast necessities provided for as if he were at home. In fact the experience of being 'snowed in" is no longer without its romantic, not to say pleasant, aspects.

A correspondent of the Chicago *Times*, on the Union Pacific road, devotes a paragraph to the coal deposits in the vicinity of Carbon, six hundred and fifty three miles west of Omaha. He describes the surface as black with the outcrops of the immense beds. At Carbon a bed sixteen feet in thickness is being worked, several tunnels having been run into the side of the hill, and from one to two hundred tuns are daily taken therefrom. The coal is of excellent quality, and well adapted for use on locomotives.

It is reported that the British Government proposes to give some reward of honor to Major Palliser, whose inventions, particularly his chilled shot, have been and are productive of enormous saving to the country, while they add greatly to the efficiency of its armaments.

One of the silver palace cars owned by the New York & New Haven Railroad Company, took fire on Dec. 29th, at the depot on Twenty-seventh street, New York city, and was nearly consumed. The fire originated, we understand, from the overheating of the apparatus for warming the car. This is the second silver palace car owned by the company that has been seriously damaged by fire. This company's machine shops, at New Haven, were also recently destroyed by fire; loss about $100,000.

Very extensive additions are being made to the celebrated Washburn & Moen Wire Works, at Worcester, Mass., consisting in part of a new building 500 feet long by 50 feet in width, and two 400-horse power engines. The present capacity of the works is thirty tuns per day which will be doubled when the present enlargement is completed.

Texas is growing a cotton that is reported superior for poor soil or uplands. It yields largely, and in strength is superior to the ordinary cotton.

The first day of December witnessed the laying of the first rail on the Rockford, Rock Island & St. Louis Railroad.

A company has been organized at Palmyra, Mo., to manufacture agricultural implements. Capital $100,000.

The cotton mills of South Carolina are thriving and many are being enlarged. The Sprague Manufacturing Company, of Providence, are also reported to have purchased tBe Columbia canal water power for the trifling sum of $300.

A manufactory of boot blacking in Pennsylvania turns out 25,000,000 boxes per year.

During the past season the Surveyor General in St. Croix Valley, Minn., is said to have sealed one hundred and twenty million logs.

Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; beside, as sometimes happens, we may prefer to address correspondents by mail.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at $1 00 a line, under the head of "Business and Personal."

☞ *All reference to back numbers should be by volume and page.*

D. and S., of Mich.—200 inches of water under four feet head is not theoretically or practically equal to 100 inches under sixteen feet head, either in quantity or in the power it will exert in driving machinery.

H. B. E., of———Compressed air can be used as the motive power for any form of steam engine in use, but the principle of condensation in low pressure engines can not obviously be applied to compressed air.

E. B. R., of N. Y.—The pressure of water upon the sides of a cistern or pipe containing it is directly as its hight. The diameter of the column has nothing to do with it.

D. U., of Ohio.—Soluble glass would we think not answer well for the coating of the insides of cider and wine casks. Although pure block tin faucets would not be likely to injure such liquids we think a good wooden faucet preferable to any metal one for such purposes.

W. H. T., of Wis.—The only preventive against the accumulation of frost upon windows that we can recommend, is the use of double glazed sashes. This gives a stratum of air between the inside and outside glass, a very bad conductor of heat, and prevents the congelation of moisture upon the inner panes.

J. A. B., of Conn., asks why the electricity generated by a swiftly running belt cannot be used to light the gas burners in a shop. He proposes a wire with projecting prongs placed, to gather the electric fluid, near the belt, and leading through the shop near each gas burner. The only difficulties he may meet are the want of sufficient energy in the initiatory spark and the cost and trouble of the connecting apparatus.

J. B., of Ohio, is a raiser of tobacco "for his own use" and finds it too strong for smoking. He asks how it may be made milder. We advise him to expose the leaf, moistened with water, to the sun's rays for a few days.

R. P. S., of Ohio.—"What is the best length for shot gun barrels; should the bore taper toward either end or be straight; how is percussion paste made?" The best length for the barrels of fowling pieces or rifles is not yet settled by sportsmen. Some insist on a length of 36 inches while others believe 18 inches to be ample. We incline to the opinion that as good an effect can be produced by a barrel of 18, or only 16 inches, as by one of greater length. The bore for shot guns should not taper. No advantage is gained by tapering either from muzzle to breech or *vice versa*. The fulminate used in persussion caps is made from mercury, nitric acid, and alcohol. Common starch or dextrine is used to give the crystals cohesiveness and form them into a paste, and a thin water proof varnish is used to defend the fulminate from moisture. We do not advise its preparation by one not possessing chemical knowledge. Ure's Dictionary gives the formula and details for its preparation.

C. B., of Iowa.—This correspondent sends us an article descriptive of a sketch intended to illustrate his idea of a velocipede. It is in short, a velocipede, or the propelling power, inside a wheel, the outside diameter of which he states to be about 6 feet 6 inches. The device is simply a circular horse power or treadmill, the operator propelling himself and his contrivance with hands and feet. It is hard to believe it will supersede the style now in use although C. B. says it "works."

J. W. D., of———All other things being equal, the size of the speculum in a reflecting telescope adds to its power, as it gives increased illumination and consequently admits of higher powers in the eye pieces. We think it would be extremely difficult to cast a speculum 12 feet in diameter, as the metal requires extreme care in cooling to prevent cracking, and also care in pouring and grinding. Such a speculum if made would be enormously expensive. The length of tube required would depend upon the focal distance to which the reflector was ground.

E. B., of N. Y.—There is no foundation for the assertion that a ship loaded with cotton will, all other things being equal, make quicker time than one loaded with iron.

J. H. M., of N. Y.—Varnished maps can be cleaned from fly specks by washing if their surfaces are not cracked. Freckles may be removed by the following recipe: Blanched bitter almonds 1 oz; blanched sweet almonds ½ oz; beat to a paste, add one pint of pure water, strain through a piece of coarse muslin and add powdered corrosive sublimate, 10 grains, dissolved in a little alcohol. Shake thoroughly before using and apply with a soft cloth, and wipe off gently. Corrosive sublimate is a poison when taken into the stomach, therefore don't get it on your lips.

J. C. D., of La.—The relative value of wood and bituminous coal may be stated thus: Bituminous coal 23·36°; Wood 17·36°. In common use, two cords of hard wood are considered to be equal in heat giving qualities to one tun of coal.

D. B., of Mass.—The article on "Green Color for Sweetmeats" is on page 146, Vol. XIX, of the Scientific American.

H. H. B., of Ohio.—The humming sounds of telegraph wires is due simply to their vibration by currents of air. They are, in fact, only modifications of the Æolian harp.

M. S. W., of Texas.—"Will not a steam boiler 30 inches diameter bear—all other things being equal—one fourth more pressure than one of 40 inches diameter?" Ans. Yes. "Also, is not the strain on the hoops of a cistern 10 feet diameter double that on those of one 5 feet diameter with the same depth of water?" Ans. No. See Silliman's Physics, page 155, paragraph 193, also reply in this column, current issue, to "E. B. R.," of N. Y.

G. H. S., of Mass.—Modeling wax for taking impressions of coins, medals, etc., may be made by melting shellac to which add when fused one-fourth by weight of Venice turpentine. It may be colored by any pigment to produce the shade desired. When used it should be melted and poured or pressed upon the object and removed when set or cooled.

E. P. L., of Ill.—"What size pulley should be placed on main shaft of engine making 150 revolutions per minute to drive a circular saw of 48 inches, its pulley being 24 inches diameter." A saw of 48 inches diameter should run about 500 revolutions per minute. To do this would require a pulley on the shaft that makes 150 revolutions per minute, of 6 feet 8 inches. If, however, the stock to be sawed is soft wood and clear, the pulley may be seven feet in diameter. Thus, assuming 500 revolutions for the saw—which is laid down by practical sawyers as correct—500 divided by 150, the revolutions of the driver, equals 3⅓. Multiplying by this the diameter of pulley on saw, or the driven pulley (24 inches) is 80 inches which equals 6 feet 8 inches, the size of driving pulley.

J. B., of Ind.—Other substances beside the diamond will scratch or cut glass. Some specimens of quartz and even very hard steel will scratch glass. The test is no satisfactory means of distinguishing between the diamond and fine specimens of quartz crystals.

Inventions Patented in England by Americans.

[Compiled from the "Journal of the Commissioners of Patents."]

PROVISIONAL PROTECTION FOR SIX MONTHS.

3,302.—Horse Collars.—Charles K. Marshall, New Orleans, La. October 28, 1868.

3,342.—Tortion Springs.—J. F. Holmes, New York city. November 3 1868.

3,355.—Apparatus for Inducing Motion in Mobile Substances by the Action of Air and Steam in Combination.—John T. Hancock, Boston Mass. November 23,

3,360.—Manufacture of Felted Fabrics and Wearing Apparel and other Articles from the same.—John Falconer, New York city. November 23, 1868.

3,573.—Atmospheric Hammers for Crushing Ores and other Purposes—H. W. Colver, Brooklyn, N. Y. November 21, 1868.

3,574.—Gearing for Multiplying Motion on a Single Shaft.—L. S Fithian, Brooklyn, N. Y. November 24, 1868.

3,584.—Machinery for Manufacturing Cigars.—R. A. Bright, Providence, R. I., and L. B. Stone, New York city. November 25, 1868.

3,586.—Sad-Irons, and the Means for Heating the same.—S. M. Johnson, Lockport, N. Y., and M. C. Turner and Robert Turner, New York city, November 25, 1868.

3,601.—Paddlewheels for Steamships.—Charles Seymour, La Porte, Ind., and Washington and Fitch Raymond, both of Cleveland, Ohio. November 26, 1868.

3,610.—Harvesting Machines.—D. M. Osborne, Auburn, N. Y. November 26, 1868.

3,619.—Oil Cups or Lubricators for Machinery.—Henry L. Fearing, President of the New England Patent Oil Cup Company, Boston, Mass. November 27, 1868.

3,631.—Manufacture of Steel.—Thomas S. Blair, Pittsburg, Pa. November 28, 1868.

3,642.—Apparatus for Receiving and Delivering Mail Bags and Packages on Railways.—F. K. Sibley, Auburndale, and L. C. Wade, Newton Upper Falls, Mass. November 29, 1868.

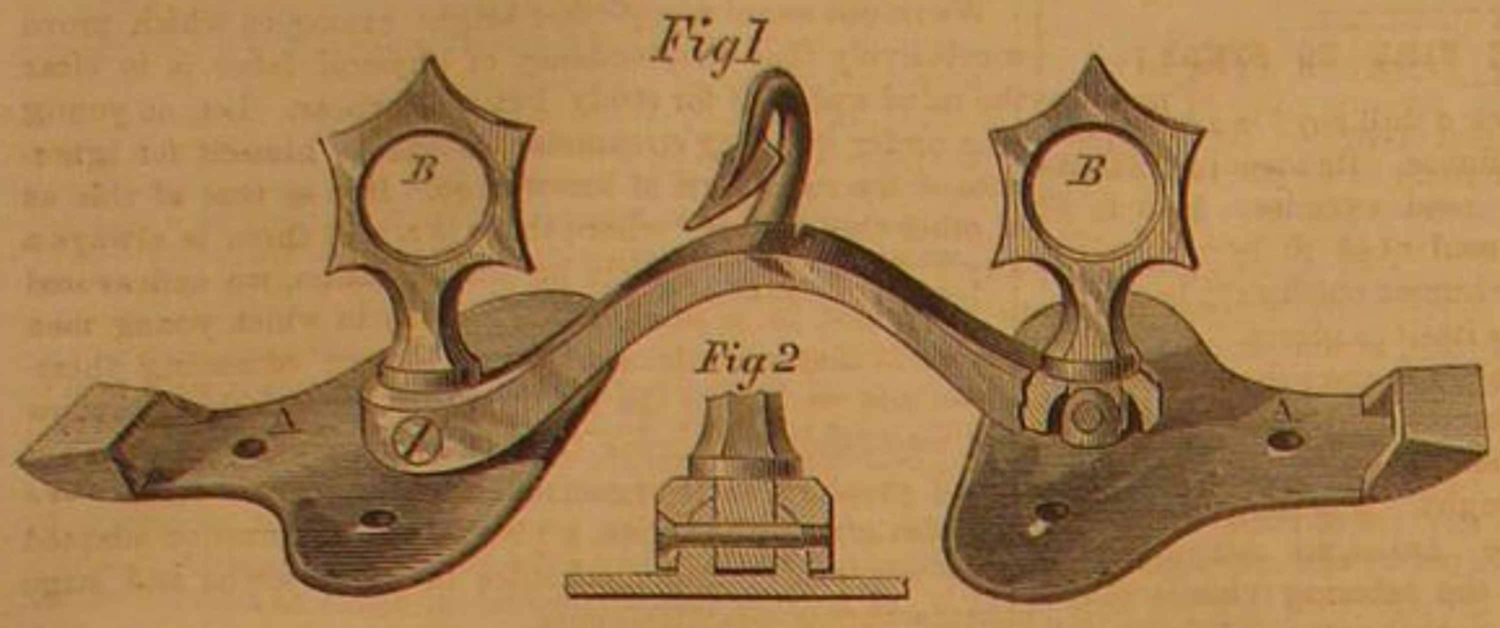
3,650.—Tuck Markers for Sewing Machines.—H. W. Fuller and Isaac W. Barnum, New York city. December 1, 1868.

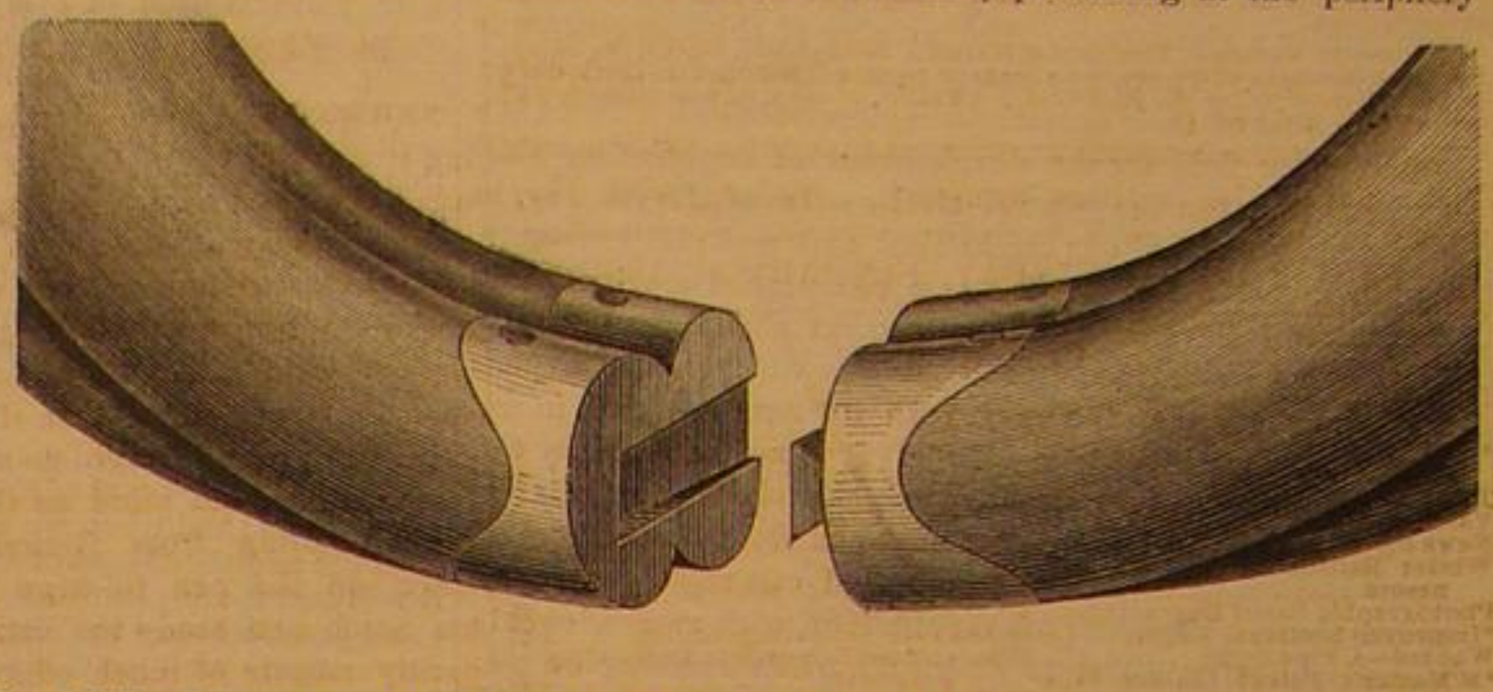
3,673.—Carriage and Locomotive Wheels.—D. P. Nickerson and W. S Streator, Cleveland, Ohio. December 7, 1868.

