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MANUFACTURE OF OIL OF VITRIOL.

BY J. F. GESNER, M. A.

SOME one has said that the world knows least of its greatest men. If this be so with reference to individuals who shape, for weal or for woe, the destinies of their kind, with how much more truth may it be asserted of the great material products, that minister so vastly to man's comfort and enjoyment! Few have any adequate idea of the importance in our arts and manufactures of the corrosive liquid, known in commerce as the oil of vitriol. So important is the subject of our article, and so various and numberless the products, necessary almost to our daily existence, depending upon its manufacture, that it has been said that the material prosperity of a country may be judged of very accurately by the amount of oil of vitriol it produces.

The chemist knows oil of vitriol as sulphuric acid, and writes it, in characters rather cabalistic to the uninitiated, as $H_2 SO_4$. The characters, however, are easily understood. The capitals are merely the initials of the elements composing the compound, and the figures under them (1 being understood when no figure is written) denote the number of times each element enters into combination.

And here comes in one of those great and comprehensive laws which it is the glory of science to discover and apply. We have written sulphuric acid $H_2 SO_4$, and we have not done so at haphazard. Our hydrogen, oxygen, and sulphur behave, contrary often to our experience in the case of individuals, with unvarying decision and consistency. For the sake of simplicity we may write our compound SO_3, H_2O, bearing in mind that the second half of the symbol, H_2O, indicates 1 part of water, H_2O always meaning water in chemical language. The elements in the first part of the compound, SO_3, are sulphur and oxygen, and SO_3 means 1 part of sulphur and 3 parts of oxygen. Now we cannot change these relative proportions of sulphur and oxygen and retain the same compound. The instant we do so, a new chemical compound springs into existence. If we make, for instance, two parts of oxygen combine with one of sulphur, we have no longer sulphuric acid, but the pungent suffocating odor of a burning sulphur match, due to sulphurous acid gas, a definite compound that cannot be formed with any other different proportions of the combining elements.

By investigation, chemists have discovered that the different elements have certain and unfailing combining weights. For instance, the combining weight of sulphur is 32, that of oxygen 16, that is, in the case of sulphurous acid, 32 grains, ounces, or pounds, etc., of sulphur, have combined with twice 16 grains, ounces, pounds, etc. (not twice any other number of grains, ounces, pounds, etc.) of oxygen to form $32 + (16 \times 2) = 64$ grains, ounces, or pounds of sulphurous acid. So that, in any number of grains, ounces, or pounds of sulphurous acid, we know that $\frac{32}{64} = \frac{1}{2}$ is sulphur and $\frac{32}{64} = \frac{1}{2}$ is oxygen; in the same way SO_3 denote that 32 grains, ounces, or pounds of sulphur, have combined with three times 16 grains, ounces, or pounds of oxygen, making up $32 + (3 \times 16) = 80$ grains, ounces, or pounds of anhydrous sulphuric acid. In any number of equal parts, by weight, then, of SO_3, we know that $\frac{32}{80} = \frac{2}{5}$ parts are sulphur and $\frac{48}{80} = \frac{3}{5}$, parts are oxygen. In the case of SO_3, we have a striking example of the change a new entering element or compound can effect in a given substance. SO_3, without its equivalent of water, which we have called anhydrous sulphuric acid, is a white, solid substance, and may be molded in the fingers like wax, without danger if not pressed too hard. It has neither acid nor corrosive properties. Drop a quantity, however, into a little water, and there is a hissing noise, and an evolution of steam, as when you quench a red hot iron. So strong is the affinity of this inert harmless wax for the equally bland water, and so violently do they combine, that no amount of heat will serve afterwards to separate, without decomposition, the two, which make up the intensely acid liquid, oil of vitriol.

Although sulphur was well known to the ancients, they were not acquainted with its compound with oxygen, the subject of our article. Paracelsus, who died in 1541, seems to have been the first who understood its composition. That sulphur, or brimstone, should have been known, centuries before its compound, sulphuric acid, was recognized or applied to any use, is due not only to the limited knowledge possessed by the old alchemists, but to the fact that the acid rarely occurs in the free state. The affinities of sulphuric acid are so strong that, not content to exist alone, it must, as it were, have some intimate chemical companion with which to form a chemical alliance. And how different the compound from the elements and compounds composing it! Glauber's and Epsom salts are familiar in our mouth as household words; but who would recognize sulphuric acid and soda in the one, or oil of vitriol and magnesia in the other? Plaster of Paris is a familiar substance, inert and harmless, with no trace of our corrosive acid and the caustic lime composing it. But notwithstanding this strong tendency to combine with other bodies, sulphuric acid has been found in the free state. It is sometimes discovered free in the water which drains from coal mines, evidently produced by the decomposition of the iron pyrites contained in the coal, as will be seen further on. Boussingault found it in a mountain stream, called the *Rio Vinagre*, in the Andes, and calculated that the waters of this torrent annually carried down to the sea 15,000 tuns of sulphuric acid. In the island of Java, it exists in the waters of a stream which has its source in the crater of an extinct volcano. In all of these instances, it has evidently been produced in the way in which we shall presently see that it is now manufactured on the large scale, namely, from the oxidation of sulphur.

Sulphuric acid was first prepared by submitting, to an intense heat, the salt known as green vitriol or copperas. The substance does not, as the term copperas would seem to imply, contain any copper, but is simply a sulphate of iron, known to the chemist as ferrous sulphate. For some centuries, this was the only known mode of making the acid, and its manufacture in this way is still carried on in Nordhausen, in Saxony, whence the name of the product, Nordhausen acid or fuming oil of vitriol.

The distillation of the ferrous sulphate is made in earthenware vessels, called, from their shape, long necks. These are set in a reverberatory furnace, with an earthenware receiver luted to each with clay. The product is a very strong fuming acid. From its oily appearance, and the fact of its being first derived from green vitriol, we have the ordinary commercial term oil of vitriol. This mode of manufacture was found to be too expensive, and inadequate to supply the increasing demand. To the French is due the next important step in the manufacture of sulphuric acid, namely, by the oxidation of sulphurous acid, which, as has been already remarked, contains one atom less of oxygen than sulphuric acid.

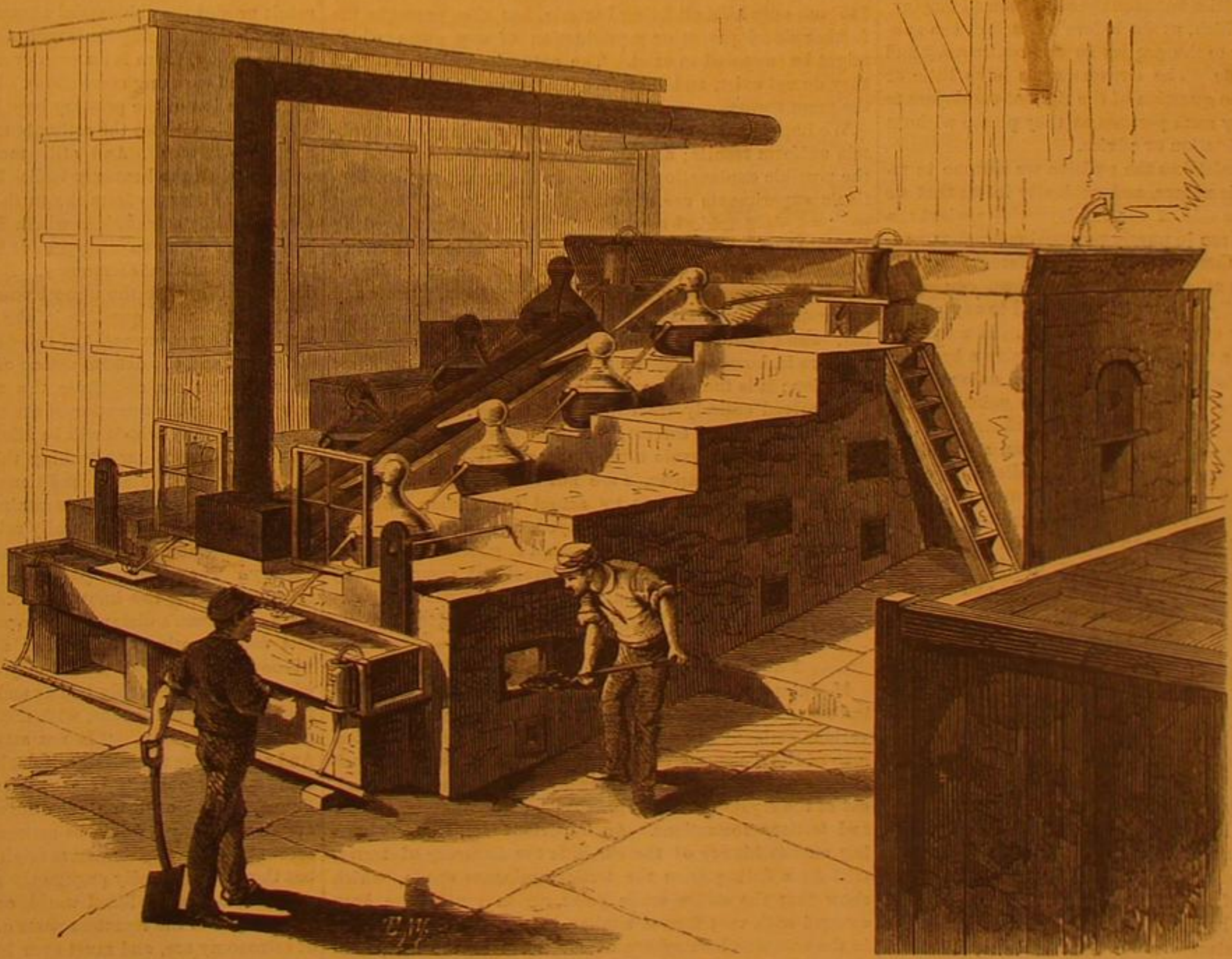
Now the production of sulphurous acid is a very cheap and easy matter. All we have to do is to burn sulphur in the air; and there are few of us in the habit of using the ordinary sulphur match who are not fairly acquainted with its production on a small scale, and also with one of its properties when it has reached the nostrils.

The cheap production of sulphurous acid, then, being taken for granted, means must be found, at once easy and economical, to oxydize it into sulphuric. The French endeavored first to effect this by burning sulphur in glass globes, the interior surfaces of which were kept moistened with water; but the product of sulphuric acid was found to be very small. Sulphur, when burning even in pure oxygen, will not oxydize to sulphuric acid, except to a very limited extent, neither will free sulphurous acid take up any more oxygen from the air, although there may be plenty around it and to spare.

We are indebted to the English, though the suggestion is said to have been first made by two French chemists, Lefevre and Leméry, for the next great improvements on which the present manufacture of sulphuric acid is founded. Dr. Ward, of England, found that, by introducing niter or potassium nitrate into the burning sulphur, the product of acid was largely increased. His apparatus consisted of large glass vessels holding from forty to fifty gallons. These were placed in two rows in beds of sand, and a few pounds of water poured into each. Stoneware pots were first introduced into the necks of these glass vessels, and afterwards a red hot ladle, into which was thrown a mixture of sulphur and niter, placed in each pot. The necks were then closed with wooden stoppers. The sulphurous acid from the burning sulphur was found to be oxydized by the nitrous fumes from the ignited saltpeter, and the resultant, sulphuric acid, was absorbed by the contained water at the bottom of each glass vessel. Sulphuric acid made in this way sold for from 30 to 50 cents per pound in our currency. Its price is now about one penny per pound in England, and with us ranges from $2\frac{1}{2}$ to 2 cents. The great cost of the acid made by Ward's process, as compared with the price at the present time, was owing to the necessarily limited size of the apparatus, being made of glass, and the high price of the niter used.

It was not until Dr. Roebuck, of Birmingham, England,

(Continued on page 114.)



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THAT "DASTARDLY OUTRAGE" AGAIN.