Improvement in Harness for Horses.

The first of the accompanying engravings represents a new style of horse collar which opens and fastens at the bottom. By its use the collar rim is not strained in removing it from the horse's neck, the collar is removed with the harness, and time and trouble saved. Beside this, the not merely an apparent cruelty to the horse in removing or putting on the collar is avoided. It cannot be a pleasant operation to the horse to have his ears borne backward or jammed forward, and his head compressed while the collar is being forced on or pulled off. The head and neck of a horse is almost as tender and susceptible of pain or injury as those of a human being, a fact worthy consideration.

The ends of the collar under the neck are seated in metallic sockets; they being secured by screws, and the faces of the sockets having, one a dovetail, the other a suitable recess for its reception. The union is effected instantly by sliding the dovetail tenon into the corresponding recess and as easily removed. The construction and advantages of this device are sufficiently apparent without further detail.





SHARP AND SHANNON'S IMPROVED HORSE COLLAR AND PATENT HARNESS TREE AND PAD.

The harness tree and pad are shown in Figs. 1 and 2. The pads are of heart shape, giving a considerable bearing surface on the animal's back, and being elegant in appearance. They are of metal or wood, preferably of the former as combining strength and lightness, and are lined with any suitable material. The outer ends are formed with a square loop, through which the strap suspending the trace buckle is passed, its end secured by a rivet or screw at A, Fig. 1. The bridge, or tree, has sufficient arch to keep it from resting on the horse's spine, and has at its ends square mortises for the reception of the lugs of the pad and the tenons of the terrets, B. Both the pads and the terrets are secured to the tree by a single bolt or rivet, as seen in the section, Fig. 2. The Horse Collar patent bears date August 25, 1868. The Harness Pad was patented November 17, 1868. Both through the Scientific American Patent Agency.

The simplicity and advantages of this method of constructing these portions of harness appear to be sufficient to recommend them to all owners of horses. Further information may be obtained by addressing the patentees, W. A. Sharp or J. A. Shannon, Tama City, Tama Co., Iowa.

SUMMARY OF THE VELOCIPEDE.

The first patent on the velocipede of which we have any record, was as early as 1818, granted to W. Clarkson, Jr. The model was destroyed at the time of the burning of the Patent Office in 1836, and we have not been able to find his claim to learn the nature of the invention.

Velocipedes were in use in England it is said in the latter part of the last century, but were after the plan defined by Webster in Merriam's Unabridged Edition, which says:

VELOCIPEDE [*L. velox*, swift, and *pes*, foot], a carriage for one person, having two wheels placed one before the other, in the same line, and connected by a beam, on which the person sits astride, and propels the vehicle by striking the tips of the toes against the earth.

This style is still in use to some extent in Paris, and is claimed to be equal in many respects to the kinds now generally used, which are propelled by the foot and crank, or hand and lever. The old ones were more easily controlled, there is no doubt, but the degree of velocity cannot be attained from striking the toes against the ground that is acquired by the crank movement. A London paper, printed in 1822, has the following item:

A NEW VELOCIPEDE.

A man upon a new sort of velocipede attracted a number of people together at the Elephant and Castle, London, on Thursday, to witness his activity and the swiftness with which he travels. He is a shoemaker by trade, and finding the trade bad at Newark-on-Trent, in Nottinghamshire, of which place he is a native, he built this mechanical horse, as he terms it. It is on a different plan from the others. It is worked by two handles, which set two wheels in motion, and cause two levers in front to be put in motion, which set the machine going at the rate of at least six miles an hour. It is the completest machine of the kind that has as yet been invented. He has traveled in fine weather sixty miles a day. He has two iron stirrups in which he places his feet; they keep him steady on the saddle.

One of our largest carriage manufacturers in this city employs all his force in building velocipedes, and his orders vastly outnumber his ability to supply the demand.

In Paris there are not only manufactories of these new locomotives, but founderies where the iron work of which they are composed are cast. One of these employs two hundred and fifty workmen. They have become so common in the streets of that city that no person takes the trouble to stop and look at the riders. The novelty has passed away, and the little machines may be seen any hour trundling around with velocity in the most crowded streets, amid a network of omnibuses and carriages.

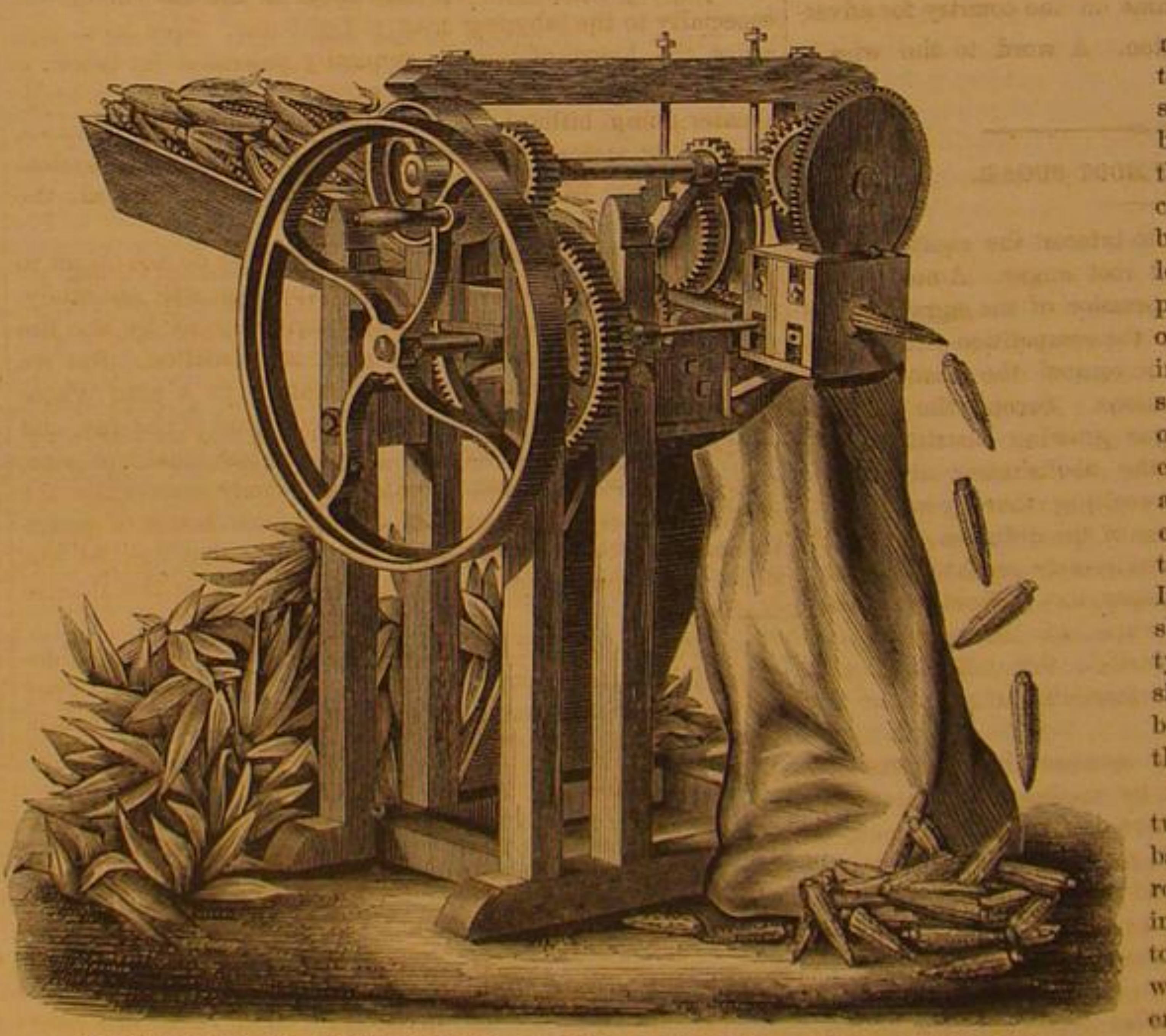
A Lyonese velocipedist is willing to make a bet for any amount that he can beat the fastest trotter in a race. Since our last article on this subject a velocipede for running on ice has been successfully tried on one of the Brooklyn park ponds.

With such skill as our inventors can bring to bear we expect to see a machine so constructed that it will answer the purpose requisite for land, ice, and river travel. These three conditions have been already overcome by different inventors, and patents are pending on some very ingenious contrivances, which have passed through this office on their way to the Patent Office.

But now what is wanted is a combination of the mechanism exhibited, in some of these several inventions, into one machine, so that a person may ride and cross rivers on ice, or by water, without dismounting. A great number of letters have been received at this office during the last few weeks on this subject. Some inquire the cost, others the name of manufacturers, and many wish to know the best machine. One gentleman writes as follows: "I am a physician, and would like to use a velocipede instead of a horse and buggy if it will answer, and not require too much labor to propel it. Please give the address of a reliable manufacturer of the article. Is there any self-propelling vehicle made that will be safe and not too costly?" etc.

Improvement in Machinery for Husking and Shelling Corn.

With all its advantages it must be confessed that labor saving machinery, especially when applied to the work of the farmer, is terribly destructive to the romance with which poets have invested the pursuit of the agriculturist. The hum and buzz of the threshing machine, however suggestive of unlimited plenty and profitable prosperity, does not bring up the associations recalled by the regular reverberations of the old fashioned flail. And the husking machine arouses regretful recollections of the merry husking frolics, at which the finder of a red ear of corn rivaled its glow with his blushes as he exacted the forfeit from his fair neighbor. But the sentimental has no place among the utilities—the inventor is an iconoclast.



DICKINSON'S COMBINED CORN HUSKER AND SHELLER.

The engraving presents a view of a very useful machine in which the operations of husking and shelling are successfully combined. It may be driven by hand or power, and can be used in the corn house or barn, or taken to the field and worked at one shock after another, a perambulating worker that does not require the material to be brought within reach of its iron arms. For this purpose the machine is constructed with broad tired wheels and drawn through the field by a team. In the barn it may be driven by horse power, as is the threshing machine.

It husks, shells, and bags the corn at one operation, requiring only the attention necessary to arrange the ears in the feed trough to present the small ends first. The husks fall from an incline to the ground, the cobs are dropped in front, and the kernels are deposited in a bag as shown.

Further information may be obtained by addressing the patentee D. A. Dickinson, at 127 South Paca street, Baltimore, Md.

EMERY WHEELS---HOW THEY SHOULD BE MADE.

Though an old appendage to the machine shop, still perhaps emery wheels are not so much used and appreciated as they would be if more attention were given to their construction. It has been customary and, for aught we know, now is, to make them of white pine boards glued up from circular pieces of the board, three, four, or more of them according to the thickness required, thereby presenting at the periphery the grain of the wood in all its positions; endwise, sidewise and in all the intermediate positions.

Now, it is well known that all the woods, particularly the soft woods, swell or shrink in seasoning very much more laterally than longitudinally of the grain, and of course if moisture is present the wood will swell more laterally than longitudinally, thus leaving hills and hollows over the surface of the wheel, constantly changing hill for hollow, hollow for hill.

It does not do to say, "then turn off the wheel and true it" inasmuch as every time you cover the wheel you wet with the liquid glue and expand it unequally; when we clean the wheel we have again to wet it and with the same results.

It would naturally be suggested, under these circumstances, to use metal for our wheels. This is found impracticable because the metal is too rigid—not sufficiently elastic—even when covered with thick leather.

The requirements, then, are a sufficient elasticity, and that the swelling and shrinking shall be uniform. This may be approximated by making the wheel of white pine wood cut in radial segments so as to bring the grain of the wood longitudinally as nearly as possible parallel to the surface of the wheel. For an eighteen inch wheel make it of eight segments which, when turned off, nicely balanced, and covered with thick sole leather, and that turned off at a moderate speed, will be true, elastic, and likely to remain so. It is important that the wood should be of the same density; the wheel should be, if possible, made up from the same board to insure equal elasticity throughout the whole surface.

Before the final finish in turning off it should be nicely balanced to insure its being round when finished. Covering the wheel should be left to the expert in using it, who will soon find the grade of emery suited to his work.

We have had some experience in polishing hardware, plane irons, chisels, compasses, calipers, etc., and have found for a finishing wheel (after a good fair surface has been obtained) the following mode to work well and rapidly, giving a good fair polish answering all the requirements for such tools. We gave the wheel a coat of say No. 60 emery taking care to have it even and smooth. Melt beeswax in a vessel, stir in flour of emery (keeping the mass warm in the meantime) until you make a paste as thick as you can. Now remove it from the heat, but still stir it so that the emery won't settle to the bottom.

When cold rub this on the wheel until a good coat is formed, then start up your wheel and apply a flint to it to smooth the surface and the wheel is ready for use. Should it be too harsh apply another coat of the composition and follow with the flint until the required fineness is acquired.

A wheel treated in this way will last for years by renewing the composition as required, being careful always to keep it perfectly balanced; without this the work will be wavy and the coating will wear off on the heavy side.

SENATOR MORTON, of Indianna, has introduced into the Senate the proposition forbidding the landing of any submarine cable in any part of the United States without the consent of Congress.

Scientific American.

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VOL. XX., No. 4....[NEW SERIES.]....*Twenty-fourth Year.*

NEW YORK, SATURDAY, JANUARY 23, 1869.

Contents:

(Illustrated articles are marked with an asterisk.)

WE are now printing 35,000 copies of the SCIENTIFIC AMERICAN, and subscriptions are rapidly flowing in, from Maine to California—from the Lakes to the Gulf. Our columns offer one of the very best mediums in the country for advertisers who value a large circulation. A word to the wise is sufficient.