We have been recently favored with a lengthy epistle from Mr. John Fehrenbatch, the author of a letter lately commented upon by us, relating to alleged grievances of workmen in the works of Messrs. Stearns, Hill, and Co., of Erie, Pa. The present document is little more than a repetition of the personal difficulties between the above named employers and their men, which, as we before remarked, is a subject interesting solely to the parties in the controversy and in no wise to the public. The circumstances have little or no bearing on the main question of the right of employers to hire or exclude exactly such persons as they please without resorting to outside dictation or advice.

Our correspondent mistakes the position we assume in regard to troubles of this nature, and evidently infers that we desire to champion the side of the employers as against the men in all cases and even in purely personal misunderstandings. We deal with these questions with reference to their effect upon one or the other of the great classes, employers or employed, impartially, and not with regard to any particular set of men or any especial establishment. If a concern treats its workmen in a manner calculated to give a basis for the generally unfounded assertions of trades' union demagogues, we endeavor by well meant advice to point out the fallacy and inexpediency of such a course; and similarly, on the other hand, we do not hesitate to condemn any body of workmen who, by attempts at intimidation or dictation, cause employers generally to adopt stringent measures calculated to restrict their privileges or injure their interests.

The letter before us includes an extract from a speech of the President of the International Union, in which the employers in question are stigmatized as "pirates and robbers of the rights of labor." This is not the way to bring about the amicable adjustment of any trouble. In our opinion, a wiser course would be to counsel moderation and proper respect for the rights of others.

SPONTANEOUS GENERATION.

All experiments thus far made with infusions of different substances, for the purpose of producing infusorial animalculæ, appeared to prove that the access of air was necessary for their formation. Pasteur, who has extensively occupied himself with these investigations, found at last that the germs of these animalculæ could, under certain circumstances, resist a temperature of 212° Fahr., as he obtained bacteria from solutions which had been previously boiled and afterward came only in contact with air which had been dried and purified by passing it through red hot pumice stone.

However, in 1869, Dr. H. Charlton Bastian took the matter up, and commenced trying if he could not produce animal life in a vacuum. He experimented with various fluids, especially infusions of hay and turnips; he placed them in one ounce flasks, having narrow drawn out necks, and heated the solutions in them rapidly till they commenced to boil over, so as to be sure that all air was expelled; then he kept them boiling for from a quarter to half an hour, while the steam was escaping with some force; then the neck was sealed up by melting the glass with a blowpipe flame, while at the same time the heat was withdrawn. In this way he produced after some practice a perfect vacuum, that is to say, one where air was excluded, and only watery vapor present. The proof of this was that the water hammer effect was quite obvious; this means that the water could be made to fall with a shock from one end of the tube to the other, without passing an atmospheric bubble, as is the case when air is present. When the little flasks were thus prepared, they showed the development of bacteria and other minute moving organisms just as well as if they had not been submitted to great heat, and air had access. The time required for this phenomenon varied from a few hours to several days. Even when the flasks, after being closed, were submitted for several hours to boiling water, the organisms appeared; and Dr. Bastian went even so far as to submit them for four hours to a temperature of 300°, and about 6 in excess, without preventing the subsequent development of the animalculæ. He reasoned then as follows: As the germs cannot come from the air and pass through the glass, only one of two conclusions is admissible. 1. That the invisible germs of the animalculæ are able to stand a heat of 306° without being killed; or (2) that living things can be evolved from nonliving matter.

The first conclusion is that of Pasteur, and is based on the assumption of the old maxim *omne vivum ex ovo* (all life comes from an egg), deduced from the fact that it is known to be true for all the higher animals and plants, and that its extension to the lower forms of life, which are intermediate between animal and vegetable, is supposed to be a legitimate deduction on the ground of natural law.

The second conclusion is that defended by Dr. Bastian; he maintains that the doctrine of evolution, now established by an overwhelming weight of evidence, absolutely requires that living matter must at some time have arisen from that which was not living, and that, in absence of any reason to the contrary, the uniformity of natural law should lead us to believe that the process continues to take place. He says that all analogy is against the possibility of the assumed germs retaining their life after being subjected to a heat of over 300°. No living being that we know of can endure the heat of boiling water, 212°, except a few seeds of the higher plants, which are protected by a very hard and nonconducting coat. Most animals and plants, indeed, perish at a much lower temperature. With regard to the bacteria themselves, they are mere specks of naked protoplasm; they are utterly destroyed at 140°, as sufficiently proved by the numerous experiments made by Pasteur, Bastian, and others. It is unlikely, therefore, that they should have germs capable of enduring 306°.

Experiments were also made by Dr. Bastian with fluids capable, after being boiled, of nourishing bacteria when any were put into them, and of supporting their copious reproduction, though not evolving them anew when enclosed in hermetically sealed vessels. The uniform result was that 140° not only kills all living bacteria, but also prevents the further development or reproduction of any germ which might be supposed to exist. The natural conclusion is that they do not exist, and therefore these experiments exploded the germ theory.

We hope that these investigations will continue so as to obtain uniform results; as only then can a full discussion of the possible explanations ensue. In the meantime, Dr. Bastian's experiments are drawing the attention of the most eminent philosophical naturalists. For instance, Alfred R. Wallace ranks Bastian's book as equal in value to Darwin's "Origin of Species," or Spencer's "Principles of Biology," especially in regard to "curious and novel facts," "new and astounding views of the origin of life," "excellent reasoning," and "acute criticisms."

There is, however, one point to which we wish to draw attention; it is the assumption that these living organisms are evolved entirely from inorganic matter. This, we believe, is not strictly correct; the infusions all have organic origin; they are organic compounds, and it is well known that the organic compounds are not decomposed into their inorganic elements, except by actual combustion. Starch, sugar, gelatin, etc., are not destroyed, as such, by a temperature of 300°, therefore, if we attempt to generate living organisms from inorganic matter, we must not commence by using organic substances, but must confine ourselves to elements, or their simple inorganic chemical combinations.

RECENT GEOLOGICAL INVESTIGATIONS.

M. Jules Marcou communicates some interesting geological notes to the French Geographical Society, gathered from various eminent sources, while preparing a new geological map of the globe, recently forwarded to the Vienna Exposition. In Spitzbergen, M. Nordenskjold has found (independent of the crystaline rocks) palæozoic, carboniferous, triassic and tertiary formations. An important fact, from its bearing on the history of the earth, is the discovery of terrestrial flora dating from the tertiary miocene epoch, which show that the entire arctic polar region must have been covered with vast forests similar to those which now exist in the northern hemisphere as far north as the borders of the tropic of Cancer. In Norway, peat deposits have been found in Andae Island one of the Loffoden group, which, like similar beds in Yorkshire, England, are of the jurassic epoch. The existence, in Russia, of an enormous triassic formation has been determined; this had, heretofore, by Sir Roderick Murchison and others, been attributed to the Permian system. In Syria and Egypt, continuous and extensive deposits of red sandstone indicate the homogeneous nature of the rocks of Asia and Africa. On the other hand, the most recent geological studies, made in New Zealand, Australia, and some of the Pacific islands, prove that Madagascar, in spite of its proximity to the African continent, appears to belong to a totally distinct formation which closely resembles that of New Zealand and Western Australia. In South America, MM. Musters and Pourtalès have found a group of extinct volcanoes between the Gallegos river, Cape Virgin and the eastern entrance of the Straits of Magellan.

M. Marcou considers the classification of stratified rocks, as generally laid down in modern geological treatises, as very imperfect and not justified except in a portion of the northern temperate zone. In the West Indies and California, and on the Missouri river, he states that the difficulties of classification augment in proportion as new discoveries are made. In the first mentioned part of the globe, for example, Dr. Waagen has found, in beds of limestone a foot and a half thick, forms of fossils which are generally distributed in very different deposits, and which are supposed to belong to carboniferous, triassic and jurassic rocks. These evidences are not accidental, but are multiplied in Nebraska, Illinois, California, Australia, and even in New Zealand.

THE BASE LINE OF ASTRONOMY.

When a land surveyor wishes to find the distance between two points, separated by an obstacle to direct measurement, say an impassable swamp or a sheet of water, he resorts to triangulation. To the right or left of the line to be determined, he lays off another line, from the extremities of which he takes the compass bearings of the points whose distance from each other he wants to learn. The angles thus found, together with the length of the measured line, are all the data needed for calculating the length of the required line. In extensive surveys, this principle of triangulation is used almost exclusively. A single base line is measured with great accuracy, and all the other distances in the survey are calculated by means of a series of triangles erected on it. The correctness of the entire work depends, consequently, on the exact determination of the length of the primary line. If there be an error in this, the utmost care in all subsequent observations and calculations cannot prevent the survey from going wrong. Hence the minute precautions always taken in choosing the site and determining the exact position of the base line, in reducing it to a perfect level and in finding its length to the minutest fraction, precautions involving the utmost niceness of instrumental construction, the utmost care and patience in observation and calculation, and repeated measurement, occupying months of time.

If the exact survey of a State or a strip of coast line is worthy of so much preliminary care and cost, how much more so is the survey of the universe! In surveying the earth, it is possible at any time to test the correctness of the work by measuring a new line and comparing its length thus found with the length obtained by calculation. In the survey of our Atlantic coast, for example, such a test line was measured on an island in Chesapeake Bay, the original base line lying on Mount Desert Island off the coast of Maine; the result proved the substantial accuracy of the entire work of triangulation covering the larger part of seven or eight States. In astronomy, there is no such ever present means of testing results and ensuring correctness. Everything hinges on the determination of the primary base line, so that any error in it inevitably vitiates the estimate made of every other astronomical distance. And still more, the dimensions and weights of all the heavenly bodies beyond the moon, not less than their distances from the earth and from each other, are determined by calculations which involve the astronomical base line as a known element. It is the foundation, in fact, of all mathematical astronomy. Hence the importance of its determination with the utmost possible accuracy.

The base line in question is the sun's distance from the earth. The measurement of this distance with all attainable exactness, and the determination of the maximum limit of unavoidable error, constitute the most important problem now engaging the attention of the astronomical world. The rare opportunity which will be afforded by the approaching transits of Venus for attacking this fundamental problem, under the most favorable conditions and with all the improvements in means and methods attained by modern science and mechanical skill, very naturally raises those phenomena to the highest rank among the astronomical occurrences of the century. They cannot pass without furnishing data for greatly reducing the known inaccuracy of the current estimate of the sun's distance, and consequently for a more correct determination of all other astronomical magnitudes. "Known inaccuracy!" some may exclaim, especially those whose ideas of heavenly bodies and spaces have been gained from ordinary text books, with their positive statements and professed precision. "Is not astronomy an exact science? And are not the magnitudes it deals with known with mathematical exactness?" If they were, the coming transits of Venus, instead of being scientifically the most momentous events of the age, would be matters of comparatively small account. A few astronomers might make a note of them, but they would hardly engage the attention of all the governments of the civilized world, or give occasion for costly expeditions to the remotest parts of the globe. The figures of astronomy are, and must ever be, approximations to the truth. The question is how small can the margin of error be made.

At present the limits of error, in the measurement of the line on which all other astronomical measures depend, are so far apart that sixty worlds like ours, standing side by side, would not be sufficient to fill the gap. As a consequence, there is an uncertainty of at least four thousand miles in the exactest estimate of the sun's diameter, or some hundreds of millions of cubic miles in his calculated volume; and every other magnitude beyond the moon is proportionately indeterminate.

Ten years ago the accepted figures were very much farther from the truth. For forty years, Encke's estimate of the sun's mean distance, deduced from the observations of the transit of Venus in 1761 and 1779, that is, in round numbers 95,000,000 miles, had held its ground; but so many lines of evidence converged to prove those figures too great that astronomers could not refrain from making the enormous reduction which took the general public so much by surprise about a decade ago. Noticing this astronomical change of base, Sir John Herschel wrote: "The superficial reader (one of a class too numerous) may think it strange and discreditable to science to have erred by nearly four millions of miles in estimating the sun's distance. But such may be reminded that the error of 0·32" (thirty-two hundredths of a second) in the sun's parallax, on which the correction turns, corresponds to the apparent breadth of a human hair at 125 feet, or of a sovereign at 8 miles off."

It is on such minute measurements that the approximate exactness of astronomy depends. The limit of probable error in the latest and most satisfactory determination of the sun's distance is somewhere about half a million miles, say one eighth part of the last correction. We may leave it to the reader to calculate how extremely delicate the observations of the coming transits must be to effect any considerable reduction in this apparently great but relatively minute inexactness.

EFFLUX OF STEAM.

If a fluid issues through an opening, without friction, the velocity of its flow will be the same as it would acquire in falling through a hight due to its pressure. For instance, suppose that steam at atmospheric pressure flows into a vacuum. Steam at atmospheric pressure, or 14·7 pounds per square inch, will have a pressure of $14·7 \times 144 = 2116·8$ pounds on the square foot. A cubic foot of steam, at this pressure, weighs about 0·0364 pounds, so that the hight of a column of steam, necessary to produce this pressure per square foot, would be $2116·3 \div 0·0364 = 58153$ feet. The velocity acquired by a body in falling through this space is found by extracting the square root of $64·32 \times 58153$. This gives 1934 as the velocity in feet per second with which steam at atmospheric pressure will flow into a vacuum, if there be no frictional resistance. In practice, it is found that when a fluid is discharged through an orifice or tube, the actual velocity is less than the theoretical, so that a coefficient of correction is necessary in using the theoretical formula. Numerous experiments have been made upon the velocity of discharge of water, air and steam, those upon water being the most extended and reliable. It is difficult, when experimenting with steam, to maintain a constant pressure, and the velocity is so great that it is not easy to make an exact measurement. For these reasons, the results of different experimenters vary greatly. In this article, we shall endeavor to give the most accurate results that have been obtained.

There is one case, in the flow of water, in which the actual velocity of discharge varies but little from the theoretical. We refer to that in which the water flows through a mouthpiece shaped to the form of the contracted vein. This mouthpiece has a length about equal to the diameter, and is constructed with a bell shaped mouth, its diameter being decreased at the middle of its length to about eight tenths of its original size. Experiments with this kind of mouthpiece in the case of steam, however, show varying coefficients of velocity for discharges under different pressures. The table given below will illustrate this.

TABLE OF COEFFICIENTS OF THE VELOCITY OF DISCHARGE OF STEAM INTO THE ATMOSPHERE, THROUGH A MOUTHPIECE HAVING THE FORM OF THE CONTRACTED VEIN.

Pressure in pounds per square inch above atmosphere.	Weight per cubic foot.	Coefficient.
1	0·0396	0·93
5	0·0510	0·85
10	0·0598	0·78
20	0·0815	0·71
30	0·1025	0·69
40	0·1232	0·68
50	0·1436	0·67
60	0·1636	0·66
70	0·1833	0·65
80	0·2030	0·64
90	0·2224	0·63
100	0·2410	0·62

These coefficients have been determined experimentally for orifices varying from four tenths of an inch in diameter up to one and a half inches. We will now explain how to use them, illustrating by an example.

The expression for the theoretical velocity is $v = \sqrt{2gh}$, or the velocity of discharge in feet per second is equal to the square root of twice the acceleration due to gravity multiplied by the hight due to the effective pressure. The actual velocity is equal to the theoretical velocity multiplied by the proper coefficient.

EXAMPLE: With what velocity will steam at a pressure of 50 pounds by steam gage issue into the atmosphere through a mouthpiece having the form of the contracted vein? Answer: $50 \times 144 = 7200$ pounds pressure per square foot. $7200 \div 0·1436 = 50139$ feet = hight due to pressure. $\sqrt{64·32 \times 50139} \times 0·67 \times 1203$ = velocity of efflux in feet per second. Corrections can be applied to the coefficients given in the preceding table, to adapt them to other cases than that in which the steam issues through a mouthpiece having the form of the contracted vein.

For a tube having rounded edges, and a length equal to once and a half the diameter, deduct 0·03 from the coefficient for any given pressure. For a tube with square edges, and a length from once and a quarter to twice and a half the diameter, deduct 0·13 from the coefficient. For a plain tube whose length is 12 times the diameter, deduct 0·24 from the coefficient. When the length of the tube is 24 times the diameter, deduct 0·28 from the coefficient.

To find the velocity of efflux through an orifice in a thin plate, the thickness of the plate being not more than one tenth the diameter of the orifice, correct the coefficients given in the table as follows: Deduct 0·36, when the pressure does not exceed half a pound per square inch. Deduct 0·21 when the pressure is equal to one atmosphere.

We will give an example in one of these cases, as it will illustrate the method of proceeding for all: Suppose steam of 40 pounds pressure per gage issues through a pipe one inch in diameter and twenty-four inches long, what is its velocity? Answer: $40 \times 144 = 5760$ pounds pressure per square foot, and $5760 \div 0·1232 = 46753$ feet, hight due to pressure.

$\sqrt{62·32 \times 46753} \times (0·68 - 0·28) = 694$, velocity of efflux in feet per second. The preceding constants were determined experimentally by Mr. George Wilson, of England. It will be observed that they apply to orifices from four tenths of an inch to one and a half inches in diameter, and having lengths from one tenth to twenty-four times the diameter, the experiments having been made on the efflux of steam through orifices varying within these limits. Approximate formulas, for general use, have been established by the late Professor Rankine, and we will give these, illustrating them by examples.

Case 1: When the pressure of the medium into which the steam flows is less than three fifths of the pressure in the reservoir, the number of pounds of steam discharged through a pipe or orifice is found by multiplying the area of the pipe (in square inches) by the pressure of steam in the reservoir, and dividing the product by 70. Example: How much steam will be discharged from a boiler into the atmosphere, through a 3 inch pipe, the pressure per gage being 15 pounds? Answer: Here the absolute pressure in the boiler is $15 + 14·7 = 29·7$ pounds per square inch, and the area of the pipe is 7·07 square inches. Hence the quantity of steam discharged per second will be $(29·7 \times 7·07) \div 70 = 2·99$ pounds. The volume of this steam will be $2·99 \div 0·0707 = 42·4$ cubic feet, and the velocity of discharge in feet per second will be found by dividing the volume by the area of the pipe in square feet. This gives the velocity: $42·4 \div 0·0492 = 864$ feet per second.

Case 2. When the pressure of the medium into which the steam is discharged is more than three fifths of the pressure in the reservoir, the number of pounds of steam discharged per second is found as follows: Multiply the area of the pipe (in square inches) by the product of the external pressure divided by 42 and the square root of the difference of the internal and external pressures divided by two thirds of the external pressure. Example: Steam of 5 pounds pressure, per gage, is discharged through a 2 inch pipe into the atmosphere. Absolute pressure of steam in boiler $= 5 + 14·7 = 19·7$ pounds (absolute external pressure $= 14·7$ pounds). Area of pipe $= 3·1416$ square inches. Applying the rule, we find the quantity of steam discharged per second $= 3·1416 \times (14·7 \div 42) \times \sqrt{(19·7 - 14·7) \div (\frac{2}{3} \times 14·7)} = 0·785$ pounds. The volume of this steam is $0·785 \div 0·0487 = 16·1$ cubic feet, and the velocity of discharge is $16·1 \div 0·0218 = 739$ feet per second, 0·0218 being the area of the pipe in square feet.

With the formulas given above, our readers will be able to solve nearly any question that may arise regarding the efflux of steam, with sufficient accuracy for most practical purposes.

EZEKIEL PAGE.

We regret to hear of the demise of Ezekiel Page, formerly of Boston, Mass., inventor of the machine for turning oars. Mr. Page's name has been associated with this particular branch of industry for more than a generation; and at one time he possessed the only factory in the world wherein oars were made by machinery. Indeed at the present day the chief business connected with the oar trade in this country remains in the hands of the Page family. The manufacture has been so perfected that little chance remains for improvement. It is difficult to obtain a poor article from any concern where the Page machinery is used, because the mechanism never slights its work, but imparts true and exact proportions to every piece of lumber. Clumsy ill-shaped oars must be looked for in shops where the labor is done by hand.

Ezekiel Page's first improvement in this line was patented in 1842, for a new method of sawing out the oar lumber. The old method was to saw the logs into square sticks equal in size to the width of the oar blade, one oar being cut from one stick. By giving a peculiar movement to the carriage of the saw machinery, Page was enabled to get two oars out of the same block. He produced two blades where only one before was made. This gave him the oar monopoly and entitled him to rank as a benefactor of the race. His name will be for ever honored by every loyal boatman.

Page's next improvement, patented in 1845, was a mechanism for producing the swell on the oar handle. This he accomplished by means of a contrivance for moving the slide rest of the lathe, in such a manner as to compel the cutters to shape the wood to the exact form required.

Ezekiel Page, at the age of 62 years, rests from his labors. He never made much noise in the world, and yet he contributed, for the use of his fellow men, a discovery of immense economical importance. Think of the millions of oars now used in all parts of the world, and then remember that he taught us how to double the number out of the same piece of wood.

There is one other legacy that he has left us, more precious even than his useful inventions. It is the record of a generous, upright, amiable and well-spent life. Ezekiel Page was an honest man.

Friction of Water in Pipes.

In our article on this subject, on page 48 of the current volume, the formulas should have been printed as follows:

1. Prony's formula:
$h = 0·00040085 \times (L \div d) \times [(v + 0·15412)^2 - 0·02375]$.
2. Brooklyn Water Commissioners' formula:
$$h = 0·00046749 \times (L \div d) \times (v + 0·397)^2.$$
3. Lane's formula:
$$h = 0·000625 \times (L \div d) \times v^2.$$

We republish them, as, separated from the verbal explanations given in the article, they might be misunderstood.

SCIENTIFIC AND PRACTICAL INFORMATION.

BLACK VARNISH FOR ZINC.

Professor Böttger prepares a black coating for zinc by dissolving 2 parts nitrate of copper and 3 parts crystallized chloride of copper in 64 parts of water, and adding 8 parts of nitric acid of specific gravity. This, however, is quite expensive; and in some places, the copper salts are difficult to obtain. On this account Puscher prepares black paint or varnish with the following simple ingredients: Equal parts of chlorate of potash and blue vitriol are dissolved in 36 times as much warm water, and the solution left to cool. If the sulphate of copper used contains iron, it is precipitated as a hydrated oxide and can be removed by decantation or filtration. The zinc castings are then immersed for a few seconds in the solution until quite black, rinsed off with water, and dried. Even before it is dry, the black coating adheres to the object so that it may be wiped dry with a cloth. A more economical method, since a much smaller quantity of the salt solution is required, is to apply it repeatedly with a sponge. If copper colored spots appear during the operation, the solution is applied to them a second time, and after a while they turn black. As soon as the object becomes equally black all over, it is washed with water and dried. On rubbing, the coating acquires a glittering appearance like indigo, which disappears on applying a few drops of linseed oil varnish or "wax milk," and the zinc then has a deep black color and gloss. The wax milk just mentioned is prepared by boiling 1 part of yellow soap and 3 parts Japanese wax in 21 parts of water, until the soap dissolves. When cold, it has the consistency of salve, and will keep in closed vessels as long as desired. It can be used for polishing carved wood work and for waxing ballroom floors, as it is cheaper than the solution of wax in turpentine, and does not stick or smell so disagreeable as the latter. A permanent black ink for zinc labels is prepared by dissolving equal parts of chlorate of potash and sulphate of copper in 18 parts of water, and adding some gum arabic solution. The black polish above described is recommended as permanent and capable of resisting quite a high temperature.

MANUFACTURE OF CHLORATE OF POTASH.