AMERICAN BEET ROOT SUGAR.

Many causes are now at work to interest the capital of this country in the production of beet root sugar. Among these may be enumerated, first, the depression of the sugar trade of the West Indies consequent upon the competition of European beet root sugar, which threatens to compel the abandonment of the business on many plantations. Second, the changed condition of affairs in the sugar growing districts of the United States on account of the abolishment of slavery and the increased cost of labor resulting therefrom. Third, the recent introduction and success of the diffusion process in the East Indies, which renders it extremely probable that the same process will very much cheapen the production of beet root sugar. Fourth, the success which has been achieved by some establishments already devoted to this industry in this country, which demonstrates the feasibility of a further extension of the manufacture.

We have not yet learned the success which the Roberts diffusion process has met with in its application to beet root sugar extraction in Germany, where it is now undergoing a term of probation; but whether it succeeds or fails, we do not entertain a doubt that the beet, and not the cane, is to be the chief source of sugar supply for the future.

The beet has the advantages that it can be raised upon a very much more extended portion of the earth's surface; it can be worked for a long time after it is harvested, a very great advantage over the cane; and with labor at equal rates, it will yield a given weight of sugar of equal quality at a less cost than cane. These are facts capable of demonstration. Our attention was called to this subject at a time which presented much less favorable auspices than the present for the establishment of this industry in America, the period when the blight of civil war was resting upon the land. At that time we obtained from some gentlemen, one of whom had become familiar with the matter by long practical experience as superintendent of a beet root sugar manufactury in Europe, estimates of the cost, expenses, and probable profits of a similar establishment here, which we may at some future time after some changes to suit the altered condition of affairs lay before our readers.

Very few are aware of the enormous quantity of sugar used in this country, and the extremely small proportion grown here. The reports of the Commissioners of Agriculture show that the United States consume over one billion of pounds of sugar, and forty-five million gallons of molasses annually. Of this great total not one per cent is of home production, while every pound ought to be grown on our soil.

The fact has long been established that, owing to peculiarities of our soil and climate, beets grown in this country contain from one to two per cent more saccharine matter than those grown in Europe. In the manufacture of beet root sugar circumstances are all in our favor except the one item of labor, but as labor only represents about 34 per cent of the cost of production; the difference between its value in this country and in Europe is nearly counterbalanced by the cheapness of our lands and the increased product, so that without taking into account the tariff on sugar we could nearly compete with French and German producers.

The amount of revenue received by France from the sugar industry is greater than from any other one source. In this respect it is to France what the malt tax is to England. Now possessing advantages superior to France in every particular except cheap labor, it is we think impossible to show why this industry should not spring at once into healthy activity, if capitalists would open their eyes to the promise of profit it offers.

DO LABORING MEN HAVE TIME TO STUDY?

"All work and no play, makes Jack a dull boy" is a true saying if not a model of literary excellence. Its meaning is that mind and heart as well as muscle need exercise. Man is a complex being. Body, mind, and soul need to be mutually and harmoniously developed, or the human machinery becomes out of balance, and speedily shakes itself to pieces. A certain class of social philosophers have taken it upon them to assert that the laboring classes in this country, albeit they perforce cultivate muscle enough, do not, and cannot, for want of time, cultivate soul and mind as they ought. A distinguished essayist, hailing from Boston, the American Athens, has taken up the pen to urge that the laboring classes play too much and study too little, that the nature of the case hardly admits of much effort at mental improvement. So many hours' labor and such hearty meals to get through it all are required, that any attempt at intellectual improvement on the part of the working classes, is, in our Boston philosophers' opinion, necessarily as the gait of the ox to that of a trotting horse.

We have a word to say upon this subject, and we shall begin by agreeing with our essayist, that workingmen, especially young workingmen, study too little, but we dissent totally from the statement that there is anything in the nature of their labor to prevent them as a class from successful study, if they could be induced to undertake it systematically.

Let us see. It is asserted that they eat too heartily, that they *must* eat too heartily to be fleet minded. We admit, because our experience as well as physiological science proves it, that a hearty meal cannot be followed immediately by vigorous mental application. The attempt to do it must inevitably work ill to body and mind. But we also know from theory and practice that the last meal of the day should be, especially to the laboring man, a light one. This meal precedes the hours of leisure generally possessed by laboring men, the hours which are too generally spent in smoking, theater going, billiard playing, drinking in many sad cases, or what is scarcely better, a season of mental and physical inanity by the fireside, slowly but surely degrading all the faculties.

Now let it be distinctly understood that we do not object to harmless amusements *per se*. If workingmen will not study, they had better play than smoke, drink, or sit by the fire and mope. We believe in the *duty* of recreation. But we also believe that study itself *is* recreation to a man whose muscles have been in active play for ten hours of the day, and the best kind of recreation, too, when the last meal has been, as it should be, a light one. Then the body rests while the mind is fresh and vigorous, and two or three hours of profitable and most interesting intellectual enjoyment can be had at far less expense than the pipe, the billiards, or the theatre demands.

Let us now look for a moment at the question of time. Suppose a laborer to work ten hours, and to devote two hours per day to meals and going to and from work. There remain twelve hours out of the twenty-four. Allow nine hours of this for sleep—an hour more than necessary for most persons—but say nine hours; three of leisure remain. But suppose one hour of the three to be spent with the family, there are still two hours of time for quiet study. Now exclude Sundays from the calculation, and allow one secular evening for amusement solely, there remain ten hours per week for study—an amount of time that would, with ordinary intelligence, answer to master the rudiments of the French or German language in a single year, thus opening a new and rich field of amusement and culture. Ten years of such a course would give a man the mastery of the French and German tongues, a fair knowledge of mathematics pure and applied, an outline of the physical sciences, and skill as a draftsman. The writer of this article, still on the sunny side of forty, asserts that the average of all the time he has been able to devote to study during his life has been considerably less than two hours per day. Let any mechanic at the age of twenty consider how much advantage the above acquirements would be to him at the age of thirty, should he obtain them, and then go to work and get them. The requisite books can be obtained for less than many a young man spends for cigars during six months. Twelve years since we were in a machine shop in the center of New York State, where we were having a model constructed. The young man to whom the foreman and proprietor had assigned the work attracted our attention from some remarks which seemed to indicate a higher cultivation than is usually met with in young men occupying similar positions. Thereupon we set ourselves to draw him out. We found him familiar with the higher mathematics, an expert draftsman, and thoroughly posted in natural philosophy and the chemistry of the metals. He had commenced French and German. All these accomplishments were the reward of evening study, pursued steadily since the date of his apprenticeship, commenced at the age of sixteen. This young man was at that time just past twenty-one, in apparently perfect mental, moral, and physical health. He has since risen by successive steps to foreman, and is now a partner in the same establishment, a man of wealth and influence.

The essential character of recreation is that it transfers the strain from one part of the vital machinery which needs rest to another that does not, thus equalizing wear. But the human system is not like a lathe or a steam engine, incapable of repairing itself. As soon as rest is given to any part of it, if healthy, it commences to repair itself. But a condition of perfect rest is that the mind shall be wholly withdrawn from the consideration of fatigue, that toil should be forgotten in the absorbing character of the recreative occupation. What, we ask, is better calculated to accomplish this result than a proper course of study?

We might name many other bright examples which prove conclusively that the tendency of physical labor is to clear the mind and fit it for study, but we forbear. Let no young man under ordinary circumstances excuse himself for ignorance of the rudiments of knowledge. It is as true of this as of other things that "where there is a will there is always a way." In a recent article on self-education, we endeavored to point out in a brief manner a way in which young men might, if disposed, do something toward educating themselves, and we may in the future return to the subject to show that association will prove in this, as in all other relations of life, of great value if organized upon a proper basis. We may also give, in due time, a plan for an organization adapted to the wants of young mechanics in rural towns and large manufacturing establishments.

INCREASING THE POWER OF STEAM BY SUPERHEATING.

One of our numerous inquirers asks if he cannot increase the power of his boiler by superheating his steam. He expects to double its power in this manner; to use his own words: "Passing the steam through a two-inch pipe, 12 feet long, the pipe being heated to 600°; a check valve, placed between the heated portion of the pipe and the boiler, to prevent back pressure, and thus superheating the steam." He asks, also, "what degree of heat has steam at 100 lbs. pressure to the square inch, and what at 200 lbs?"

These last questions we will first answer. At 100 lbs., steam is 338°, and at 200 lbs., is only 387° (or a fraction less), leaving a difference in temperature between the 100 lbs. and 200 lbs. pressure of only 49°. Although our correspondent does not explicitly state the fact, he evidently intends to carry his superheating steam pipe into his furnace. It is a matter for inquiry why he wants a check valve between the heated portion of his pipe and the boiler. He says to "prevent back pressure on the boiler." True, but what about the boiler pressure necessary to fill his superheating pipe? If his pressure in that is greater than in the boiler, how is he to lead steam from his boiler to take the place of his superheated steam used in the cylinder of his engine?

The advantages of superheating steam are, we think, too highly estimated, and its disadvantages too little regarded or noticed, generally. Ordinary steam (the vapor given off by boiling water in a closed vessel) contains, mechanically suspended, a large amount of water; it is saturated steam, not pure steam. Even without any appreciable diminution of force by condensation, the water held in suspension weakens the power of the steam. Superheating, or additional heating, sufficient to convert the water in the steam into steam, pure and simple, is undoubtedly economical if it can be done without such an expenditure of fuel as to neutralize its economy; but it will be seen that the addition of heat to the steam, at ordinary pressure, does not correspondingly increase its power or pressure per square inch. Very "dry," or highly heated steam, exerts an injurious influence on the parts of an engine with which it comes in contact. It contains less of the lubricating properties than steam not wholly denuded of its watery particles. Atmospheric air generally contains quite a large proportion of moisture (water), but when this moisture has been all evaporated by heat, the air possesses no lubricating property, a fact which is a constant source of annoyance to users of hot-air engines. The working parts in contact with this perfectly dry air are "cut" and injured, when they should be kept in a condition of constant lubrication, and thus protected from inordinate wear. So the superheating of steam may be carried to excess, costing more than the gain, or supposed gain, by excessive heating.

Finally, we do not believe the power of a steam boiler can be doubled by any method of superheating the steam it generates, and we think that steam dry enough and powerful enough can be generated in an ordinary boiler without any special ar-arrangement for superheating.

PATENT OFFICE CONTRACTS.

Senator Ferry offered a resolution, which was adopted, directing the Secretary of the Interior to transmit copies of all correspondence between him and the Commissioner of Patents relating to the contracts and supplies of stationery for the Patent Office; also, copies of all orders of the Secretary appointing Committees to examine and report upon such contracts, with copies of the Committees' report.

It appears that Commissioner Foote, having declined to pay the bills of the contractor for furnishing stationery and bond paper for the Patent Office, on the ground that there was fraud in the contract, the Secretary of the Interior appointed a commission, composed of B. F. James, Norris Peters, and E. W. Griffin, principal examiners in the Patent Office, to inquire into the alleged frauds.

The charge is now made that these Commissioners were in collusion with the contractors, and that their report amounts to nothing. On the other hand, the Commissioners declare that they investigated the whole matter thoroughly and impartially, and came to the conclusion that the bills must be paid according to contract, unless fraud is shown.

According to the report a contract was made by a former Commissioner for 600,000 sheets of bond paper at eight cents per sheet. We understand that Commissioner Foote and the Printing Committee of the House have made investigations, and they are of the opinion that there are evidences of flagrant frauds.

It appears to us to require considerable charity to conclude that eight cents per sheet is a fair price to pay for ordinary bond paper. The transaction has about it a suspicious look, and we hope the Commissioner will fearlessly carry on the investigation. The telegraph reports that Secretary Browning is dissatisfied with Commissioner Foote's action in this matter, and is making efforts to secure his removal. Browning is a queer fish, but we can scarcely believe that he wants to remove an official who undertakes to expose frauds. We shall see.

IMPROVEMENT IN FINISHING PICTURES.

Among the most recent patents, is the one granted to Mrs. Sarah A. L. Hardinge, artist, 57 Fleet street, Brooklyn, for a method of finishing pictures, specimens of which we have examined. Very beautiful and charming effects are produced and the improvement promises to have an extensive introduction, as it may be employed by any artist with entire success.

The patentee states as follows in the specification:

"This invention consists in the employment, in combination with the surfaces of photographic prints, lithographic prints, woodcut prints, engravings, and all kinds of pictures, whether upon paper or other material, of a translucent sheet or film such as wax, upon which film the inks or pigments used in coloring or finishing the picture are laid. In carrying out my invention I take any ordinary print or picture, as for example a photographic print, and upon the face thereof I place a sheet of ordinary white wax, sufficiently thin to be so translucent that, when the wax is in close contact with the picture, the principal outlines thereof can be discerned through the wax. I then carefully press the wax film into close contact with the surface of the picture, either by hard pressure or by means of a roller, or by passing the picture through a roller press, or other suitable press. In order to apply the necessary pressure, I cover the surface of the wax with fine paper. The application of suitable pressure serves to harden and condense the wax, making an excellent surface for the reception of inks and colors.

"The translucent film of wax thus applied will adhere very closely to the surface of the picture, which is then to be finished up by laying upon the film any suitable inks or colors that may be desired for the finishing of the picture, such as oil colors, water colors, india ink, etc.

"One of the peculiar advantages of my improvement is that the harsher lines and defects of the picture are more or less covered or softened, while the general effects of the lights and shades are blended and improved. This renders the use of my invention specially advantageous in connection with miniature coloring, as the skilled artist is enabled to preserve completely the original likeness, and yet with a comparatively small expenditure of time to produce the most charming and exquisite effects by stippling and coloring.

"The facility with which the background of the picture may be altered, lightened when too dark by the application of white colors, or darkened with dark colors when too light, or otherwise artistically changed, will be obvious. Alterations and corrections in the picture, may also be readily effected. In case of accidental injury to the surface of the picture, it may be easily repaired and preserved. The border of the translucent film may be embossed with any suitable ornamental composition.

"In other examples, where the picture consists of a profile or other naked figure, the semi-translucent material, after being applied upon the surface of the picture, may be traced with a needle or pointed instrument around the form of the profile, and all of the film except that directly upon the profile may be removed and the edges of the film then leveled down to the background. In this way the film-covered portion of the picture when colored up and finished, will appear to stand out in relief forming a medallion picture of very beautiful appearance.

"In the general use of my improvement the artist is enabled to produce accurate, life-like colors and effects with a facility which results from no other process with which I am acquainted.

"The use of the film herein described, serves also to prevent the original picture from fading and preserve it from injury from moisture and atmospheric changes."

THE PHILOSOPHY OF THE OVEN.

Reported for the Scientific American.

The seventh lecture of the scientific course before the American Institute, delivered by Professor Horsford, on the above subject, at Steinway Hall, on the evening of January 6th, was one of the most practical yet delivered. We greatly regret that our want of space forbids us to give more than a brief abstract.

After announcing the points to which he wished to especially direct the attention of the audience, namely, the "History of the Oven" and "How to make good Bread," the lecturer dwelt briefly upon the importance of the subject. He asserted that although among inferior animals, types of almost every art which characterizes man's civilization, could be found, not one, even of the highest orders of monkeys—resembling man more closely than any other animal—attempts to increase the palatableness of his food by cooking.