To manufacture chlorate of potash on a large scale, it has been recommended by W. Hunt to adopt the following method: Milk of lime is made to trickle down over bricks, placed in a tower where it comes in contact with a continuous current of chlorine gas. Chlorate of lime is the chief product, and, by treating this with chloride of potassium, chlorate of potash is formed, which can be purified by crystallization.

YELLOW GLASS FOR PHOTOGRAPHIC PURPOSES.

The following simple method of testing the actinic properties of yellow glass for dark rooms is by Le Neve Foster, and the only apparatus required is a cheap glass prism. When a strip of white paper is placed on a dull black surface and looked at, through the prism, by daylight, it has the appearance of the rainbow, showing a complete spectrum. On bringing the yellow glass in question between the prism and the strip of white paper, those colors which are absorbed by the colored glass disappear. If on looking through the prism any blue or violet rays are seen, it is certain that the glass transmits the chemical rays and hence is unfit for photographer's use. If only red and yellow be seen, it is non actinic.

TESTING SULPHATE OF ALUMINA.

Sulphate of alumina frequently contains an excess of acid which injures it for use in dyeing. Whether the sulphuric acid be present in excess is easily ascertained by stirring the pulverized salt into alcohol, which dissolves the free acid but not the salt. It is then only necessary to filter the solution and test for acid with litmus. The amount of sulphuric acid can also be obtained volumetrically. Pure sulphate of alumina produces with a decoction of campeachy wood a dark violet or purple color. If free acid be present, the color is browner.

PROGRESS OF THE HOOSAC TUNNEL DURING THE MONTH OF JULY, 1873.—East end section: Heading completed December 12, 1872. Central section: Heading advanced westward, 151 feet. West end section: Heading advanced eastward, 137 feet. Total advance of headings during month, 288 feet. Length opened from east end westward, 14,225 feet; length opened from west end eastward, 9,677 feet. Total lengths opened to August 1, 1873, 23,912 feet. Length remaining to be opened August 1, 1,119 feet.

ALBUMEN EXTRACTED FROM MILK.—Schwalbe has found that if oil of mustard be added to cow's milk in the proportion of one drop to 1·1 drams, the milk does not coagulate even after being kept for a considerable period: but that the caseine is transformed into albumen. If this discovery, says *Les Mondes*, is confirmed, it will be of considerable importance in the printed fabric industry.

SQUEAKING BOOTS AND SHOES.—To prevent the soles of boots or shoes from squeaking, says the *Shoe and Leather Chronicle*, rasp, with a coarse rasp, the outsole and insole, and every other piece of leather that comes in contact in friction by the action of the foot. Then apply freely good wheat or rye paste. If this is well attended to from heel to toe, the boot or shoe will not squeak.

COLT'S FIREARMS COMPANY has just received an order for 80,000 pistols. Smith & Wesson have commenced work upon 20,000 Russian pistols, and will make about 150 daily.

[*Continued from first page.*]

in 1786, substituted large chambers of lead for the glass vessels used by Ward, that the manufacture of sulphuric acid on the large scale, and at a greatly reduced price, became an established fact. It was found that, in working these chambers, a comparatively small quantity of niter could convert a very large amount of sulphurous acid into sulphuric, and chemists consequently set themselves to study the reactions that took place.

THE SULPHUR BURNERS.

There is a compound of nitrogen, known as nitrogen tri-oxide, N_2O_3, that is, 2 atoms of nitrogen combined with 3 atoms of oxygen, which will yield up at once, to sulphurous acid, one atom or equivalent of oxygen, just sufficient to oxidize the sulphurous into sulphuric acid. This nitrogen tri-oxide, having lost one atom or equivalent of oxygen, will take up its lost oxygen from the air, if mingled with it, and again deliver up its oxygen to another portion of sulphurous acid, and so on *ad infinitum*, acting as a carrier of oxygen from the air to the sulphurous acid. All that we have to do, then, is to mix sulphurous acid gas, air, and nitrogen tri-oxide with some steam, the water of which is an essential ingredient in sulphuric acid, in a suitable vessel, to obtain all the oil of vitriol needed. On the large scale this is one of the most complete and interesting operations of practical chemistry.

On entering chemical works, where oil of vitriol is made, our attention is first directed to the

SULPHUR BURNERS.

These consist of small furnaces built of brick, a section of one of which is shown in the illustration above. Their sizes and number are regulated by the amount of sulphur proposed to be burned in a given time. The bed of each burner consists of an iron plate, termed a burner plate, on which the combustion of the sulphur takes place, and underneath which there is a flue (as seen in the illustration, connected in the rear with the chimney or shaft). Through this flue and underneath the burner plate, a constant current of air circulates. Its object is to regulate the heat of the plate, which might otherwise become so hot as to volatilize the sulphur. Each furnace is provided with a door, closed with an iron shutter but sufficiently loose to allow enough air to enter to completely oxidize the sulphur which burns into sulphurous acid. Into each burner the workman throws at intervals a shovelful of brimstone, as the crude material is sometimes termed. The moment this is done, he takes up an iron receptacle about a foot long, and 4 or 5 inches wide and deep, termed a niter pot. This is rapidly filled about half full of nitrate of soda, and covered to the depth of an inch or two with oil of vitriol from an earthenware pitcher at his side. The niter pot being charged at the mouth of the burner, the workman pushes it with a two pronged iron fork into the now glowing sulphur to about the middle of the furnace. The door is closed, and the same operation repeated with each burner until all are charged.

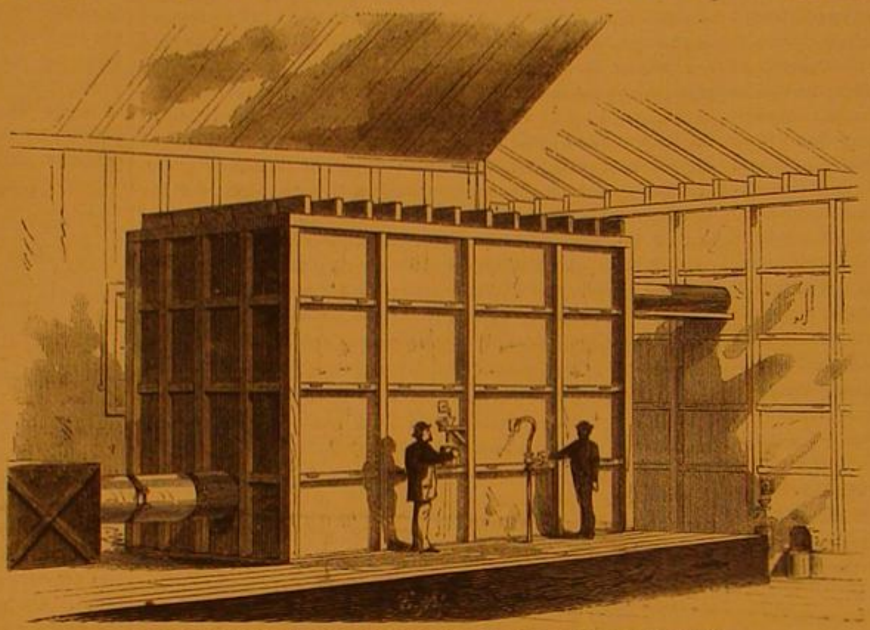
NITER POT AND FORK.

We have seen how necessary nitrogen tri-oxide is in the oxidation of sulphurous into sulphuric acid. This nitrogen tri-oxide, however, is not at once produced. The fumes from the niter pot, from the action of the oil of vitriol upon the nitrate of soda, consist of nitric acid, NO_5. But in the chamber this nitric acid yields up nearly all its oxygen to the sulphurous acid, becoming reduced to NO, or nitric oxide. This nitric oxide, meeting with the air in the chamber, abstracts oxygen, becoming nitrogen tri-oxide, N_2O_3, which we have considered as the carrier of oxygen from the air to the sulphurous acid.

Although sulphur is almost exclusively employed in this country as the source of sulphurous acid, in England very large quantities of iron bisulphide, known as iron pyrites, are used. The mineral being often a bright, brassy looking ore, is sometimes termed fool's gold, from the fact that many inexperienced persons are deceived by its appearance. Where it occurs in large beds or veins, and especially when it contains a small percentage of copper, it may be economically utilized as a source of sulphurous acid. This is the case at Anthony's Nose, on the Hudson river, where chemical works were erected a few years ago by Mr G. W. Gesner, a manufacturing chemist of New York, for the purpose of utilizing an extensive bed of pyrites that occurs in the hills close by. This deposit of ore was originally developed in the hopes of finding copper, but the great mass of the ore is hard, compact iron pyrites. In the production of sulphurous acid, it is burned in high, narrow furnaces. When once kindled, the mineral contains sufficient sulphur to support its own combustion. The workman has only to keep the ore well stirred up or " tickled " at intervals, the ore being supplied to the furnace by a door at the top, and the residue, when the burning is completed, carefully raked out from the bottom. From the sulphur burners, then, or from the pyrites kiln, let us follow the mixed sulphurous and nitrous fumes, through a flue, seen on the left in the illustration, to the

LEADEN CHAMBERS.

Here we have an immense room or series of rooms, whose top, bottom, and sides, are constructed of 5 lbs. sheet lead, or lead that weighs 5 lbs. per square foot. The walls and top are sustained by a framework of wood, to which they are fastened at intervals by leaden straps, fixed to the chamber, and overlapping the wooden frame, while heavy columns of wood or iron beneath serve to support the great weight of the structure above. The room under the chambers contains the bins for the storage of the sulphur and niter used. Lead is used in the construction of the chambers, because sulphuric acid has but little oxydizing effect on it except at a high temperature, but no solder can be employed in joining the sheets, because this soon gives way. The heavy sheets of lead must be cemented at their edges in some way that will make a tight, strong joint, and one that the acid cannot eat through. This is done by melting the edges of the sheets together by means of a blowpipe, done by men technically called lead burners. The lead burner is supplied, through long flexible tubes, with a current of hydrogen gas and one of atmospheric air. The hydrogen is generated in the usual manner, by the action of dilute sulphuric acid on metallic zinc, and the air is supplied from a pair of bellows, operated by an attendant. To avoid any risk of explosion, the gases are mixed just before combustion in the blowpipe itself. The combustion of the mixed hydrogen and atmospheric air gives rise to a very hot flame, by means of which the lead burner melts the clean edges of the soft metal together, making a joint that will last as long, of course, as the lead itself. Considerable practice and skill are required in the operation, and a horizontal joint is made more easily than a vertical one.



MANUFACTURE OF OIL OF VITRIOL. THE LEADEN CHAMBERS.

Steam is admitted into the chamber, by a small pipe, fitted with a stopcock, as seen with the attendant in the illustration. Finally, we have a vast space inclosed on all sides with lead, and filled with dense suffocating fumes of sulphurous acid and nitrogen tri-oxide, mingled with the more harmless vapor of water and atmospheric air. Here take place the chemical transformations previously shown, and here the production of sulphuric acid goes on uninterruptedly night and day, to the extent, in the largest works, of thousands of gallons daily.

The capacity of some of these chambers, the largest of which are found in England, is worth noting. Mr. Scholefield, of Bradford, near Manchester, has a chamber 70 feet long, 35 feet wide, and 35 feet high, with a capacity of 85,750 cubic feet. At Spence's chemical works, Newton Heath, England, there is a chamber 75 feet long, 40 feet high, 50 feet wide, containing, consequently, 120,000 cubic feet, or room enough to inclose two or three good sized houses. Muspratt Brothers and Huntley, at Flint, North Wales, have a chamber 140 feet long, 24½ feet wide, and 19½ feet high.

Fixed to the side of the chamber, and shown in detail in the illustration, we have a drip for testing gravity. This consists of a leaden receptacle, into which the acid formed in the chamber trickles or drips, through a pipe perforating it. The acid is caught by means of a trough or spout running along the interior side of the chamber, and is tested, when received, as to its specific gravity by a hydrometer. The acid formed in the chambers falls with the condensed steam, and collects on the bottom or floor. This liquid has a specific gravity of 1·55, stands at 45° Baumé's hydrometer, and is known as 45 or chamber acid. Containing 50 per cent real acid, it is frequently used for various purposes, as the manufacture of superphosphate of lime. Its concentration, however, as we shall presently see, is generally carried much further.

DRIP FOR TESTING GRAVITY

We have seen how the nitrous fumes, or nitrogen tri-oxide, act the part, simply, of a carrier of oxygen from the air to the sulphurous acid. Theoretically, then, when once the chambers contained the requisite amount of nitrogen tri-oxide, this should suffice for the oxidation of an unlimited amount of sulphurous acid. Practically, however, from 6 to 10 per cent of niter, in proportion to the sulphur, is ordinarily required. This is owing to the fact of so much nitrogen tri oxide being carried up the chimney, or stack, with which the chambers are necessarily connected to maintain a draft through them. To save these fumes we have what are called

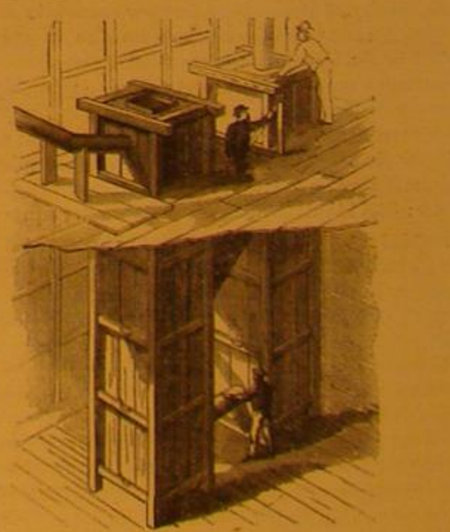
COKE COLUMNS,

or " Gay Lussac's Towers," from the name of the illustrious chemist and inventor. These consist of high narrow chambers lined with lead, and filled with pieces of coke, down through which oil of vitriol is caused to drip from the top. The towers are connected, as seen in the illustration, the first at the top with the end of the chamber, the second joined to the first at the bottom by a leaden flue, and finally the top of the second tower connected with the stack. The waste gases of the chamber, containing the nitrous fumes, are thus compelled to pass down the first tower and up the second, before escaping. In their passage, the oil of vitriol, trickling through the coke, largely absorbs the nitrous fumes, so that by this method the amount of niter used is reduced 50 per cent; the acid containing the nitrous compounds is then returned to the front of the chamber, where the heat is sufficient to liberate the nitrous fumes again.

To effect the first concentration of the chamber acid, it is run off into

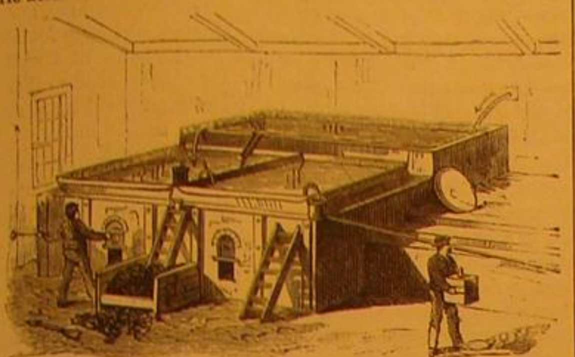
LEADEN CONCENTRATING PANS.

These are shallow leaden vessels, made of very stout sheet lead, and set in a furnace upon wrought iron plates, which receive the direct flame of the fue. Three, four, or more pans are generally used, and connected together by siphons. In the lead pans, the concentration is carried up to 60° Baumé and specific gravity 1·75, at which point, at the heat necessary for evaporation, the acid begins to attack the lead. This is termed 60 acid or pan acid, and is sometimes sold and used for various purposes. Neither the manufacturer nor the trader, however, is satisfied with this degree of concentration. From the lead pans, the acid is usually run off into platinum stills, where it is concentrated until it attains the specific gravity of 1·842 and stands at 66 Baumé, when



THE COKE COLUMNS.

it is called 66 acid or oil of vitriol. These beautiful white platinum stills are very expensive. A still capable of making 100 carboys, or 16,000 pounds, a day will weigh only 200 pounds, yet cost $20,000, or at the rate of $100 per pound. And yet platinum is the only available metal which will withstand the action of sulphuric acid, at the high degree of heat, 600° Fah., necessary for the manufacture of oil of vitriol, or 66 acid. Even this metal, in the course of time, becomes so thin at the bottom of the still that it must be patched or renewed. When a break occurs, it is sometimes soldered with gold. To avoid the large outlay of capital for a platinum still, various suggestions have been made as to the use of other materials, and various forms of apparatus have been devised for the final concentration of sulphuric acid.



LEADEN CONCENTRATING PANS.

Although glass has been tried, and used in England, we know of no apparatus more ingenious and effective than the

PATENT GLASS CONCENTRATING RETORTS

shown in the large illustration (front page), and now in successful use at the Phœnix Chemical Works, South Brooklyn, N. Y. Here we have eight glass retorts, each holding about five gallons, and each set in a separate sand bath, in furnaces charged from the side. The acid from the leaden pans enters by a siphon, the upper retorts of each set or series, and flows out, after attaining a certain hight, by a glass tube, into the next lower vessel. By the time the acid has reached the lower retort, it is concentrated up to strength, that is, 66° Baumé. It then flows out into a leaden pipe set in a trough of running water, where it is cooled to some extent, and whence it flows into shallow leaden pans to undergo a further reduction of temperature before it is packed for the trade. The goose neck of each retort is connected with a leaden pipe, seen in the illustration between the two series. This pipe joins a flue (seen on the left, rising from the lower end of the furnace) which conveys the mixed vapors of acid and water, evolved during the concentration, to a condensing chamber, also of lead, where the acid, which would be otherwise lost, is recovered.

Although of so fragile a nature, the inventor informs us that, with care and attention, it is not very often a retort breaks; he had not lost one during the last six months. When this does happen, however, means are provided in the shape of a channel, which runs under and communicates with each sand bath containing the retorts for the purpose of recovering all the acid possible and delivering it into a receptacle in front of the furnaces.

This apparatus of concentrating retorts is far cheaper than a platinum still. The glass retorts, with their furnaces and connections, capable of concentrating 100 carboys daily, will cost about $2,000, while a platinum still, capable of doing the same work, will cost $20,000.

We now follow the acid from the concentrating retorts to the cooling cisterns, where our illustration shows the workman

FILLING THE CARBOYS.

This is done by means of a leaden siphon, provided with a stop cock. Care is taken not to fill it quite full, otherwise the absorption of water from the air by the acid, in the

FILLING THE CARBOYS.

course of time, will cause an overflow. A carboy is a large blown glass bottle containing eight or ten gallons, packed in hay or straw and set in a square wooden box. The mouth is closed when full, to prevent spilling and access of air, as far as practicable, by a stopper of clay, which is covered with a common canvas rag, and the whole smeared outside with tar. This makes a primitive rough-looking package, and one extremely liable to accident and breakage; but the trade seems to be satisfied with it. An opportunity is here afforded for some ingenious inventor to make an improvement.

When once the glass is cracked or broken at the bottom, there is a sudden end of the carboy, as both straw and wood soon become converted into soft charcoal. These carboys are transported all over the country, and, when emptied, returned to the manufacturer, if not too distant, to be replenished.

The quantity of oil of vitriol annually manufactured in Great Britain amounts to about 200,000 tons, that made in the South Lancashire district alone exceeding 3,000 tons per week.

We are indebted to Messrs. Gridley & Coffin, proprietors of the Phœnix Chemical Works, and to Mr. Saunders, the superintendent, for facilities afforded in making the illustrations connected with our article.

NORWAY AND SWEDEN.

An esteemed correspondent, now traveling in Northern Europe, remarks as follows:

"Never could more dissimilar nations be united under one government than Norway and Sweden. Norway clings with the most absurd tenacity to old things and old ways of doing them, while Sweden is ready to advance with the rest of the world. The difference appears strikingly on the line of railroad between Christiania and Stockholm. The road is about 400 miles long, of which, say, 100 are in Norway and 300 in Sweden. The time for express trains is about 20 hours. Of this, something like 8 hours is taken for the Norwegian 100 miles, leaving 12 hours—really, only 11 hours—for the Swedish 300 miles, or 12 miles against 25 miles per hour. But most of the travel in Norway is by the very old fashion of carrioles and post horses, the principal roads—under government care—being in good order and the speed averaging, with push, six or seven miles per hour.

The American Consul in Christiania—which is the only live part of Norway—is trying hard to get our mowers and reapers into use there, though thus far with indifferent success. In Sweden, these things are being taken hold of with something like freedom. The Swedes are, evidently, a contriving and mechanical people, and in such things very much in advance of their neighbors. They are just the kind of people to be at home in America, and the very best kind of people America could have. In both countries, as well as in Great Britain, I heard the loudest kind of lamentation over the great emigration to America. Lack of laborers causes strikes and high prices, they say, and reduces the means of the old countries and the values at the same time. Land, generally, seems to have touched its highest point everywhere on this side the ocean, and to be falling with no little rapidity, and with an ever diminishing number of purchasers. Of course, I speak generally and not particularly. What shall we do about it? seems to be an absorbing question, in each of the countries through which I have passed. The story of success in America flows back from every pen; and those who remain, having friends who have gone before, are in nearly every case anxious only to get away themselves."

Origin of Plagues.

Dr. Tholozan, physician in chief to the Shah of Persia recently read a paper before the French Academy of Sciences on the origin of pestilence. It has been generally believed, he said, that the plague or eruptive fever was exclusively engendered in low, warm, and marshy regions, especially in the north of Africa and in Asia Minor. This opinion is, however, without foundation, and a large number of facts as well as the evidence of past inflictions, prove that the disease may originate in any latitude, under all climates and in all countries, however elevated. It is not a consequence of climate or meteorologic influence, nor even the necessary concomitant of unhygienic causes, however energetic. Famine, for instance, breeds typhus fever rather than the plague. This exclusion of all physical origin leads to the conviction that the malady is due to some animal ferment; the pest, in short, is an organic fermentation.

M. Tholozan added that he considered the deadly forms of pestilence so common in Kurdistan to be principally due to the intimate contact of the inhabitants with their sheep in unhealthy and badly aired cabins.

Shocking Accident.

J. E. E., of Pa., says that Miss Craft, a young lady from Beaver Falls, Pa., while in a flouring mill, was standing near two upright shafts that were revolving at the rate of fifty revolutions per minute, one of the shafts being covered with sticky corroded oil. Her dress, being of light material, touched and adhered to it; and instantly winding around the shaft, she was drawn between the two (they are only a few inches apart) which caught her flowing hair, then tearing the entire scalp from her head, to the eyebrows. One leg was badly fractured and she was much lacerated and bruised. She lies in a critical condition and her physicians have no hopes of her recovery.

Upright running shafts are always dangerous, and owners should have them encased with wood boxing

New Photo-Process.

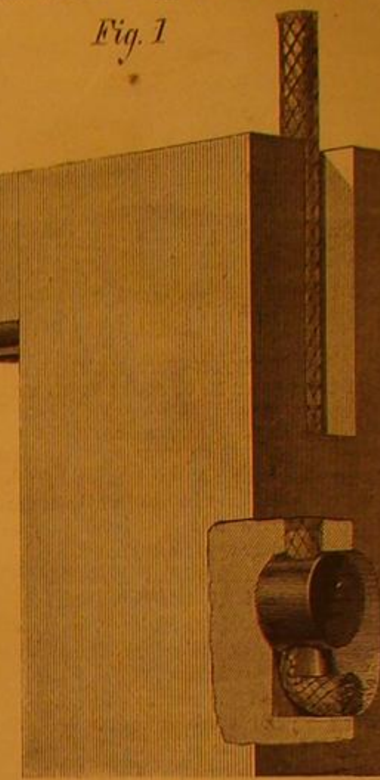
A recent improvement, announced by Mr. Burgess, a photographic artist of Peckham, England, consists in sensitizing gelatin by means of bromide of silver. The mixture is applied warm to the glass plate, and the picture may be taken with the plate either wet or dry. The time of exposure is the same as for the ordinary wet collodion plates. The alkaline-pyro developer is used, the picture making its appearance rapidly, with any required degree of intensity. The new process promises to compete sharply with the ordinary collodion process.