The art of baking or roasting is a very old one, dating back to the earliest periods of history. The device for baking used by the aborigines of this country, was the very simple one now used at clam-bakes, consisting of a shallow hole in the ground, in which a fire was built, and a mass of embers accumulated to heat the stones. When the stones had been sufficiently heated, the embers were removed, the clams heaped in their place and covered with seaweed. The heat of the stones relaxed the muscles of the clams in contact with them, the shells parted, and water flowed out to be instantly converted into steam, which in its turn opened all the shells above, and subjected the fleshy parts to a temperature of 212°. The lowermost layer of clams was subjected to a heat which produced destructive distillation, giving rise to savory odors, which penetrating the mass above, communicated to the meat a racy flavor of the highest acceptability, as many of us are ready to testify. The oven in use in ancient Syria, of which Sarah on the plains of Mamre took advantage, when directed to quickly knead three measures of meal, and make cakes on the hearth for the entertainment of unexpected guests, we may conceive did not differ greatly from our aboriginal device, if we omit the seaweed. But there was also in use a jar-shaped cavity in the earth, cemented on the bottom and sides, in which a fire was built. When the walls were sufficiently heated, the embers were removed, and the dough, prepared by mixing crushed wheat and water, was plastered in thin layers on the sides. This yielded a sort of Graham wafer, a kind of wheaten hoe-cake, of the palatableness of which many of our soldiers during the late war can give testimony, and which was the unleavened bread of the ancients. The elevation of this hollow structure to a convenient hight above the surface of the ground, may be regarded as the second step in the development of the oven. This usually consisted of an irregular hemispheric cavity, made of clay or stone-brick, supported on a platform, having a door on one side for the introduction of fuel and the dough to be baked, and another lesser opening on the top for the escape of smoke. When the interior walls of this oven had been heated by the flame of dried fire-wood, the embers were removed, the dough placed upon the floor of the oven, and the chimney and door closed, leaving the dough to be baked by the radiant heat from the walls. This kind of oven was everywhere to be met with half a century ago outside the log-houses of our frontier settlements. As the dwelling-houses were improved the oven was uniformly given a place in the chimney stack, beside the kitchen fire. In considerable towns bakeries grew up, and large ovens on the same general plan as the smaller were constructed. The objectionable characteristics of this time-honored oven was this: from the moment the dough was introduced the oven began to cool. The oven with continuous heat we owe to Count Rumford. Benjamin Thompson (Count Rumford, by patent of the King of Bavaria), a native of Woburn, Mass., attained great distinction as an inventor in the applications of heat. He is best known as the founder of the Rumford professorship in Harvard University, as the Rumford medal of the American Academy, and as the chief agent in the founding of the Royal Institution of Great Britain. His oven was an iron cylinder, heated from without by a supply of hot air, which might be regulated. It may be regarded as the germ of the cooking-stove and range. He conceived the idea of accomplishing in confined space what previous to his time had only been attained before an open fire. He subjected the meat throughout to heat, not high enough to scorch the surface, until the interior pieces had experienced the requisite modification to render them acceptable to the taste, and then introduced air heated to a temperature that would promptly brown the surface, causing the destructive distillation which is essential to produce the savor of well roasted meats. The meats so prepared were considered not inferior to the best roast meats produced by slowly revolving them before an open fire, and required very much less fuel. The brick oven, especially designed for baking bread, has been greatly improved in the direction of economy of fuel and labor.

The lecturer next explained the Aerotherme, introduced about a quarter of a century ago in France, which surrounds the oven by trunks of heated air, maintaining, like the Rumford iron oven, a constant and regulated temperature, and explained several diagrams prepared to illustrate its operation. At the Paris Exhibition there were several mechanical bakeries in operation. One of them, a French device, had a series of open-work shelves, each of the shape of a sextant, attached at the junction of the radii to a vertical shaft, by means of which the shelves could be swung over a bed of coals or into heated space, and kept there till the bread or biscuit was baked, and then carried round to the point of commencement to be discharged. Another of American invention, had the shelves suspended in a huge open work cylinder, in which their horizontality could be maintained, while by the revolution of the wheel they could be carried over the bed of coals, baked and returned. The Vienna oven is an Aerotherme, to which two important additions are made; one to admit steam into the oven during the process, so as to maintain a moist atmosphere down to the last few minutes of the baking; and the other a separate fire, from which radiant heat, of great intensity, may be thrown into the oven and reflected from the smooth roof, to almost instantly redden a very thin crust. The cracker bakery is a highly heated trunk, through which an endless metallic apron is made to carry a constantly renewed supply of cracker dough. The baked crackers are as regularly discharged from one end of the trunk as the fresh crackers in dough are introduced at the other.

Another invention in this direction contemplates the baking of a sufficient amount of bread to supply a city from a single establishment, and is the work of a man whose name is familiar to you from eminent services in the art of war as well as in the arts of peace, Mr. Hiram Berdan. He conceived the idea of an oven which should produce all the loaves of uniform evenness and with a rapidity before unheard of. His apparatus may be described as consisting of two towers filled with heated air, in one of which was an elevator always slowly ascending, and in the other a similar contrivance always slowly descending. On these was arranged a series of platforms with a few inches between; each platform, or huge tray, containing a hundred loaves or more. As each platform attained the summit in one tower it was shot across to the other tower, in which it descended to the bottom and discharged itself. As soon as it was discharged it was shot across to the foot of the ascending tower and refilled with loaves of dough to renew its course. The time of ascending and descending was so arranged as to exactly complete the baking. The whole series of movements of the platform was automatic, and carried on by steam power. Several of these grand ovens—the mechanical bakeries—were constructed in our large cities, and promised at one time to revolutionize the system of city bread baking. Precisely why they did not succeed I do not know. Some of them were destroyed by fire, under circumstances which led the proprietors to think the fires were the work of incendiaries.

The lecturer next proceeded to define the ordinary processes of cooking, baking, roasting, broiling, toasting, frying, stewing and boiling as all processes of cooking. In what do they differ? In boiling, the article of food is subjected to a temperature not exceeding 212°, the boiling point of water. In frying, it is subjected to the temperature of boiling fat or oil, which may be 500° or 600°, the boiling point of the fat or oil employed. In baking, roasting, broiling, and toasting, the interior temperature rarely exceeds 212°, but the exterior temperature may be 400°, or 600°, or 800°. In these, destructive distillation yields hydro-carbons, which are agreeable to the palate, and which are allied in composition to oil of peppermint, cloves, pepper, rose-oil, etc. Of all the cereals wheat is best suited to the wants of man. It contains principles of nutrition admirably adapted to the human organism. One portion enters into the composition of the vital tissues, and another subserves the purposes of fuel in providing warmth and force. Health may be preserved upon a diet of bread alone. The grain can be preserved indefinitely long in sound condition, with but little care. When the grain is crushed as between the stones of a mill there results a reddish gray powder—the whole meal—which is made up of scales and dust. These two products may be separated by bolting, giving on the one hand bran, divided in England into several grades of toppings, pollard, etc., and in this country into connell, shorts, sprouts, coarse and fine middlings, etc., and on the other hand, fine flour. If the fine flour be intimately mixed with a small quantity of water it constitutes the elastic, somewhat tenacious, substance, with which we are familiar in the form of dough. If this dough be kneaded in a gentle stream of water, the water will become milky, and if the water be placed in a jar there settles out a white powder. If the washing be continued, at length the water will cease to be milky and we shall have remaining a tough, highly elastic body somewhat like India-rubber, known as gluten. The white powder, that has been separated is starch. The gluten has been separated by chemists into several bodies which have very nearly the same construction, but which differ from each other somewhat in properties. All of them contain nitrogen and phosphoric acid, and beside carbon, hydrogen, and oxygen. Starch contains only carbon, hydrogen, and oxygen. Besides the gluten and starch, the wheat contains a little sugar and oil. The chemical properties of these two bodies—the gluten and starch—are in the highest degree unlike. An acid like vinegar or lactic acid (the acid of sour milk) will deprive the gluten of its elasticity and in time convert it into a fluid.

The lecturer here enumerated the different kinds of fermentation liable to take place in dough under different circumstances, and then proceeded to describe the production of brewer's yeast. When a mass of ground rye, or corn, or wheat, is brought with warm water and the addition of a small quantity of yeast to a lively fermentation, the froth is skimmed off and repeatedly washed in large volumes of cold water from which it settles out a fine white powder. This is the yeast plant of the distilleries. If the wheat, or rye, or corn was sound, the yeast plant will be suited to bread fermentation, but if it was sour or in any way defective, the yeast plant will carry the taint to the dough. The brewer's yeast is made with more care; crushed rye is mixed with malt meal and fermented. The malt, as you know, is made from barley which has been steeped in water, allowed to germinate to consume most of its gluten, and also to convert its starch into dextrine and sugar, and then roasted to arrest the germination. Of course, the mixture of rye and malt contain relatively less gluten and more gum and sugar than pure rye or wheat meal. The foam from this fermenting mass washed and pressed is largely made at Rotterdam and exported to England under the name of German barm. This substance is known to us, mixed with bran and dried, under the name of yeast-cakes. These forms of ferment have the advantage that they may be made comparatively pure—that is, composed of the yeast plants that will yield alcohol and carbonic acid. When mixed with a large quantity of boiled potatoes (chiefly starch) they will yield precisely what is wanted to puff the bread up, make it light, and impart to it a delicious aroma that leaves nothing to be desired. But to secure this result what must you be sure to do? As the acetic and putrid fermentations follow closely on the alcoholic, you cannot rely on your potato yeast as a source of leavening for more than a very few days. You must be prepared to renew it frequently. The dough must not be allowed to cool, but must be maintained at an even temperature of some 80° to 90° and when it has attained the requisite prorosity and before acetic fermentation sets in it must be placed in a hot oven. If neglected, so as to permit the formation of either acetic or lactic acid, the gluten will be liquefied more or less, its tenacity will be lost, and the bubbles will run together, producing a few large instead of numerous small pores, and the dough will be liable to collapse and become heavy and sodden. I assume that you have the genuine yeast plant, suited, with proper care, to the ultimate production of alcohol and carbonic acid, and these alone, but when you take into account what shocking compounds are sometimes produced as beer, or ale, or whisky, and the susceptibilities of ferment to the influences of temperature and time, you will readily understand that the pure yeast plant is rather ideal than actual. There is an amusing prejudice in some parts of our country, not wholly confined to the less informed portions of communities, on the subject of alcoholic fermentation in bread. In a report on bread, prepared a few years ago by a generally well-informed gentleman, who happened to be a clergyman of Massachusetts, for an annual agricultural festival, the chairman dwelt upon the duty of every young lady to know how to make good bread. It was quite easy. It required attention to only two or three particulars—there must be good flour, a hot oven, and the fermentation must be carefully watched. It must be stopped at the right point, by putting the bread in the oven, and the right point was just before any alcohol was produced. This recalls the advertisement of a baker in London, many years ago, who had heard for the first time that alcohol is a product of granary fermentation. He advertised that bread baked by him contained none of the alcohol produced in the ordinary process of fermented bread.

He was followed a few days later, by a rival who announced that he took no pains to remove from his bread the alcohol produced in the process of fermentation. (It is to be presumed that these establishments preceded the "United Metropolitan Hot Muffin and Crumpet Baking and Punctual Delivery Company.") The quantity of this important product, though small in the individual loaf, is in the aggregate, large. Liebig estimates the annual amount in all Germany at not less than 7,500,000 gallons per annum. You do not need to be reminded that with the philosophy of good yeast bread, however clear before you, the ideal loaf cannot be made without good flour. The proportion of this, unfortunately, is small. The wheat runs the gauntlet from the day it is lodged in the ground. If it escapes the birds and is permitted to germinate, the soil may be wanting in nourishment, or the winter frost may snap the tender roots and delay the vegetation in spring, or it may be deluged with rains or scorched and blanched with continuous sunshine and drought; or preyed upon by the weevil or hessian fly; or smitten with rust at the critical instant when the organic activities are at the highest; or caught by showers in the shock and "grown" in the sheaf; or not sufficiently dry when it goes to the market; or soured in the granary; or heated in grinding; or become sour, and lumpy, and musty in the barrel. After having escaped all these dangers it is dreadful to think of its being poisoned by putrid yeast, or overtaken by a warm dog-day atmosphere, which is fatal to the best of yeast, or forgotten when passing through the critical stages of fermentation and baking. It is not to be wondered at that science has been invoked to preserve to us this invaluable grain and conduct it through the changes that are to give us bread. Thenard, Bossengault, Dumas, Payen, Megemouries, and others in France, Liebig, Knapp, Krocker, Mitscherlich, and others in Germany, and Thomas, Hassal, Pereira, Danglish, Odling, and others in England have lent their aid. The best bread of Paris, Vienna, and London may be regarded as in some degree the fruit of this labor, though the larger share of the credit is due to the bakers and skillful housewives who have mastered the unwritten science and art that lie at the foundation of their success.

Professor Horsford next discussed at length the different chemicals which have been used in making bread, dwelling particularly upon the self-raising flour prepared by intimately mixing phosphoric acid, in combination with potassa and lime; or taking the acid phosphate of lime and adding chloride of potassium to the self-leavening flour, which besides furnishing the phosphate of potassa on the addition of water, sets free hydrochloric acid. The hydrochloric acid being more soluble, acts more promptly on the bicarbonate of soda, producing chloride of sodium (common salt) and sets free the carbonic acid to inflate the dough. Thus constituted, the self-raising flour has, in most respects, very nearly the nutritive value of normal wheat, without the inferior color, and the liability to rapidly sour of the whole wheaten meal.

An extract from a letter by Baron Liebig was read, asserting that the nutritive value of flour is increased ten per cent by Professor Horsford's phosphatic bread preparation.

The speaker next noticed the attempts of Bonssingault and others to ascertain the nature of stale bread and said that the stale crumb may be regarded as a framework of gluten coated with glassy dried starch, which is not readily dissolved by saliva. Of course when taken into the mouth, it requires time before it becomes flexible, and can be easily compressed to force out the fluids it takes up in the mouth by virtue of its capilliary action. But by heating, the water of hydration of the gluten is driven out, the starch which invests the gluten is moistened and rendered flexible, and the whole crumb recovering the sponge-like elasticity of fresh bread, yields its juices when masticated, and is palatable. To test this, I placed in a glass tube a quantity of gluten, and sealed it up. I then placed the end containing the gluten in warm water, and beheld a few moments later moisture condensed on the interior of the upper end of the tube, which was cool. On withdrawing the tube from the water, after a few hours, the film of moisture had disappeared. Water had been driven out from the gluten by heat, and had been reabsorbed on cooling. I then placed another quantity of gluten in the bottom of a tube, above it a tuft of cotton, and above the cotton a quantity of loose shavings of very thin glacial starch. Now I expected, that if moisture was given off from the gluten, it would penetrate to the space occupied by the shavings, half liquefy the starch, and make it adhesive, in this condition the starch shavings would be gummed fast to the glass, and it would no longer be possible to shake them about. The experiment realized my expectations. The solution, then of the question of the difference between stale and fresh bread is this: *The gluten is dehydrated by heat in freshening, and the water driven out, softens the dried starch which coats the gluten. Thus softened the crumb is more palatable. On cooling the water is withdrawn from the starch, which is rendered dry and stiff in consequence, and restored to the gluten; and the bread becomes stale.* There is another point which is regarded as quite mysterious. It is called *the pile of bread*, and is an evidence of excellence. It is a term familiar to bakers, though possibly not to all my audience. A loaf in which all the pile is good may be separated into strips somewhat like the husks that coat an ear of Indian corn, or the coats that invest an onion. How this should appear in a loaf produced from a body apparently so homogeneous as dough is thought very extraordinary. The explanation is simply this: where the gluten of the flour is unimpared by heat or souring, it retains its tenacity, even when greatly attenuated. When the dough is kneaded, it is repeatedly spread out and folded over upon itself, from the border toward the center. The surface is repeatedly dusted with flour, until these layers of flour at last, after long-continued kneading, are everywhere present in the loaf, separating thin sheets and strips of the fermented dough, each strip containing fibers of tenacious gluten. Now this fine flour, by the last act of the ferment, is carried into the mucous stage of fermentation. So that when the loaf is baked there are planes or surfaces of soft mucilage, planes of separation, threading the loaf in the direction from the bottom around the outside toward the center at the top. These permit the loaf to be stripped off somewhat as short pie-crust though separated into flakes.