THE reason why common salt sometimes becomes moist when exposed to the atmosphere is because it is not pure Chloride of calcium and chloride of magnesium are impurities generally present in salt, and they absorb moisture from the air.

HARRIS & HEWITT'S PATENT SASH CORD FASTENER.

The object of the invention represented in the accompanying engravings is to dispense with the knot commonly used to fasten window cords to sashes. Any one, who has ever attempted to re-adjust the old fashioned though simple arrangement, will not fail to appreciate the utility of the

Fig. 1



new device. An old knot is very commonly drawn up into the hole through which the cord passes, and requires no small exercise of time and patience to force it out. This only begins the trouble, for the rope has become hard and jammed, and persistently refuses to untie. After breaking off his finger nails and working himself into an uncomfortable perspiration, the operator, probably with a few forcible interjections, settles the difficulty by hacking the obdurate knot off with his knife. Then he pokes the rope carefully through the hole again, triumphantly ties a new knot, and pulls down the sash with a sigh of relief. The window descends nicely until within two inches of the bottom, and declines to move any further. He pulls, and pitches his whole weight on it, and gets mad, and screams short texts not taught in Sunday schools, and finally tries to push it down with his foot, and in doing so breaks a pane of glass. Then he retires for a short distance, and sits down on a tool box and glares. Eventually he discovers that the cord, by cutting off the knot, has become too short, and the weight is jammed against the pulley: and consequently, after briefly communing with the weight and the cord and everything in any wise connected with the window, he puts on his coat, and goes down the street for a new rope, which, after considerable tribulation, he manages to adjust.

All this trouble is obviated by the little fixture herewith illustrated, the cost of which is only nominal, being, at retail, less than six cents to a window. It consists of a short cylindrical casting with a taper hole through it, through which the cord is passed after being threaded through the opening in the edge of the sash in the usual manner. There is also a serrated wedge, which is pressed into the hole in the fixture beside the cord, as shown in the illustration, fastening it very securely. This wedge is so proportioned that it is impossible to draw it through the casting, and no matter how hard it may be dragged up, a slight pull at the short

Fig. 2

Fig. 3

end of the cord will instantly release it for renewal or re-adjustment. No special preparation of the sash, different from that ordinarily made for the knotted cord, is necessary.

The expense of this fixture, it is claimed, in first hanging, is more than saved in time and cord. It has been tested or examined, and is approved, by the leading builders and architects of Newark, N. J.

Patented July 22, 1873, by Horace Harris and Frederick Hewitt, 788 Broad street, Newark, N. J., from whom further particulars may be obtained.

APPROACHING EXHIBITION AT MONTREAL.—An agricultural and industrial exhibition will be held at Montreal on September 16, 17, 18, and 19, 1873. In all departments, the competition is open to exhibitors from any part of the world. The whole fields of agriculture and manufactures, commercial and domestic, are covered by the long list of premiums. Mr. Georges Leclère is the secretary, who will furnish full particulars if addressed at Montreal, P. Q.

THE GREAT EXPOSITION—LETTER FROM UNITED STATES COMMISSIONER PROFESSOR R. H. THURSTON.

NUMBER 6.

VIENNA WELT-AUSSTELLUNG, JULY, 1873.

The work of the juries has, at last, been nearly completed, and the members of the international jury are leaving Vienna for their widely separated homes.

In Group XIII, which embraces machinery and means of transport, the work is all done, even including the awards of the great *Ehren Diplom*, unless, as is almost invariably the case at such exhibitions, a few tardy or careless exhibitors have been overlooked.

The publication of the awards will not be officially made for some weeks; but it seems well understood that the distribution has been made with unusual discrimination; although the usual error of too great liberality will, very probably, be noted here, and an occasional obvious mistake may subject the jury to severe criticism.

Of these awards, the United States section is generally supposed, and probably with good reason, to have received a liberal share, and to have taken a proportion of the medals for "Progress" entirely beyond comparison with that of any other nation. The richness of our own section in original and valuable mechanical devices is thus well illustrated.

Unsatisfactory and incomplete as our exhibit in the Machinery Hall appears to every American engineer, it seems, to the European, remarkably rich in valuable novelties.

It will probably be found that, should any of our people find themselves undeservedly overlooked, or their exhibits not as fully appreciated by the juries as they should be, their misfortunes will, in most cases, be a consequence of their own errors, either in neglecting to secure good representatives here, or in the still less excusable, although extremely frequent, neglect to prepare for the jury exact and minute descriptions of their apparatus and of their claims. American exhibitors have been vastly more careless of their own interests, as a rule, than have the exhibitors of any other nation. Should the result prove that we have been kindly dealt with, it must be attributed to the conscientiousness of the juries, and to the peculiar ingenuity and the exceptional merit displayed in our machinery department, rather than to the efforts of those most directly interested in securing careful examination and thorough discussion of the merits of individual exhibits.

One of the most interesting records in our notebook is that of a day spent in looking over the

STEAM ENGINES,

of which a large number, of all sizes and varieties, are distributed throughout the exhibition. The larger examples of stationary engines are, very generally, more or less exact copies of the Corliss. The Sulzer engine, which is one of the largest on exhibition and which has attracted special attention, would be considered a modified Corliss engine—a modification also which is, on the whole, in the wrong direction. It appears in my notebook under the denomination of "the Sickels Corliss-Greene engine of the Swiss section." It has a "drop cut-off"—the invention of Sickels—and has the poppet valve which is usually found on American engines of the Sickels type. Its governor determines the point of cut-off, and it is therefore, so far, a Corliss engine. The peculiar motion adopted for engaging and disengaging is something intermediate between that of Corliss and one of the systems of Greene. The engine has a condenser, and is said to work with a creditable degree of economy.

Comparatively few of the Corliss engines seen here are precise copies of the original. Builders have usually endeavored to produce some difference of detail, which they claim to be peculiar to themselves, and to be improvements upon the standard machines. They seldom or never succeed, however, in either avoiding its defects or in introducing improvements. The defects of the Corliss engine are not numerous, and those which exist are inherent in that peculiarly typical and unique design which has grown into its most perfect shape in the hands of its originator. To eradicate them necessitates a change in every detail and the complete transformation of the whole design. To effect improvement, the engineer who makes the attempt must excel all who have yet made a similar effort.

The Corliss engine is a quarter of a century old, and is, to day, very nearly as it was then, one of the most complete illustrations of a mechanical type that can be found. It affords, to the student of mechanical "comparative anatomy," one of his most interesting studies. But the Corliss engine cannot be claimed to be a perfect machine. English builders, who usually exhibit quite a different style of engine, while forgetting that an effective expansion (variable by the governor) can only be obtained, so far as engineers have yet learned, by the use of a detachable valve gear, unless at the sacrifice of delicacy in regulation, have persistently adhered to the use of the steam jacket, a detail never seen in the Corliss engine. The best

ENGLISH EXHIBITORS

have usually presented a type of engine which is quite different from the Corliss. The bed is usually flat and broad, and carries the cylinder, the guides, and the shaft pillow-blocks, as was formerly the universal practice with horizontal engines. The steam cylinder is jacketed, and the jacket is fitted with independent pipes to supply it with steam and to drain off water of condensation. The valve gear is that of Meyer: two blocks united by a screw with right and left hand thread, riding on the back of the main valve. In at least one instance, the designer has shown his appreciation of the importance of allowing the least possible clearance by dividing the valve and making of it two, which cover ports at either end of the cylinder, instead of adopting the ordinary form with its necessarily long steam passages. The governor moves a valve in the steam pipe and the degree of expansion is determined by the engineer, who, by use of the screw, separates or draws together the cut-off blocks as occasion may seem to require.

One English firm exhibits an engine in which this is done by a link motion, the link being moved by a Porter governor. The Porter governor, it may be remarked, is to be met with in every part of the Machinery Hall and its annexes. Even the rough and awkward looking engines which drive the machinery of the breweries and the sugar mills are frequently supplied with this American regulator.

The crank is usually given up for engines of short stroke, and a disk, carrying a counterbalance, takes its place. The workmanship of these standard British engines is usually excellent, and several firms present machines of the best of workmanship and having a most magnificent finish. Such a style of finish I have never been fortunate enough to see at home, even on engines "gotten up for the occasion," as these evidently are. One English engine, of considerable size, has a plain steam valve at each end of the cylinder, and, on the top of each, is an expansion valve, apparently of the "gridiron" sort, sliding *transversely*. The time of its movement, relatively to that of the main valve, is determined by an ingenious system of ponderous gearing, intermediate between the valve motion shaft and the main shaft, whose axes are varied in position by the action of a large fly ball governor. It may work well, as a number of certificates exhibited by the builder claim that it does; but the first impression of the stranger is that such a weight of gearing must add seriously to the cost of the engine, even if it does not impede the action of the governor, and add perceptibly to the resistance of the machine itself. It looks like a monstrosity of engineering.

Two compound stationary engines are exhibited. One, in the British section, by Galloway, has cylinders of 14 and 24 inches diameter, respectively, and a stroke of 2½ feet. Its cranks are set opposite each other. Regulation is effected by a peculiar governor, resembling Porter's in being weighted and running at high speed, which adjusts the link operating the main valve. The steam jacket is not used, this important defect being supposed to be compensated by the resulting simplicity of the cylinder castings, and by the convenience with which the intermediate valves may be reached. This engine is rated at 100 horse power, is well made, and moderately well finished. The

FRENCH

exhibit no stationary engines worthy of special notice, except, perhaps, in one case, where an engine has been built with crank shaft bearings spread far apart with no other apparent object than that of placing the eccentrics inside. The awkwardness of the arrangement is something remarkable and not at all to the credit of the designer. The

SWISS,

beside the Sulzer engine already noticed, exhibit two Corliss engines, and a fourth engine which combines the Corliss and the well known device known among engineers as the "French cam." In this example, the condenser and air pump are contained in the engine frame.

The other engine, which would generally be considered the best of all from the fact that it least departs from the standard design, is well built and prettily finished. Its balance wheel is a mortise gear, and a very common feature of those foreign built engines. The only stationary engine presented by

BELGIUM

is that of the great firm of Bede & Co., which seems, in the opinion of engineers here, to divide the honors with that of the *Gebrüder Sulzer*. It is a "mixed Sickels-Corliss," and is one of the least objectionable of the new departures from the familiar American design. The steam valves are moved by two separate heart-shaped cams. The trip and the regulating apparatus are essentially the forms of Sickels and Corliss respectively.

GERMANY AND AUSTRIA

exhibit several Corliss engines, usually with useless changes, miscalled "improvements," and also a few engines of less creditable form.

The Dingler compound engine is one of the quietest engines in the Exposition, and attracts attention by its noiselessness and its rapidity of rotation. It seems to be fitted with continuously revolving valves, and to possess many peculiarities which will require further investigation.

On the whole, it may be said that the now well established principles of steam engine economy: dry steam, high pressure, a maximum expansion, high piston speed, efficient steam jacketing, and perfect regulation: are not fully recognized in the design of any one steam engine exhibited here, and that the best machines, of considerable size, which are found in the exhibition, are more or less exact copies of a well known standard American engine. Of this, or of any other of the several leading forms of steam engine which are so familiar at home, no single example is to be seen in the

UNITED STATES SECTION.

Of a smaller class, the two beautiful little vertical engines of the New York Safety Steam Power Company, which are in operation in the American department, are excellent examples. Their elegance of design, fine workmanship, and high finish attract attention and elicit many compliments from visitors. The neat horizontal engine of the Norwalk Iron Works represents also another of our best efforts in small powers, and another small engine, furnished by Pickering & Davis, is always under inspection. This latter engine has been designed especially for the use of the Underwood angular belting. Its fly wheel is in line with the piston rod and is driven by a pair of rods and cranks, one on either side. The narrowness of the face of the wheel which is allowed by the cord like belt permits this arrangement to be adopted without too great lengthening of the crosshead.

Judging by what is to be seen here, it must be concluded that the building of stationary steam engines for general purposes has made very little progress during the interval which has elapsed since the Paris Exposition, which last permitted a similar international competition, and indeed, it may perhaps be said, during the last score of years. Correct principles are but little more completely, although much more generally, applied now than many years ago, notwithstanding the fact that the great scientific principles which underlie all successful engineering practice have, during this same interval, received their most wonderful and essential development.

It is to be hoped that the same observations may not be called forth by the study of the American International Exhibition of 1876. Yet it rarely happens that marked changes in engineering practice take place in so short an interval of time as that which separates us from that event.

R. H. T.

Correspondence.

Boilers and Boiler Owners.

To the Editor of the Scientific American:

Your article on "Boilers and Boiler Owners," on page 38 of your current volume, reminds me of a specimen I saw three or four weeks ago While in an engine room near here, the engineer showed me a piece of the feed pipe and mud drum taken from under his boiler. Two weeks previous to the time of taking the mud drum out, the boiler had been tested to a pressure of 125 lbs. per square inch, the pump and boiler gage agreeing. By examining I found that a hammer could be driven through the pipe and drum at any place, while, in some places, the blade of a pocket knife could be thrust through.

Query: Why is it that boilers and mud drums are enabled to sustain so high a pressure, in such a condition as the above, and the one at Bay City, Mich., were in? A. J.

Austin, Texas.

Jumping from Railway Trains.

To the Editor of the Scientific American:

The query of J. B. T., on page 27 of your current volume: "Why is it that engineers, etc., jumping from moving trains, invariably jump in the direction of the moving train?" induces me to write a few words on the subject; a subject that every one who rides, whether by horse or steam power, ought to fully understand for all such are liable to be sometime exposed to danger. They should know what is best to be done at the last moment of an emergency, never before; for jumping is so dangerous that it is only when the case is desperate that it should be attempted. The reason for jumping forward is that that course is the safest; the experience of engineers confirms this, and it is easily demonstrated by theory. Your correspondent argues that it is the most dangerous. If every one could, like him, jump with the velocity of 15 miles an hour, =21 feet per second, the difference might not be so great, but I consider only the case of average humanity. But in his case, if the velocity of the train is 30 miles an hour, and he jumps in the opposite direction 15 miles an hour, he will then move 15 miles an hour with the train, and strike the ground with a force that will almost certainly be fatal.

In the hope that some lives or limbs may be saved by a more general understanding of what should be done in such cases, permit me to explain this; I have not yet seen it in print.

The comparative safety of jumping from a moving vehicle does not depend on the velocity of the jump, which should not exceed the velocity of the vehicle, if it can be helped, but entirely and solely on the anatomical build, if I may use the term, of man. The jump should be made facing, as nearly as possible, in the direction of the motion; select if practicable the place; turf is best, sand is next. Never jump on a pile of stones, for a collision with stone is as dangerous as any possible casualty. One foot should be in advance, so that it will come in contact with the ground first. Follow it instantly with the other foot, and each will receive a part of the blow, and each will check the speed little. Then first one hand, then the other, will take a part of the force, and serve to protect the head and trunk. If the patient is then alive, he may pick himself up, if he can, and count his broken limbs and contusions.

A diagram will, perhaps, best explain the succession of events that the jumper should endeavor to procure, for the greatest safety to his person. He should try to have his limbs act like the spokes of a wheel. One foot, *a*, in advance touches the ground, the other foot, *b*, will pass by and touch, then the hands, *c* and *d*, and the head will follow. The momentum may be enough to cause the feet to turn over the head in a somersault; but this is the best that can be done, that is, to check the momentum a little at a time.

If a person takes the advice of J. B. T., and jumps in the contrary direction, what follows? If the vehicle is moving only 15 miles an hour, and he jumps with the force of 5 miles an hour, he is actually moving backwards with the velocity of 10 miles an hour; and as soon as his foot touches the ground, it stops, but his head and body describe a curve through the air with a force due to the speed, the back of his head and his back strike the ground simultaneously. Results, a broken spine, a cracked skull and a general destruction of the action of the internal organs.

Not many years ago I was the involuntary witness of an experiment of this kind. A horse car was being driven pretty rapidly by me, on the opposite side of the street. I noticed a passenger, with an apparently heavy bundle in his hand, preparing to get off; the conductor was looking another way; I saw the man's danger, but was too far off to interfere. He deliberately stepped off the car as if it were motionless, but the instant his foot touched the pavement, his body and head, retaining the speed of the car, were thrown down with great force on the stones; his hat and bundle flew in different directions, accompanied with the unmistakable sound of breaking of iron castings. The man, for a wonder, did not appear to be much injured, but picked himself and his property up, a much astonished and probably a wiser man.

Let every one remember that the only safety in leaving a moving vehicle is to face in the direction of the motion.

Boston, Mass. CHARLES STODDER.

Explosive Projectiles.

To the Editor of the Scientific American:

I have read in your volume XXVIII., page 394, a description of a compound explosive projectile, which is, in my judgment, similar to one I invented in the year 1868. I offered it to the British Government in that year for trial, but it was refused. On September 2, 1869, I sent one to the Emperor of Russia for his approval; it was received, but the answer is not yet returned. I offered it to the present British Government, accompanied by a drawing, November 25, 1870. It was politely refused, and the drawing kept.

My projectile contained three bullet chambers attached to the main cylinder, grooved from top to bottom in center of chambers to one half the thickness of metal in main cylinder, and also grooved all round the center of the main cylinder. Each chamber contained 106 bullets, or 318 bullets in all. Outside size of projectile was eight inches; the chambers were tapped, screwed, and plugged air tight. It can be filled in chambers with small shells and liquid fire, bullets and powder, fulminate, or other materials, as wished. A brass time fuse was fitted inside the powder chambers, and screwed in.

My projectile was considered by many to be the most destructive known. When proved with only a minimum charge of powder, 13 lbs. of the main cylinder could not be found. This distribution of bullets and fragments took place without either fuse or plugs being in the chambers. The difference between my projectile and F. A. Morley's, according to the account, is that he has a separate fuse for each chamber, and possibly more chambers.

On page 368, same volume, on "Electrical Fire Arms," by Professor S. Gardner, you wish him to drive the bullet by electricity. I presume that can easily be accomplished. There is yet one further stride: to kill by electricity itself, at any distance, paralyzing those who may not be killed outright. J. T. FRASER.

Liverpool, England.

Composite Lenses.

To the Editor of the Scientific American:

F. H. R. (see page 100 of your current volume) does not show the flint lens in his section drawing, and the central lens may be made thinnest; but his views are eminently sound. As inventor of the composite object glass, I will call attention to its main defects.

First, the diffraction around the edges of the lenses will slightly injure the definition, as may be seen by placing a network over the glass of an ordinary telescope. Secondly, the segment lenses are harder to correct by hand than the zones of a single lens, and the local polisher machine will spoil their extreme edges, which must be cut off, reducing their size. The third difficulty is the adjustment of the parts. The iron frame must be protected from unequal expansion; and the lenses must not differ in focus the one hundredth part of an inch. The heliometer with its divided object glass, and the success of Mr. Sellack, at Cordoba, in mending a broken eleven inch photographic objective, show that the plan is a feasible one.

We have consulted oracles on the subject with the following responses: Professor Winlock thinks that a solid object glass would be the best, if we could get one. Clark & Sons believe it possible to build an equatorial with solid object glass five feet six and a half inches clear aperture, less than seventy-five feet focus, with a useful power of 3,325 (50 for each inch of aperture) for the sum mentioned. They think it would be easiest to mount it between walls, allowing a movement of only two or three hours in right ascension. They recommend importing the glass makers, as they had to wait three years and paid $12,000 for their pair of glass disks from Birmingham. Henry G. Fitz considers the adjustment of the composite lenses difficult, but that, if this were attained with sufficient accuracy, the telescope might readily be corrected photographically by the addition of a third lens, and thinks this a better plan than using monochromatic light for the purpose. S. H. M., JR.

[For the Scientific American.]

The Composition of the Tails of Comets.

At the conclusion of my communication on the subject of the cause of the zodiacal light, I suggested the question whether the tails of comets might not be accounted for upon similar principles. As I believe that the application of the optical principles concerned in this case (as well as in the other), to account for the appearances observed, is new, I have since considered the subject more fully; and as a result, I submit these explanatory diagrams for the consideration of those who may take an interest in the subject.

The proposition which I have here attempted to demonstrate is that the tail of a comet is an optical phenomenon, caused by the reflection of the sun's rays from the surface of the comet to the earth's atmosphere and thence to the spectator.

Fig. 1 is a section, in the common plane (which, for convenience, we will call the ecliptic) of the earth, comet and sun (the sun being in the direction of the arrows); S is the spectator; D B is the portion of the illuminated surface of the comet which is visible to the spectator. All the space comprised between the points E, D, B, S, would be illuminated by reflection from that portion of the surface of the comet between the points D B. But the atmosphere which renders the light visible only extends to a, 1, 4; therefore the spectator would only see that included between the points a, 1, 2, 3, S. The comet would therefore appear to him to be at 1, 2, 3. The line a, 1, 2, 3, would appear as the line E, D, B; and the line S, 3, would appear as the line S, B. It will be observed that the line a, 1, does not touch the illuminated portion of the comet, but is interrupted by the interference of the dark portion of the surface between the points 1 and 2. That space, therefore, would appear darker than the rest of the illuminated space. This fact will be noticed among our conclusions.

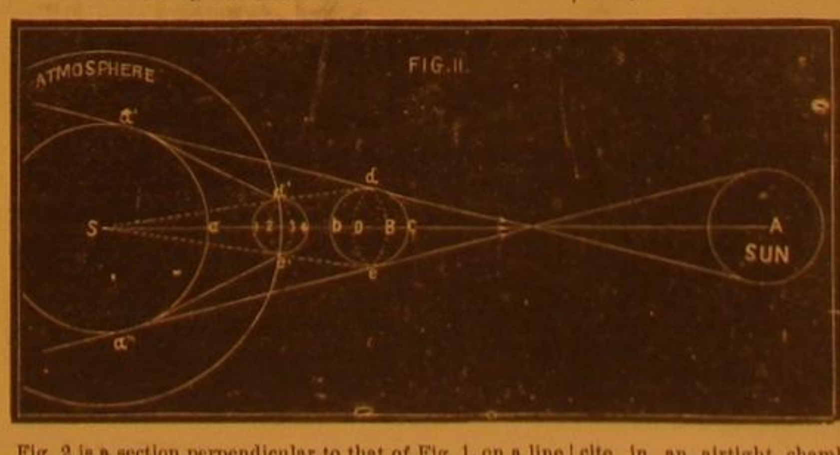


Fig. 2 is a section perpendicular to that of Fig. 1, on a line drawn from the point S (Fig. 1), through a, b, c, and thence to the center of the sun. S, A, (Fig. 2) represents that line, the letters and figures indicating similar points, as in Fig. 1, and the sun being in the direction of the arrows. With regard to the spectator at S, all the space comprised between the points a', d, B, e, a'', would be illuminated by reflection from that portion of the surface of the comet between the points D, d, B, e; but for the reason assigned in describing Fig. 1, the spectator would only see that part included between the points a', d', e', a''. The comet would appear to be at d', e'; the line a', d' would appear as the line a', d; and the line a'' e' would appear as the line a'', e. The appearance therefore to the spectator would be that of a crescent-shaped comet on the confines of the atmosphere, with a tail spreading out from the nucleus, e', 2, d', 3, in a direction opposite to the sun, having at its extremity a width equal to a' a'' (Fig. 2) and a depth equal to S, a (Fig. 1).