You will ask how such good flour as such "piled" bread is made from, may be obtained. The question is not easily answered. But some general guiding principles may be recognized. Wheat should not be cut until it is absolutely ripe. A little may be lost in harvesting, but nothing like what may be lost by cutting it while any portion of the berry is liquid. The moist straw by its evaporation draws the fluids out of the berry, and lessens enormously its nutritive value. Cut ten days too early is equivalent to a loss in weight of scarcely less than one-fifth of the whole weight. With thoroughly ripe, well-filled grain there is little difficulty in preparing good flour. But we must select from the flour which the market affords. Good flour from fully ripe, dry grain but recently ground, will not contain lumps. These are due to souring which softens the gluten and sticks the flour together. Good flour will readily mix with water to form a uniform creamy batter. Good flour will yield, with a small amount of water, a tenacious, elastic, homogeneous dough. Good flour will not smell sour or musty, but will exhale a fresh, fruity aroma. It will, when pressed in the hand, retain the imprint of the fingers. The chief characteristics of the self-leavening flour is its uniform cellular texture. This is an essential condition of the healthful preparations of farinaceous food. It should be porous, to permit the ready imbibition of the fluids that serve in digestion. The self-leavening flour is the substratum upon which whatever is desirable may be erected. Mixed with water, or sour milk, and immediately baked in a hot oven, it gives plain bread. If the tins are small the result is biscuit. Increase the quantity of water, beat in an egg, and spread the paste on a hot plate, and the product is a griddle cake. Add molasses and ginger, and you have gingerbread. Stew the leavened mass with raisins and you have a pudding. Eggs, sugar, and flavoring extracts, give you a sponge cake. If there be a fancy for the faint, delicate aroma of hops in bread, replace a portion of the water with Scotch ale. If a rich reddish brown crust to the bread be desired, add a trace of sirup to the milk or water. Will you apply the self-leavening principle to other forms of farinaceous food, mingle the phosphoric acid and the bicarbonate of soda with the corn meal, or rice, or rye, or buckwheat, and the task is accomplished. With the self-leavening agent at command, little time and moderate skill are required to secure uniformly excellent results. Let me conclude by giving you special instructions for making good yeast bread, the philosophy of which, I will hope, will now be easy to comprehend. Have flour freshly ground, and not too finely bolted. Prepare the yeast as follows: Boil thoroughly with the skins on, in one quart of water, enough potatoes to make a quart of mashed potatoes. Peel the boiled potatoes and mash them to fineness; mix intimately with them one pint of flour, and stir the whole to an emulsion with the water in which the potatoes were boiled. Cool the product to about 80° (lukewarmness), and add half a pint of the best fresh baker's yeast, and a tablespoonful of brown sugar. Set aside the mixture at an even temperature of about 80°, till it works well, or is in active fermentation. Of this yeast take half a pint to a gallon (7 lb.) of flour, mixed with three pints of water, or two of water and one of milk, all at the temperature of about 80°, add a little salt, knead thoroughly and set aside to rise at the temperature mentioned. When it has risen to nearly the full volume for the dough divide it into loaves, knead again, set it aside at the temperature already named till it attains the full size of the loaf, and place in an oven heated to not less than 450°. Let the loaves of dough be smaller than the tins. Keep them covered with flat thin plates of stiff paper till the dough is fully raised and the heat carried up to and sometimes maintained throughout the loaf at 212°, to convert all the starch to the mucilaginous or emulsion form and destroy the ferment. Then remove the cover, and permit the browning to take place. If the loaves are large a higher temperature will be required. Seven pounds of flour will make eight loaves of $1\frac{1}{2}$ lb each when baked, or flour of $2\frac{1}{2}$ lb each. Such yeast will keep a week in winter and from two to four days in summer. Bread made with it, in faithful obedience to these instructions, will be good.

The lecture was illustrated by various experiments, among which was the baking of a loaf of bread from the self-leavening flour. Although lengthy, it was listened to with interest and frequent applause.

A NEW REGISTER FOR BUSINESS MEN.

The whole business community, and especially the mercantile classes and bankers, will find the work of McKillop, Sprague & Co., advertised on another page, of vast importance to them.

We have examined the register, which is annually issued by this old established house, and are astonished with the possibility of rating the financial standing of so many business men and firms with such apparent correctness.

No village is so small, whose merchants, with however little trade or capital, do not find their names and postoffice address recorded in this register. Manufacturers who wish to send circulars advertising their business, cannot from any other source procure so correct a list of names as they will find in this volume. The occupation as well as name and address being given, renders it easy, for persons so desiring, to reach any special class of manufacturers or tradespeople, whether they reside in cities, towns, or villages.

Editorial Summary.

THE *American Builder* asserts that marble of a very fine quality and in large quantities has been found near Marshalltown, Iowa. In color and texture it bears striking resemblance to the celebrated Caen stone of Paris, and must therefore of necessity be found very useful for ornamental purposes. Like the Caen stone it hardens on exposure to the atmosphere. If, after thorough tests have been made, this new stone should prove good its claims to durability, we see no reason why it should not come into general use for the purposes to which it is so admirably adapted. The want of some such material has been long felt.

A MISTAKE OF FOUR MILLIONS.—A somewhat important error in our measurement of the distance of the sun from the earth has been discovered. It is now proved that we have been accustomed to over-estimate the distance by four millions of miles, and that instead of ninety-five millions the real figure is ninety-one. This discovery is credited to Mr. Stone of the Royal Observatory, at Greenwich, England. Is it not probable that the sun and earth are gradually drawing nearer to each other? There are some persons who profess to believe, that ultimately our earth will plunge into the orb of day and be consumed. We patiently await the result.

PROFESSOR P. C. SINDING, of this city, will issue, this month, the first part of a fine edition of "Thorwaldsen and his Works," with explanatory text and three hundred and sixty five copper-plate engravings. The whole series will consist of twenty numbers, five of which form a volume. The illustrations, from the burin of Mr. F. G. Unnevehr, will include a dozen fine engravings after specimens in the Copenhagen Gallery. Professor Sinding, a Dane by birth, proposes to make this a fitting memorial of his illustrious fellow-countryman.

THE UNDERGROUND RAILWAY.—The Underground Railway Company not having complied with the terms of their charter, which required that $3,000,000 should be subscribed by Jan. 1st, 1869, and $300,000 deposited with the State Controller as forfeit in case the road should not be completed, within a specified time, the charter becomes void. Doubtless the project will be revived in some form, but we greatly regret its failure at this time. The city needs such a road and must eventually have it.

CHICAGO seems to be in a suffering condition from rats. The *American Builder* relates a story of a man who had to fight his way with a pole against an army of rats opposing his progress up a stairway in that city, complains that the soil of Chicago is particularly adapted to promote their rapid multiplication, and adds that the man who will invent some plan of construction which shall render a building rat-proof, will confer an immeasurable boon on the community, and make a fortune for himself and his children's children.

A ST. LOUIS telegram says accidents have become frequent on the Iron Mountain Railroad since the change of gage, though no one has been killed yet. The cause alleged is that the inclination at the curves was not changed with the narrow gage, and the angle is such that the weight of the cars is thrown against the lower rail with such force as to tear it from the track. The road is to be releveled.

RINGS.—We hear a good deal said about "rings", "Tammany Rings," "Indian Rings," "Albany Rings," "Congressional Rings," etc. Something has lately been said about the "Patent Office Ring." In the absence of gold and silver, we are curious to know whether this patent ring is made of brass, copper, or tin? Any information upon this important subject will be thankfully received.

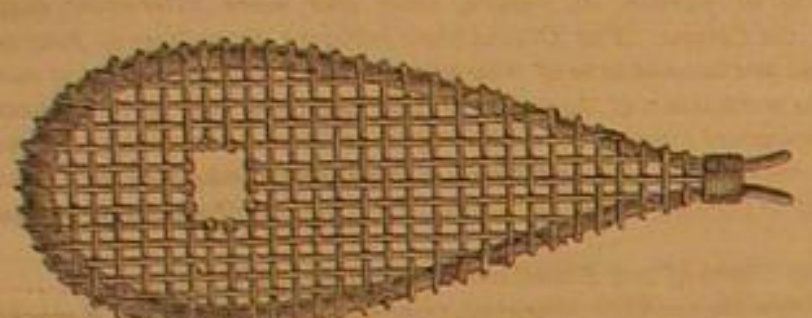
THE *Tribune* of January 6th, tells a correspondent that the year 1800 belongs to the 19th century. If so the year 100 must have belonged to the second century, and the first century must have consisted of 99 years. The first year of the 19th century was 1801. Where is the *Tribune's* arithmetic?

A new company is to be organized at Salem, Mass., with a capital of $300,000 to manufacture Bengal bagging.

MECHANICAL SKILL OF SAVAGES.

The claim which we, as scientific and mechanical people make, of possessing all the scientific knowledge and mechanical skill belonging to the race, and that civilization alone confers a power over the forces and materials of nature, is hardly borne out by the facts. The ingenuity of some savage tribes in adapting themselves to circumstances and in providing means for overcoming natural obstacles is surprising, and would reflect credit on those who pride themselves upon their practical knowledge of mechanics and the laws governing the conditions of matter. Our cabinets of curiosities contain many specimens of skill made by untaught savages, the workmanship of which would be a source of pride to an educated mechanic. We do not refer merely to the results of expenditure of time and labor, but to the adaptability of the implement to the purpose desired. Some of these specimens are not only unique in appearance, but their form and mode of employment involve natural laws with which we are not fully acquainted. In many instances the savage can excel the civilized man even by the use of similar means. As illustrative of these remarks we introduce an engraving of a snow shoe, the invention of our North American Indians, and a boomerang, discovered first among the Australian savages.

The heavy snows which cover our continent above the 43d parallel of latitude for successive months in the year, would



prove a very serious impediment to foot travel but for the snow-shoe. When the surface of the snow is frozen sufficiently to sustain the weight of a man this contrivance is not necessary, but when it lies like a deep bed of fleecy down, and offers as much resistance to the passage of the human body through it as an equal depth of water, the value of the snow shoe becomes apparent.

Its form, as generally made, is shown in the engraving. The rim is a piece of tough wood thickest in the middle and tapering to the ends. This is bent in the form shown, and the ends bound together with thongs of moose hide or deer skin. The frame is about three feet long, or less, to accommodate the size of the wearer. The space between the sides of the bow or frame is covered with a network of moose hide thongs interlaced like basket work. A space is generally left near the toe (the large part of the shoe) to receive the ball of the wearer's foot, although some prefer the network to cover the space. The toe or front of the foot alone is fastened to the shoe by straps, leaving the heel perfectly free, so that in walking the rear or tail of the shoe drags along on the snow. Only the toe of the shoe is raised in walking. One has an unpleasant sensation of being slipshod when first using the snow shoe. Only moccasins are adapted for snow shoes, as the ordinary boot or shoe is too rigid and unyielding. It might be supposed that the width of the shoe (ten to thirteen inches) would compel the wearer to spread his feet wide apart, but in walk-

ing the toe of the advancing shoe is raised slightly and slid over the one at rest, requiring no unnatural exercise or position of the legs or feet. A practiced walker can get over the snow at a very good speed; in proof of which it may be noted that on the 2d of January at a snow shoe race in Hamilton, C. W., five miles were made by the contestants in 31 minutes, 15 seconds, and 32 minutes, 11 seconds, respectively.

The boomerang is simply a curved piece of a hard heavy wood, with its edge on the concave side, like that of a scythe. The wood appears like ebony or very dark Honduras mahogany, and is highly polished. With this simple instrument the Australian savage can wound or kill his foe or game even when hidden by a rock or tree, by "shooting round a corner" like the negro's crooked gun. In the hands of an expert it may be used with great effect. Thrown from the hand it goes whirling on the same horizontal plane, at a hight of two feet from the ground, but on a sudden takes a turn, rising in a spiral plane and returning on a plane nearly parallel to that of its direct flight. Or it may be made to describe the arc of a horizontal circle and thus shoot round the corner. In the hands of the inexperienced, however, it is a dangerous plaything, coming, like curses, home to roost.

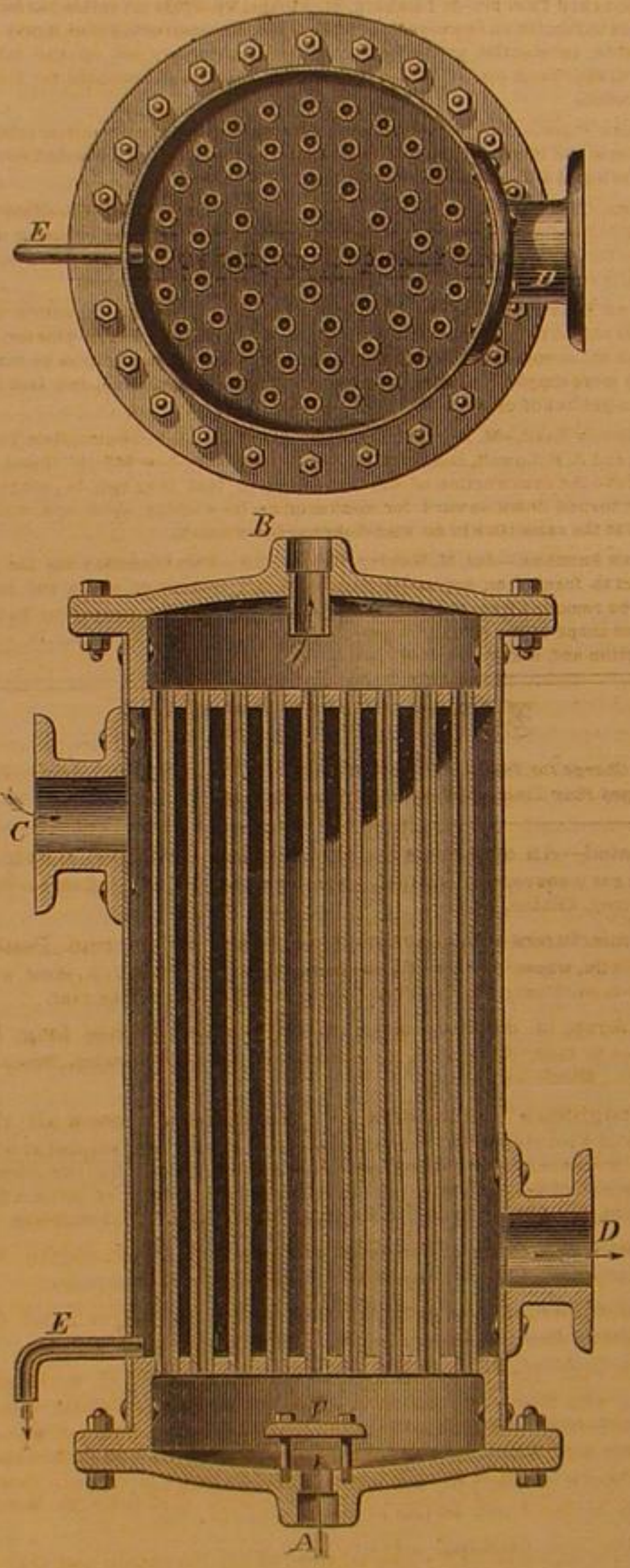
We are not aware that the philosophy of the boomerang has ever been comprehended, or its erratic behaviour explained. The "scaling" of flat stones or clam shells by boys seems to bear an analogy to the flight of the boomerang; but while the course of the stone or shell may be accounted for by the form of the missile and a mathematical formula deduced therefrom, the shape of the boomerang, when critically examined and gaged, affords no adequate basis for a philosophical conclusion.

A NEW SILVER ORE.—A new mineral called parisite, was discovered in the district of Mono, California, by Dr. Paris in 1865; it has recently been analysed by Professor Arent, and yields 6·12 per cent of oxide of silver.

ECONOMICAL AND SIMPLE HEATER FOR STEAM BOILERS.

The following communication with accompanying illustrations is from a practical engineer, who has frequently enriched our columns with the results of his experience, and whose name is sufficient guaranty of the value of his contributions:

Heaters for feed water for boilers of non-condensing engines are nothing new, but as a general rule they are imperfect in construction and of not sufficient capacity to permit a free exhaust; nor do they present sufficient surface to heat the water to the degree that they should, thereby producing "back pressure" and putting the water into the boiler at a far lower temperature than is due to that of the exhaust steam, which of course varies according to the work done previous to its being exhausted, or, perhaps, more properly speaking, expelled from the cylinder. This rarely falls below 212°, generally much above that, and there is no reason why we should not put our feed water into the boiler at very near the same temperature as that of the exhaust steam. Many devices for this purpose have been used. Heating the water by direct contact with the exhaust steam was formerly in general use:



it has this advantage, in case the water is impure—makes scale— a portion of the impurity will be left in the heater and pipe leading to the pump. I have known a heater of the capacity of 200 gallons in which more than half of its capacity was filled with a hard incrustation like limestone, and the pipe (2 inch) leading to the pump would become filled in three or four months to a degree that it would not supply the boiler. This was a serious objection, because to remove it was impossible without taking the pipe up and subjecting it to a heat sufficient to convert the limestone with which it was filled to commercial lime. Another objection to the above mode is that the feed water is heated before it is taken by the pump and the vapor constantly being given off from hot water, accumulating in the pump barrel, becoming compressed, and thereby leaving no room for the water on the rise of the plunger to follow, the pump fails to supply the wants of the boiler.

The true and only safe way, then, is to supply the pump with cold water and heat it between the pump and the boiler; by this means a regular supply can be given the pump, which, if the consumption of the steam is nearly regular, will keep the water in the boiler nearly at the same level—an important point for economy and safety.

To effect this the "Coil Heater" was devised, which is a coil of pipe say one inch in diameter placed in a vessel of cylindrical form, the water being forced through the coil, the exhaust steam admitted into the cylindrical vessel impinging the coil containing the cold water, consequently heating the water, within the coil to a degree corresponding to the temperature of the steam, the surface exposed, the quantity of water, and its temperature passing through in a given time. Now this would require for an engine of 45-horse power, about 171 feet of one inch pipe in a coil, the water from the pump would have to pass the entire length of the coil to reach the boiler, and of course, following the convolutions of the pipe, more friction would ensue than if the pipe was straight. Then, again: if the water should be impure, incrustation of necessity would follow, reducing the conducting power, increasing friction, until the aperture became too small and the result would be the breaking down of the pump or bursting of the coil. From the nature of the coil it cannot be cleared, but must be taken out and a new one put in at a great expense.

I present to your readers the tubular heater, which is not claimed as anything new, but I wish to show its superiority over the open or coil heater, both as regards economy of fuel, original cost, and facility of repairs. The accompanying engravings show a section and plan of a feed water heater that was made for the writer in the year 1846, and which has been and is now in extensive use in New England, where coal costs more than here.

By this, it will be seen that in case of incrustation, on removing the head, an instrument can be introduced to clean the tubes from scale or other deposits. In case of the failure of a tube or tubes from any cause they may be easily removed and others substituted, by any ordinary mechanic with facility without removing the heater from its place.

Another advantage it has, is that with one set of patterns a heater can be made that is adapted to engines from ten to three hundred horse power—more or less—the difference only being the extension of the length, the tubes and shell being made to any desirable length.

It is found that one square foot of tube surface exposed to the action of the exhaust steam is sufficient for each indicated horse power. This may be varied according to circumstances. If the engine works full stroke, with, say 60 lbs. steam without cutting off, the surface may be reduced. If cutting off very short, say at $\frac{1}{4}$, it should be increased, unless steam of a very high tension, say 100 lbs. or above, is carried. With the pump graduated to supply the boiler the temperature of the feed water will be found to be from 205° and upwards.

The engraving is intended to be on a scale of one inch to a foot.

The tube plates, flanges, and covers are of cast iron. The holes in the plates are reamed out smooth and slightly countersunk on the outside. The tubes are one inch outside diameter, made of copper, brass, or iron, fitted to the holes in the tube plates nicely, projecting at each end $\frac{1}{32}$ of an inch. A slightly tapered steel plug is driven in at each end, then the projecting ends are clinched down with a staking tool. When thus secured they are invariably tight and easily removed if required. The shell is made of boiler iron, say of $\frac{3}{16}$ thick

The vessel is placed upright. The water enters at the bottom at A, and is discharged at the top, B, passing through the tubes. The exhaust steam enters at the top nozzle, C, on the side, bathing the tubes which are filled with water, and is discharged at the side nozzle, D, at the bottom.

Now it will be seen that, from the diameter and length of the 57 pipes, with a pump sufficient to supply a 50-horse power boiler the water would be subjected to the action of the steam fully, giving ample time to heat it.

The small pipe, E, at the bottom on the left hand side is to take off the water that is made from the condensation of the steam. The short pipe, B, projects from the top cover downwards to leave a space above its open or lower end to act as an air chamber to relieve the shock caused by the action of the pump.

The circular plate, or disk, F, over the water entrance at the bottom is to deflect the water so that it may not pass in undue proportion through the center tubes.

F. W. BACON,
Consulting Engineer.

84 John street, New York.

NEW PUBLICATIONS.

ONWARD.

The first number of Mayne Reid's new magazine, "Onward," is one of the best illustrated and printed magazines that has found its way to our table this month. It purports to be a magazine for youths, and if the promise which this number gives is to be fulfilled in the future, the youths of this country have got much to be grateful for. Ourself, albeit we have found latterly some silver lines creeping in around our temples, and relieving the otherwise somewhat too vivid hue of our beard, wish to be counted as youthful, if such an intellectual treat is to be monthly set before the youths of the United States. In short, we are more than pleased with everything about it except the uncut leaves; but we hope Mr. Carleton, the publisher, will, in future, remember that there are some old youths in this land whose fingers are not so nimble as of yore, and with whom a magazine with leaves cut to hand finds much favor. We predict a brilliant career for "Onward."

THE AMERICAN BUILDER AND JOURNAL OF ARTS.

This new journal comes to us greatly improved and enlarged. Its illustrations are excellent, and its editorial articles have a fine flavor. We have already had the pleasure of welcoming the advent of this journal, as our readers will remember, and we consider it amply worth its subscription price, three dollars. It is published by Lakey & Adams, Chicago, Ill.

THE OLD WORLD IN ITS NEW FACE: IMPRESSIONS OF EUROPE IN 1867–1868. By Henry W. Bellows. 2 volumes. Cloth, $3·50.

We are indebted to the author, Rev. Dr. Bellows, for the above very entertaining and instructive volumes of European travel, the reading of which we have enjoyed with peculiar pleasure, greatly enhanced by the fact that during a part of the year 1867 it was our privilege to enjoy the society of Dr. Bellows and his family through Holland, Germany, and some portions of Switzerland. Dr. Bellows is an original thinker, a keen observer, and an accomplished writer, and there is a freshness and vigor about his observations which commend them to all who enjoy reading about foreign countries. The author's travels extended through Egypt, Syria, Palestine, Turkey, and Greece, and one of the most instructive features of the work is that which treats of the condition and prospects of heroic little Greece. Next to the enjoyment of the trip itself, we can recommend no better substitute than Dr. Bellow's admirable volumes, which can be obtained through any bookseller.

TRAVELS AND ADVENTURES IN SOUTH AND CENTRAL AMERICA. Charles Scribner & Co., 654 Broadway, N. Y.

A very interesting volume, from the pen of Don Ramon Paez, on the climate, products, and animals of South and Central America has just been published. The subjects are pleasantly treated by the author, whose home was formerly in Venezuela, and the book is handsomely illustrated with engravings of wild beasts, crocodiles, etc., which are indigenous to those tropical countries.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

RAILROAD CAR HEATER AND VENTILATOR.—Asa Weeks, Minneapolis, Minn.—The object of this invention is to provide an apparatus for warming and ventilating railway cars in winter, and cooling and ventilating them in summer; the apparatus being so constructed that it is cheap, convenient to manage, and economical in operation, and can be applied to a whole train without any difficulty arising from the coupling and uncoupling of the cars.

DETACHING BOATS.—Thomas H. Mortimer, Charleston, S. C.—This invention has for its object to provide a simple, cheap, and effective device, by which boats at sea can instantly be detached from the davit tackle when lowered into the water.

GATE.—S. S. Allen, Belvidere, N. Y.—This invention relates to improvements in gates, whereby it is designed to provide a convenient and reliable means for opening and closing the same, when riding either on horseback or in carriages, without the trouble and delay of dismounting.

DEVICE FOR CLEANING OIL WELLS.—Jacob Taylor, Petroleum Center, Pa.—This invention has for its object to produce a device by which the cracks and crevices of oil wells can be scraped open when they are clogged by paraffin and other impurities.

FIRE ARMS.—Peter Shuler, Morris, Ind.—This invention relates to a new and useful improvement in fire arms of that class which are commonly termed needle guns.

PISTON PACKING.—Francis A. Brown, Ithaca, N. Y.—This invention relates to a new and simple metallic packing for pistons, and it consists in a novel and improved mode of construction and arrangement, whereby a closely-fitting piston is obtained, and one which will not be liable to become affected by wear.

VEGETABLE SLICING MACHINE.—Samuel Markel, Roseburgh, Pa.—The object of this invention is to provide a machine for slicing up large quantities of vegetables, as cabbage, beets, turnips, and the like.

CORN PLANTER.—James S. Coen, Attica, Ind.—This invention relates to a new and improved machine for planting corn, and it consists in a peculiar construction of the frame of the machine and its working parts.

STEAM TRAP.—George H. Corliss, Providence, R. I.—The object of this invention is to effect an automatic escape for the products of condensation from steam, and other pipes or vessels, and at the same time prevent the escape of steam, vapor, or gas, from the pipes or vessel in which it is confined.

SMOKER'S COMPANION.—William H. Waite, New York city.—This invention has for its object to furnish a simple and convenient instrument for holding a cigar when smoked close, and also for use as a pipe stopper and for cleaning out the bowl of the pipe.

HORSE RAKE.—J. C. Stoddard, Worcester, Mass.—This invention relates to a new and improved hay rake, and is a modification of and an improvement upon a hay rake for which Letters Patent were granted September 11, 1860.

SOWING PULVERULENT MANURES.—Joseph L. Stegall, Thomasville, Ga.—This invention relates to a new and improved machine for sowing pulverulent manures, such as lime, plaster, ashes, guano, etc., etc. The object of the invention is to obtain a simple, efficient, and mechanical device for the purpose specified.

PRESSURE REGULATOR.—George H. Corliss, Providence, R. I.—This invention is for the purpose of effecting an automatic reduction of the pressure of steam, when it is to be used for heating, or where a higher pressure is raised in the boiler than is required for the purposes to which it is to be applied, and making such reduced pressure uniform.

ATOMIZING TUBES.—William K. Leach, Boston, Mass.—This invention relates to an improved method of constructing what is known as atomizing tubes, an apparatus employed in drawing up any medicated or other liquid from a suitable vessel, and diffusing the same in the air in the form of finely divided spray or atoms.

PULVERIZER.—Isaac N. Jennings, Danbury, Conn.—This invention relates to a new implement for pulverizing the soil, which can be used as an attachment to harrows or independently, as may be desired. The invention consists in applying to a horizontal beam or head a series of metal straps, which project from front and rear; those in front serving to hold down and break up loose lump, while those in rear project downward into the ground and pulverize the same. The lower front corner of the beam is protected by metal straps, and works on the ground so as to prepare the same with its weight, crushing the lumps and evening the ground before the back teeth commence to act.

IMPLEMENT FOR PULLING HOP POLES.—A. L. Hatch and W. A. Hatch, Loyd, Wis.—This invention consists of a lever or hand spike pivoted to the upright of a pedestal board or block with a joint permitting a double movement of the lever; to wit, the usual vibrating movement and a downward swinging of the lever. The lever is provided with a stout iron prong or tine affixed near the end of the same, and running out parallel to the short arm of the same, leaving a space between it and the said short arm suitable for receiving and cramping upon hop poles in the act of extracting them from the ground.

MOUNTING ARTIFICIAL TEETH.—William C. Michaelis, New York city.—This invention has for its object to improve the construction of lower sets of artificial teeth so as to make them stronger and better than when mounted in the ordinary manner, and at the same time less liable to move when used for masticating purposes.

CHURN.—James King, Succasunna, N. J.—This invention relates to a churn in which a square dasher is arranged in an oblong box in such a manner that, by revolving the said dasher the whole inner space of the churn will be swept by the dasher, and its contents well agitated, so that butter can be quickly made.

VEHICLE.—Charles De Damseaux, New York city.—This invention relates to a new manner of arranging the wheels of cars and wagons, and by connecting them with sliding rails, so that the rails will be automatically placed below the wheels as the vehicle progresses in either direction. The invention also consists in the use of segmental wheels arranged side by side, in such a manner that a certain number of segments serves to make up a whole wheel. In connection with these wheels are arranged sliding rails, which are at both their ends secured to weighted chains or ropes, and which lie on the ground to form the treading surfaces for the wheels.

HOT-AIR DRUM.—William Allchin, Newburgh, N. Y.—This invention relates to a new apparatus for heating air by the products of combustion that escape from a stove, furnace, oven, or range of suitable construction. The invention also consists in the use of a flat, rectangular drum, which is by interior partitions divided into three zig-zag channels, of which the central one serves to conduct the products of combustion to the chimney or flue, while the outer ones are passages for air which, entering the drum at the lower end in a cold state, becomes heated by the hot plates and partitions, the latter having been heated by the smoke passing up between them.

PORTABLE ADJUSTABLE STILL-WATER DAM.—Samuel Lewis, Brooklyn, N. Y.—This invention relates to improvements in a portable adjustable still-water dam, and consists in an arrangement whereby the boat float or vessel bearing the machinery may be raised clear of the water and be anchored to the bottom of a stream by long timbers or spuds.

EARTH SCRAPER.—Nelson Peck, Jay, N. Y.—This invention has for its object to improve the construction of the improved scraper, patented by the same inventor, September 4th, 1866, and numbered 57,757, so as to simplify its construction, and make it more convenient and effective in use.

SUBAQUEOUS DRILLING APPARATUS.—Samuel Lewis, Brooklyn, N. Y.—This invention consists in apparatus, designed to simplify the operation of drilling rock under water.

TOBACCO PIPES.—G. Corey, Brooklyn, N. Y.—This invention consists in hanging the bowl of the pipe on pivots in a forked stem, so that it may revolve, if desired, and so that it will by its gravity hang in an upright position.

PISTON PACKING.—David Neahr, Fort Yuma, Cal.—This invention consists of metal packing rings, made in segments, one ring fitting into a chamber or recess in another ring, said segments being so placed together as that the joints of the segments of each ring are broken by the other ring; said segments held together by a coiled or spiral spring around the same, so placed upon a follower on a metallic coiled spring in the stuffing box as to be kept tight upon the seat, the same in the inside of cap or cover of the stuffing box, whereby the same is prevented from leaking steam around the piston or through the aperture in the cap.

RICE SOWING MACHINE.—T. D. Dotterer, Charleston, S. C.—The object of this invention is to provide a machine which will work close to the ditches or fences, and over the unequal ground, and otherwise perform the work in a better manner than machines now in use.

HORSE POWER.—Charles F. Gay, Albany, Oregon.—This invention has for its object to furnish an improved horse power, simple in construction, strong and durable, and which shall be so constructed as to greatly diminish the friction and increase the effective power of the machine.

PORTABLE FENCES.—P. Lambkin, St. Albans, Vt.—This invention has for its object to furnish an improved portable fence, so constructed that it may be durable, substantial, and effective, easily and quickly set up and taken down, and which may be folded or shut up into small compass for transportation.

GANG PLOW.—Z. T. Sweet, Eugene City, Oregon.—This invention relates to a new and improved gang plow of that class which are provided with a driver's seat and are commonly termed sulky plows.

CORN CUTTER AND SHOCKER.—Hiram Harris, Circleville, Ohio.—This invention has for its object to furnish a simple, convenient, and effective machine for cutting and shocking corn, by the use of which the time and labor usually required for these operations may be greatly diminished.

CORN PLANTER.—Wm. B. Goodwin, Kinmundy, Ill.—This invention has for its object to improve the construction of the parts of a corn planter, by which the dropping slides and the marker arms are operated, so as to make them more simple in construction, more effective in operation, and less liable to get out of order.

WINDOW SASH.—M. R. Perkins, Portsmouth, N. H., J. V. Bogert, New York city, and J. F. Lowell, Boston, Mass.—This invention has for its object to improve the construction of window sashes, so that they may be conveniently turned down inward for convenience in washing them, and which shall at the same time in no wise disfigure the window.

CORN SHELLER.—Jas. M. Hawley, Holton, Ind.—This invention has for its object to furnish an improved corn sheller, by means of which the corn may be removed from the cobs rapidly and entirely, whatever may be the size or shape of the ear, and which shall at the same time be simple in construction and easily operated.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, an Extra Charge will be made.

Official List of Patents.

Issued by the United States Patent Office.

FOR THE WEEK ENDING JANUARY 5., 1868.

Reported Officially for the Scientific American.

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Patents and Patent Claims.—*The number of patents issued weekly having become so great, with a probability of a continual increase, has decided us to publish, in future, other and more interesting matter in place of the Claims. The Claims have occupied from three to four pages a week, and are believed to be of interest to only a comparative few of our readers. The publication of the names of patentees, and title of their inventions, will be continued; and, also, as heretofore, a brief description of the most important inventions. We have made such arrangements that we are not only prepared to furnish copies of Claims, but full Specifications at the annexed prices:*

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85,503.—DIE FOR FORMING PLIER JOINTS.—George R. Andrus, East Berlin, Conn.
85,504.—MOTIVE POWER FOR SEWING MACHINES.—Samuel J. Baird, Staunton, Va.
85,505.—MOTIVE POWER FOR SEWING MACHINES.—Samuel J. Baird, Staunton, Va.
85,506.—FENCE.—Augustus T. Barnes, Seneca, N. Y.
85,507.—COFFIN.—John D. Bayliss, Alexandria, Va.
85,508.—WIND WHEEL.—John Beach, DeRuyter, N. Y.
85,509.—CULTIVATOR.—Nathan Carr, Jr., and John Carr, Monmouth, Ill.
85,510.—MEANS FOR REPAIRING BLOWING ENGINES.—Thomas Critchlow, Swatara township, Pa.
85,511.—BAG HOLDER.—Leonard Crofoot, Pavillion, N. Y.
85,512.—RAG-CUTTING MACHINE.—Adario E. Crosby, Glastenbury, Conn.
85,513.—RAG-CUTTING MACHINE.—Adario E. Crosby, Glastenbury, Conn.
85,514.—SKIPPING ROPE.—John R. Cross, Chicago, Ill. Antedated December 19, 1868.
85,515.—PRINTING PRESS.—H. B. Denny, Washington, D. C.
85,516.—CORN PLANTER.—T. Duncanson, Buford, Ohio.
85,517.—PUMP.—Daniel S. Evans, Brockway, Mich.
85,518.—CAR SPRING BOX.—J. W. Evans, New York city.
85,519.—IRON FOR CARRIAGE POLES.—Benjamin Foltz, Rockford, Ill.
85,520.—APPARATUS FOR MAKING WIRE OF SHEET METAL.—Thaddeus Fowler, Seymour, Conn.
85,521.—OIL CAN.—O. H. Gardner, Fulton, N. Y.
85,522.—NAIL MACHINE.—F. A. Gleason, Brooklyn, N. Y.
85,523.—BIRD CAGE.—Gottlob Gunther, New York city.
85,524.—SEED SOWER.—Thurston G. Hall, Hume, N. Y.
85,525.—RULING PEN.—Alfred Hathaway, Charlestown, Mass.
85,526.—MACHINE FOR WASHING SHAVINGS IN BREWERIES.—Frederick Hinckel, Albany, N. Y.
85,527.—VELOCIPEDE.—John H. Irwin, Philadelphia, Pa.
85,528—DEVICE FOR FEEDING CENTRIFUGAL SUGAR-DRAINING MACHINES.—Alfred Kusenberg, Philadelphia, Pa.
85,529.—"COLD FIX" FOR LINING IRON CHILLS, MOLDS, PIG BEDS, ETC.—Henry A. Laughlin, Pittsburg, Pa.
85,530.—COMBINED PRESS AND STRAINER.—Joseph H. Littlefield, Cambridge, Mass.
85,531.—MACHINE FOR BENDING SHEET METAL.—William J. McLea, Leroy, N. Y.
85,532.—COTTON PICKER.—Albert Pettingill, East Livermore, Me.
85,533.—PLOWSHARE.—L. M. Reed, Troy, Ohio.
85,534.—SAP SPILE.—L. M. Reed, Troy, Ohio.
85,535.—BUTTON-HOLE FOR PAPER COLLARS.—William H. Robinson, Rochester, N. Y. Antedated December 22, 1868.
85,536.—STEAM ENGINE.—Horace Rockwell, Roanoke, Ind.
85,537.—EMERY WHEEL.—Addison M. Sawyer, Athol, Mass. Antedated December 26, 1868.
85,538.—POLISHING WHEEL.—Addison M. Sawyer, Athol, Mass. Antedated December 26, 1868.
85,539.—PLAYING TABLE.—Henry Seher, New York city.
85,540.—COFFEE POT.—Daniel M. Skinner, Sandwich Center, N. H.
85,541.—WHIFFLE TREE.—E. A. Smead, Tioga, N. Y.
85,542.—MACHINE FOR PRODUCING UNIFORM TWIST IN TABLE CUTLERY, SPOONS, ETC.—Egbert W. Sperry, Wolcottville, Conn.
85,543.—LOG-CANTING APPARATUS.—Benjamin R. Stevens, Grand Rapids, Mich.
85,544.—SHOOL DESK AND SEAT.—G. A. Stewart, Des Moines, Iowa.
85,545.—REAMING TOOL.—Edward Sullivan, Pittsburg, Pa. Antedated December 17, 1868.
85,546.—KNITTING MACHINE.—William A. Tangeman, Lockland, Ohio.
85,547.—POTATO PLANTER.—Joseph L. True, Benton, Me.
85,548.—PUMP.—James Underwood, Mason county, Ill.
85,549.—MANDREL FOR COILING SPRINGS.—Richard Vose and James Anderson, New York city.
85,550.—PAPER-RULING MACHINE.—J. J. Walser, Chicago, Ill.
85,551.—BUTTER WORKER, ETC.—James T. Whipple, Chicago, Ill.
85,552.—ENGINE LATHE.—A. E. Whitmore, Boston, Mass.
85,553.—COMBINED CALIPER, RULE, AND WIRE GAGE.—Frederick A. Adams, Shelburne Falls, Mass.
85,554.—HOT-AIR DRUM.—William Allchin, Newburg, N. Y.
85,555.—GATE.—S. S. Allen (assignor to himself and David Allen), Belvidere, N. Y.
85,556.—CARDING MACHING.—Anthony A. Bennett and George Vine, Norwalk, Conn. Antedated December 23, 1868.
85,557.—DOG KENNEL OR HOUSE.—Samuel S. Bent, Portchester, N. Y.
85,558.—MACHINE FOR PIERCING STITCH HOLES.—Reuel Blackwood, Philadelphia, Pa. Antedated December 30, 1868.
85,559.—PIPE CONNECTION IN RAILROAD CAR HEATERS.—Marlin S. Bolt, Elmira N. Y.

85,560.—Bed Lounge.—Ernst Boese, Frederick Boese, and Abraham Neuberger, Chicago, Ill.
85,561.—Steam Engine Piston Packing.—Francis A. Brown, Ithaca, N. Y.
85,562.—Clothes Dryer.—Andrew J. Chase, Boston, Mass.
85,563.—Corn Planter.—James S. Coen, Attica, Ind.
85,564.—Hot-air Furnace.—Theodore E. Coles, Troy, Ohio.
85,565.—Tobacco Pipe.—George Corey, Brooklyn, N. Y.
85,566.—Steam Pressure Regulator.—George H. Corliss, Providence, R. I.
85,567.—Steam Trap.—George H. Corliss, Providence, R. I.
85,568.—Tack Hammer.—John Crandell, Chicopee Falls, Mass., and Nathaniel P. Braman, Bridgeport, Conn.
85,569.—Track-laying Vehicle.—Charles De Damseaux, New York City.
85,570.—Combined Cultivator and Stalk-cutter.—E. F. Dehart, Swan Creek, Ill.
85,571.—Exhaust Device for Locomotive Engines.—Joel Densmore, Sr., Erie, Pa.
85,572.—Toy Steam Engine.—A. L. Dewey, Westfield, Mass.
85,573.—Apparatus for Unloading Grain from Wagons.—Charles S. Dole, Chicago, Ill.
85,574.—Machine for Sowing Rice. — T. D. Dotterer, Charleston, S. C.
85,575.—Belt Punch.—Mexworth D. Drake, Scituate, assignor to himself and Wm. E. Barret, Providence, R. I.
85,576.—Manufacture of Gunpowder.—Louis Henry Gustavus Ehrhardt, London, England assignor to George B. Upton, David D. Stackpole, and Samuel H. Gookin.
85,577.—Pump.—I. N. Forrester and Jas. H. Ludington, Bridgeport, Conn.
85,578.—Horse Power.—Chas. F. Gay, Albany, Oregon.
85,579.—Bung Cutting Machine.—A. J. Gibson (assignor to Wm. C. Davis, and John W. Garrison), Cincinnati, Ohio.
85,580.—Steam Engine Governor.—W. W. Gilbert, New York city.
85,581.—Corn Planter.—W. B. Goodwin, Kinmundy, Ill.
85,582.—Expanding Harrow.—I. J. Halsted, Springfield, Ill.
85,583.—Steam Engine Slide Valve.—Rob't Hardie, Albany, N. Y.
85,584.—Mode of Finishing Photographs, etc.—S. A. L. Hardinge, Brooklyn, N. Y.
85,585.—Corn Harvester.—Hiram Harris, Circleville, Ohio.
85,586.—Sash Fastener.—Henry Haslam (assignor to himself and Walter Haslam), New Britain, Conn.
85,587.—Hop Pole Puller.—A. L. Hatch, and W. A. Hatch, Loyd, Wis.
85,588.—Bottle Stopper.—J. T. Haviland, San Francisco, Cal.
85,589.—Manufacture of Dolls' Heads.—George H. Hawkins, New York city.
85,590.—Corn Sheller.—James M. Hawley, Holton, Ind.
85,591.—Pulverizer.—Isaac N. Jennings, Danbury, Conn.
85,592.—Manufacture of Corn Flour.—Chas. Jones and William Standing, De Soto, Ill.
85,593.—Corn Husking Machine.—W. D. Jones, Hagaman's Mills, N. Y.
85,594.—Churn.—James King, Succasunna, N. J.
85,595.—Portable Fence.—Philo Lambkin, St. Albans, Vt.
85,596.—Atomizing Tube.—Wm. K. Leach, Boston, Mass.
85,597.—Subaqueous Drilling Machine.—Samuel Lewis, Brooklyn, E. D., N. Y.
85,598.—Adjustable Still Water Dam.—Samuel Lewis, Brooklyn, E. D., N. Y.
85,599.—Vegetable Slicing Machine. — Samuel Markel, Roseburg, Pa.
85,600.—Mounting for Artificial Teeth.—W. C. Michaelis, New York city.
85,601.—Plow Attachment.—Jas. W. Monical, Mooresville, Ind., assignor to himself and Adam Howe.
85,602.—Grapple and Excavator.—A. T. Morris, Bloomfield, N. J., assignor to himself and Jas. Cummings, New York city.
85,603—Cooking Stove.—M. J. Mosher, Troy, N. Y.
85,604.—Reservoir Cook Stove.—M. J. Mosher, Troy, N. Y.
85,605.—Mold for Puddings.—Joseph Musgrove, East Newark, N. J.
85,606.—Packing for Steam-Engine Piston Rods.—David Neahr, Fort Yuma, Cal.
85,607.—Gate.—H. S. Otis, Prescott, Wis., assignor to himself and John Green.
85,608.—Device for Tightening Tires of Carriage Wheels.—Harris Pearson and Harvey Pearson, Depeyster, N. Y.
85,609.—Earth Scraper.—Nelson Peck, Jay, N. Y.
85,610.—Grain Toller.—C. R. Peden and B. A. Peden, Franklyn, Ky.
85,611.—Window Sash.—M. R. Perkins, Portsmouth, N. H., J. V. Bogert, New York city, and J. F. Lowell, Boston, Mass.
85,612.—Snub Posts for Rafts, etc.—Evander Phillips, Edwin A. Dunham, and Aaron Winans, Albany, Ill. Antedated December 19, 1868.
85,613.—Manufacture of Chewing Tobacco.—Wm. Rinehart and David Rinehart, Pittsburg, Pa.
85,614.—Fire Place Heater.—Watson Sanford, Brooklyn, N. Y.
85,615.—Meat Cutter.—Chas. Schiller, Baltimore, Md.
85,516.—Breech Loading Fire-Arm.—Peter Schuler, Morris, Ind.
85,617—Bolt for Trunk, etc.—Henry Simons, Phila'. Pa.
85,618.—Twine Holder.—R. L. Smith, Wolcottville, Conn.
85,619.—Machine for Sowing Pulverulent Manures.—J. L. Stegall, Thomasville, Ga.
85,620.—Horse Rake.—J. C. Stoddard, Worcester, Mass. Antedated Dec. 26, 1868.
85,621.—Gang Plow.—Z. T. Sweet, Eugene City, Oregon.
85,622.—Oil Well Cleaner.—Jacob Taylor, Petroleum Centre, Pa.
85,623.—Composition to be Used in the Manufacture of Soap.—R. P. Thomas, San Francisco, Cal.
85,624.—Wrench.—Howard Tilden, Boston, Mass., assignor to Wm. D. Andrews, New York city.
85,625.—Shoe Heeling Machine.—C. H. Trask and Henry Eldridge, Lynn, Mass.
85,626.—Tobacco Stopper.—Wm. H. Waite, New York city, assignor to himself and J. R. Watson.
85,627.—Harvester-Cutter Holder.—S. H. Wilson (assignor to himself and Cary S. Burtis), Auburn, N. Y.
85,628.—Harvester.—George W. N. Yost (assignor to Corry Machine Company), Corry, Pa.
85,629.—Hub Turning Machine.—J. J. Zufelt and R. Craig, Sheboygan Falls, Wis.
85,630.—Padlock for Mail Bags, etc.—P. A. Altmaier, Harrisburg, Pa.
85,631.—Whiffletree.—S. H. Anderson, Hannibal, Mo.
85,632.—Steam Engine Governor.—Wm. Ashby, Timber township, assignor to W. B. Caruthers, Indian Point, Ill.
85,633.—Sewing Machine.—M. M. Barnes, North Adams, Mass.
85,634.—Animal Trap.—Thomas Bingham, Stockport, Ohio.
85,635.—Scraper.—Isaac W. Boatman, Seven Mile, Ohio, assignor to himself and John M. Boatman, Peru, Ind.
85,636.—Suspended Gas Cigar-Lighter.—Dan'l F. Brandon, Chicago, Ill.
85,637.—Glass Mold.—Homer Brooke, New York city.
85,638.—Toy Repeating Pistol.—Edward Buckman and Alexander Buckman, East Greenbush, N. Y.
85,639.—Machine for Pulverizing Earth.—Wm. Martillous Bush, Greensburg, Ind.
85,640.—Velocipede.—Cornelius Callaghan, Boston, Mass.
85,641.—Land Roller.—E. P. H. Capron, Springfield, Ohio.
85,642.—Lubricating Compound for Use in the Manufacture Fibrous Materials.—Chas. Clark, Dayton, Ky.
85,643.—Bag Holder.—Sam. P. Clemons, Dansville, N. Y.
85,644.—Combined Latch and Lock.—Wm. H. Cloud, Fremont, Ohio.
85,645.—Breech-Loading Fire-Arm.—J. Webster Cochran, New York city.
85,646.—Snap.—Peter Dolan, Carbondale, Pa.
85,647.—Express Messengers' Safe.—Thos. Dolan, Albany, N. Y.
85,648.—Planing Machine.—J. H. Draper, Mooresville, Ind.
85,649.—Pickpocket Alarm.—I. T. Dyer, Quincy, Ill.
85,650.—Compound for Cure of Foot-rot in Sheep.—Geo. Eckert, Charleston, Ohio.
85,651.—Hay Raker and Loader.—Robert Elarton and E. A. Thomas, Hillsborough, Iowa.
85,652.—Corn Planter.—John Elbertson, Kirksville, Mo.
85,653.—Mode of Inserting Artificial Teeth.—Edward B. Goodall, Portsmouth, N. H.
85,654.—Feather Renovator.—Rufus H. Graves and Harvey L. Crandall, McGrawville, N. Y.
85,655.—Apparatus for Feeding Steam Generators.—Horace Griffin (assignor to himself, James A. Evans, and David Strong), New Haven, Conn.
85,656.—Fluid Meter.—James Harris, Boston, Mass.
85,657.—Stomach Bitters.—Lemuel W. Harris (assignor to himself and Herman McGonegal), Chicago, Ill.
85,658.—Horse Hay Fork.—A. J. Harrison, Cadiz, Ohio.
85,659.—Medical Compound.—George M. Hay, Americus, Ga., assignor to Harvey T. Litchfield, Boston, Mass.
85,660.—Molasses Gate.—John Hegarty, Jersey City, N. J.
85,661.—Punching Boots, and other Leather Stock.—Charles H. Helms, Poughkeepsie, N. Y.
85,662.—Cultivator.—R. H. Henry, Monmouth, Ill.
85,663.—Hydrocarbon Burner.—Samuel A. Hill, Oil City, assignor to himself and Charles F. Thumm and Oliver P. Scaife, Pittsburgh, Pa.
85,664.—Stove-Pipe Thimble.—Charles Horel, Lincoln, Wis.
85,665.—Machine for Cutting Nails.—Cyrus D. Hunt, Fairhaven, Mass.
85,666.—Roofing Composition.—Carleton B. Hutchins, Ann Arbor, Mich.
85,667.—Composition for Artificial Stone.—Carleton B. Hutchins, Ann Arbor, Mich.
85,668.—Preparation of Cod Liver and other Oils for Medicinal Use.—Thaddeus Hyatt, Atchison, Kansas.
85,669.—Horse Hay Fork.—Jos. Jennings, Jacksonville, Ill.
85,670.—Pull Iron for Horse Cars.—Allen S. Jimmerson, New York city, N. Y.
85,671.—Aero-Gas Burner.—Wm. Jones, Chelsea, Mass.
85,672.—Gun Lock.—John Kelsey, Richmond, Mo.
85,673.—Railway Rail.—Geo. W. King, Georgetown, D. C.
85,674.—Farm Gate.—D. L. Koons, Trimble, Ohio.
85,675.—Cultivator.—George W. Kring, Fairbury, Ill.
85,676.—Shingle Machine.—Isaac I. Lancaster, Vancouver, W. T.
86,677.—Lamp Chimney.—J. W. Larimore, Chicago, Ill. Antedated December 26, 1868.
85,678.—Cooking Stove.—D. S. Leavitt, Grand Rapids, Mich.
85,679.—Washing Machine and Boiler Combined.—Henry T. Lee, Jersey City, N. J.
85,680.—Shifting Carriage Top.—Geo. R. Lucas (assignor to himself and H. W. Shepard), Mannsville, N. Y.
85,681.—Boot.—Lysander O. Makepeace (assignor to L. B. Frazer and C. F. Coffin), Lynn, Mass.
85,682.—Machine for Making Sewing-Machine Needles.—F. W. Mallet (assignor to himself and and George Cook), New Haven, Conn.
85,683.—Water Wheel.—E. W. McGuire, Eaton, Ohio.
85,684.—Elevated Railway.—Richard Montgomery, New York city.
85,685.—Boat-detaching Apparatus.—Thomas H. Mortimer, Charleston, S. C.
85,686.—Horse Hay Fork.—David Morton, Mount Vernon, Ohio.
85,687.—Roofing Material.—John Munn, Camden, N. J.
85,688.—Steam Boiler Furnace.—J. L. Paige, Rochester, N. Y.
85,689.—Horse Shoe.—George A. Parker, Westford, Mass.
85,690.—Carpet Stretcher.—Samuel Pennock, Geneva, Ill.
85,691.—Snow Plow.—William A. Plantz, Iowa Falls, Iowa.
85,692.—Railroad Ticket.—W. E. Prall, Washington, D. C.
85,693.—Car Wheel for Railways.—John Raddin, Lynn, Mass.
85,694.—Saw Buckle and Frame.—J. Reilly, Baltimore, Md.
85,695.—Curtain Fixture.—C. J. Roberts, Chicago, Ill.
85,696.—Plow.—Louis Ronat, Carondelet, Mo.
85,697.—Lamp Burner.—John F. Sanford, Keokuk, Iowa.
85,698.—Vapor Burner.—Herman S. Saroni, Baltimore, Md.
85,699.—Pitchfork.—Rensselaer Schuyler and William Crowninshield, Seneca Falls, N. Y.
85,700.—Machine for Separating and Concentrating Magnetic and other Ores.—Edward L. Seymour, New York, N. Y.
85,701.—Furnace for Producing Steel and other Metals.—Edward L. Seymour, New York city.
85,702.—Horse Hay Fork.—Roscoe S. Sheldon, Chicago, Ill.
85,703.—Pile Driver.—J. J. Simons, East St. Louis, Ill.
85,704.—Toy Gun.—George H. Snow and George H. Coe, New Haven, Conn.
85,705.—Extracting Spirits of Turpentine from Pine Wood.—James D. Stanley (assignor to himself and Thomas W. Wheeler), Wilmington, N. C.
85,706.—Dry Measure.—John H. Teahl, Eberly's Mills, Pa.
85,707.—Husking Glove.—J. H. Titus, Independence, Iowa.
85,708.—Parllel Ruler.—F. A. Traut, New Britain, Conn.
85,709.—Combined Wheelbarrow and Cultivator.—Lewis Trefftz and George H. Shimpert, Pinckneyville, Ill.
85,710.—Fence.—Mynard I. Turck, Schodack, N. Y.
85,711.—Seed Planter.—Stephen B. Ward, Auburn, Ind.
85,712.—Railroad Car Heater.—Asa Weeks, Minneapolis, Minn.
85,713.—Composition for Artificial Stone.—Edward Westermayr, Chicago, Ill.
85,714.—Ointment.—Daniel Wigg, Hyde Park, N. Y.
85,715.—Wagon Brake.—Lewis Wolf (assignor to himself and T. E. C. Brinley), Louisville, Ky.
85,716.—Bee Hive.—A. T. Wright, New Vienna, Ohio.
85,717.—Faucet.—Martin Zimmerman, Earl Township, Pa.
85,718.—Steam Motor.—Hugh Crumlisk, Keokuk, Iowa.
85,719.—Manufacture of Ice, and the Refrigerating of Air, Liquids, etc.—Charles Tellier, Passy, near Paris, France, assignor to Leopold Bouvier, St. Louis, Mo.
85,720.—Railway Car.—P. H. Watson, Ashtabula, Ohio.

REISSUES.

84,800.—Hay Spreader.—Dated December 8, 1868; reissue 3,250.—Thomas C. Craven, Albany, N. Y.
41,929.—Bolt-making Machine.—Dated March 15, 1864; reissue 3,251.—William J. Lewis, Pittsburgh, Pa.
31,734.—Building for Preserving Fruits and other Substances.—Dated March 19, 1861; reissue 3,252.—Benjamin Markley Nyce, Cleveland, Ohio.
59,921.—Stair Rod.—Dated November 20, 1866; reissue 3,253. William T. Mesereau, Newark, N. J.
49,922.—Sleeping Car.—Dated September 19, 1865; reissue 2,862, dated February 11, 1868; reissue 3,254.—George M. Pullman, Chicago, Ill., assignee, by mense assignments, of himself and Ben Field.
21,698.—Horse Rake.—Dated October 5, 1858; reissue 3,255.—Adam R. Reese, assignee, by mense assignments, of Mathias Raezer, Phillipsburg, N. J.
31,035.—Tea-kettle.—Dated January 1, 1861; reissue 2,122, dated December 5, 1865; reissue 3,256.—Division No. 1.—Ezra Ripley, Troy, N. Y.
31,035.—Tea-kettle.—Dated January 1, 1861; reissue 2,122, dated December 5, 1865; reissue 3,257.—Division No. 2.—Ezra Ripley, Troy, N. Y.
75,809.—Process of Removing Tin from Sheet Metal.—Dated March 24, 1868; reissue 3,258.—D. D. Sturdevant and H. B. Harmon, Clifton Springs, N. Y.

DESIGNS.

3,304.—Stove.—Harrison Eaton, Amherst, N. H.
3,305.—Carpet Pattern.—Israel Foster, Philadelphia, Pa.
3,306.—Trade Mark.—Jacob Getz, Buffalo, N. Y.
3,307 to 3,314.—Shelf Bracket.—Wm. Gorman (assignor to Sargent & Company), New Haven, Conn. Eight Patents.
3,315.—Spoon or Fork Handle.—Henry Hobbard, New York city, N. Y.
2,316.—Carpet Pattern.—Elemir J. Ney (assignor to Lowell Manufacturing Company), Lowell, Mass.
3,317.—Stove.—John B. Nichols, Bangor, Me.
3,318.—Shelf Bracket.—J. E. Parker, West Meriden, Conn.
3,319.—Tazza for Holding Cake.—William Parkin (assignor to Reed and Barton), Taunton, Mass.
3,320.—Tea Service.—William Parkin (assignor to Reed and Barton), Taunton, Mass.
3,321.—Ornament of a Hat or Cap.—John Sealy, Jr., Newark, N. J.
3,322.—Ornament of a Hat.—J. Sealy, Jr., Newark, N. J.
3,323.—Ornament for a Hat or Cap.—J. Sealy, Jr., Newark, N. J.
3,324.—Base and Top of a Stove.—N. S. Vedder, Troy, N. Y.
3,325.—Plates of a Stove.—N. S. Vedder, Troy, N. Y.
3,326 and 3,327.—Plates of a Stove.—N. S. Vedder, Troy, and Tobias S. Heister, Lansingburgh, N. Y., assignors to N. S. Vedder. Two Patents.
3,328 and 3,329.—Plates of a Cook's Stove.—N. S. Vedder, Troy, and Tobias S. Hester, Lansingburgh, N. Y., assignors to N. S. Vedder. Two Patents.
3,330.—Doors of a Stove.—N. S. Vedder, Troy, and Tobias S. Hester, Lansingburgh, N. Y., assignors to N. S. Vedder.
3,331.—Base and Top of a Stove.—N. S. Vedder and Francis Ritchie, Troy, N. Y., assignors to N. S. Vedder.
3,332.—Plates of a Stove.—N. S. Vedder and Francis Ritchie, Troy, N. Y., assignors to N. S. Vedder.
3,333.—Sleeve Button.—Wm. H. Wilson, Providence, R. I.