The following conclusions may, I think, be drawn from the foregoing explanation: 1. When the spectator, comet and sun are in the same plane (which, in this case, we have supposed to be the ecliptic), the tail of the comet would be straight, and divided through its axis by the plane of the ecliptic. 2. If the comet's position were south of the ecliptic, the tail would incline towards the south, and would be curved convexly to the south, on account of the spherical shape of the atmosphere; and if the comet were north of the ecliptic, the inclination would be to the north, and the curve would be convex to the north. 3. The length and breadth of the tail would vary inversely as the angle between the comet, sun and spectator increased or diminished; that is, it would appear longer and broader as the comet approached the sun, and shorter and narrower as it receded. 4. In this position of the comet, there would appear to be a lune-shaped, darker space between the brightest part of the tail and the nucleus of the comet: that is, the brightest part of the tail would appear to be attached to the nucleus only at the two horns of the crescent. This is caused by the interruption of the line, a. 1, (Fig. 1) by the interference of the dark portion of the surface between the points 1 and 2 (Figs. 1 and 2). (See explanation of Fig. 1.)

The reason why the planets have no tails, when in the same relative position (with regard to the earth and sun) as the comet, is that they are, comparatively, so large that the reflection embraces nearly the whole of the atmosphere, and therefore no part is brighter than another. Comets on the contrary are, comparatively, exceedingly small; the diameters of some of them do not appear to exceed thirty miles. This is why, in the diagram, the tail appears so disproportionately broad.

If the principle of this theory be understood, it will be evident that the shape and direction of the tail may be varied almost infinitely, as they depend upon the relative positions of the three bodies, the earth, the comet and the sun.

T. R. LOVETT.

Mount Airy, Philadelphia, Pa.

Bisulphide of Carbon Engines.

To the Editor of the Scientific American:

An Irishman, on being told that an addition of quinces improved an apple pie, remarked that an apple pie made entirely of quinces would be better still. I am not an Irishman, but it strikes me that, if the attachment of a bisulphide of carbon engine to a steam engine is a great improvement, it might be better still to apply the heat directly to the bisulphide. The boiling point being lower than that of water, and the specific heat and latent heat of vaporization, perhaps, also less, it would require less fuel to produce a given quantity of vapor of given tension; and, as the products of combustion could be allowed to pass off at a lower temperature, the heat of the fuel would be more fully utilized. Also, it would seem that a second vapor engine might be driven by the waste heat from the fire flues of the first engine.

In your article on the loss of power in steam engines, it seems to me that you have overlooked two important points, in fact the most important. In your calculations, you start with steam instead of water, neglecting entirely the enormous quantity of heat required to convert water into steam, which is only very imperfectly utilized in heating the feed water, one pound of steam sufficing to heat five pounds, nearly, of water to the boiling point. That this "latent" heat can be utilized to a very great extent by the use of an easily vaporized fluid seems to be proved by the bisulphide of carbon engine, which has already effected a saving far beyond your estimate of possibilities.

The second point is the large quantity of heat which necessarily (under present conditions) goes up the smoke stack. I have already suggested one remedy for this waste in the use of a second vapor engine. Another plan which may be worth considering would be to burn charcoal, petroleum, or anthracite in an airtight chamber, surrounded by water, under such pressure that the escaping products of combustion would have, when released, the same or nearly the same temperature as the surrounding air, the question being whether the heat which passes up the chimney represents more power than would be consumed in forcing air into the furnace.

Another way to save a portion of this heat would be to apply it, as in Siemens' regenerating furnace, to heat the air which supplies the fire, unless indeed it is all required to produce draft.

Of course all these things present certain difficulties, but, to quote my Hibernian friend again, "If there was no throuble, sure there'd be no work for us."

Benton, Cal. C. H. AARON.

R. A. M. states, from his personal experience, that an application of spirits of turpentine is a certain relief for the pain of a bee sting.

A NEW DOMESTIC MOTOR.

A short time since we published an illustration of a combined rocking chair and cradle, an ingenious plan the utility of which was obvious. The inventor of the device which we now present has gone several steps further, and not only employs the hitherto wasted female power to oscillate a cradle, but at one and the same time to vibrate the dasher of a churn. By this means, it will be observed, the hands of the fair operator are left free for darning stockings, sewing, or other light work, while the entire individual is completely utilized. Fathers of large families of girls, Mormons, and others blessed with a superabundance of the gentler sex, are thus afforded an effective method of diverting the latent feminine energy, usually manifested in the pursuit of novels, beaux, embroidery, opera boxes, and bonnets, into channels of useful and profitable labor.

The apparatus, as represented, consists of a lever, A, suspended from the ceiling or other suitable support by a swiveled hook and staple. In the extremities of the lever, A, are formed slots through which pass bolts and nuts which secure the adjustable arms, B. To the eyes of the bolts are attached the ends of two ropes, which pass around double guide pulleys fastened to the floor and then to two single pulleys, arranged one beneath the forward and the other beneath the rear part of a rocking chair. The ends of the ropes are secured, as shown, to the rungs of the latter.

Near the extremities of the arms, B, sliding weights are placed, by moving which the lever can be properly balanced. Just inside the weights is secured on one arm the dasher of the churn, and at the other a cord communicating with a cradle rocker. As the chair is oscillated motion is communicated to the lever, and thence to both cradle and churn.

Necessarily this device may be put to a great variety of applications, and may supply motive power for washing machines, wringers, and other articles of household use, as well as for churns and cradles. At all events it opens a new field for "woman's labor," and one in which she is not likely to be disturbed or encounter competition from the other sex.

Patented through the Scientific American Patent Agency, April 15, 1873. For further particulars address the inventor, Mr. Gustavus Meyer, New Richmond, Allegan County, Mich., or the New York Exposition and Manufacturing Company, 52, 54, and 56 Broadway, New York city.

A NEW DOMESTIC MOTOR.

PERAMBULATING COT.

Invalids and persons who are afflicted with loss of powers of locomotion will, according to the statements of the inventor, find the apparatus herewith illustrated a great convenience and comfort. The device is called a perambulating cot, and is made with a pair of large wheels on an axle, upon which rests a light curved iron frame supported in the rear by a pair of pivoted caster wheels which follow the main wheels in any direction. On the iron frame are four curved springs, extending up to the middle section of a light wooden cot frame. There is a joint in the latter, just back of the hips of the occupant, arranged with ratchets, so that he can sit at any desired angle; and from the knee, forward, is a light tapering board and half circle foot piece. At the rear of the cot is a handle, adjustable, so that it may be made high or low, by a rod in the center of the cot frame; and there are two rods from the ends of the handle and attached to the frame at the swivel wheels, for propelling the apparatus. The feet are raised or lowered by turning a small crank on the foot board, and there is a hinged drop leg for use when necessary. Other conveniences, incidental to invalids' uses, are suitably and ingeniously provided for.

The inventor, Mr. A. W. Richards, who may be addressed at Indianola, Iowa, is a crippled United States soldier of the late war, and devised this apparatus in conformity to his own needs. He states that, although unable to sit erect, he can propel himself with ease by placing his hands on the large wheels, and thus travel from room to room. He also is enabled to be pushed around the streets by a child, in order to attend to business, etc. Numerous testimonials are submitted to us by Mr. Richards, which confirm his opinions of the efficiency of the device. It seems to us well adapted for its purpose, and particularly suited for employment in hospitals and other medical uses.

PERAMBULATING COT.

The Largest Steam Engine in the World.

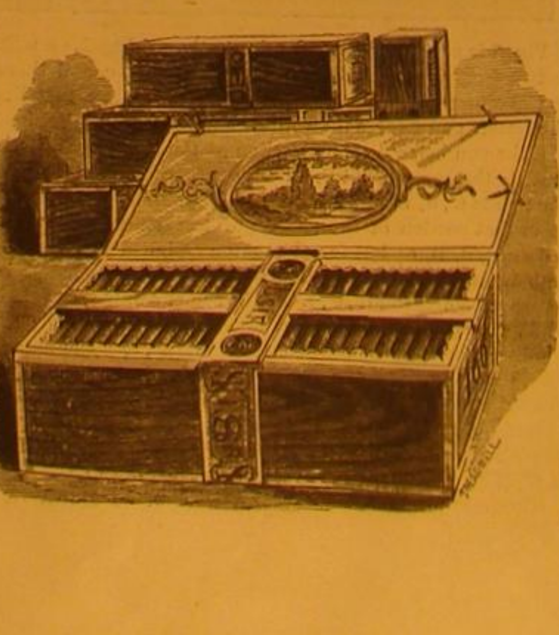
Pittsburgh claims to have in progress of construction a pair of engines which will be the most powerful in the world. Reducing the capacity of some of the largest pumping engines to a uniform lift of one foot in twenty-four hours, it is found that the one at the Lehigh zinc mines will lift 3,456,000,000 gallons; the pair at the Chicago water works, 4,500,000,000 gallons; the pair at Haarlem, Holland, 10,000,000,000 gallons; while the new Pittsburgh engines will lift 14,240,000,000 gallons. The pair will weigh 1,500 tuns, and will cost $423,550. The following dimensions will serve to give some idea of the magnitude: Cranks nine tuns: shaft, twenty-four tuns; four sections of the two valve chambers, one hundred and twenty tuns; fly wheel, seventy tuns. The four plungers will weigh upwards of four hundred tuns. Cylinder, sixty-four inches diameter; stroke, fourteen feet. Plungers forty inches diameter; eleven feet stroke. This ponderous piece of machinery will be used to raise water into Highland avenue reservoir in Pittsburgh, a hight of three hundred and fifty-six feet. It is estimated it will raise seventy million pounds of water for each hundred pounds of coal consumed, the cost being at the rate of one cent for every 3,070 gallons.

Water Boilers upon Stoves.

A brass or copper vessel tinned upon the inside, holding several gallons, is usually found connected with cooking stoves used in families. As this vessel is kept full of hot water, which is used for ordinary culinary purposes, it is important that no deleterious agent should be connected with the metal employed in its construction. A recent analysis has been made of a specimen of tinned brass plate used for making these boilers, and it was found that the tin contained 26 per cent of lead. How far this may serve to cause injury, it is impossible to say. It is certain, however, that lead is an objectionable metal to be brought in contact with culinary utensils, and hence its use must be condemned. An iron boiler lined with porcelain would be much safer, and perhaps not more costly. We understand such a vessel is constructed, and if so, it would certainly be a much safer one to employ as a reservoir of hot water for constant household and culinary use.—*Boston Journal of Chemistry.*

THE PATENT REVENUE CIGAR BOX.

Quite a stir has recently been created among the cigar manufacturers on account of the proposed requirement, by the Government, of the use of a patented form of cigar box. The object of the invention, an engraving of which we herewith present, is to prevent the fraudulent re-employment of stamped boxes. A dealer, in purchasing his stock, naturally desires to inspect in advance the quality and flavor of the article. To do this, boxes must be opened and stamps torn, so that, if the cigars be not sold, they remain on the maker's hands in cases which, so far as the mutilation of their stamps is concerned, are in precisely the same condition as if their contents had been once disposed of. It is plain that an excellent opportunity is here offered for fraud upon the revenue by packing cigars in old stamped boxes, and, in event of detection, asserting that the latter were innocently opened as above described.



The present device, lately patented by Mr. Thomas A. Wiley, of Lancaster, Pa., consists simply in fitting two cross slats, as shown, into the edge of the box, forming a dovetail connection therewith; or a single broad longitudinal strip may be employed to answer the purpose. These slats are put in place after the cigars are packed, when the stamp is pasted partly on the transverse bar and partly over the side of the box. The usual ornamental paper is affixed in the ordinary way. By raising the lid, an opportunity is afforded for examination of the contents through the ample apertures left; while not a single cigar can be abstracted without first raising the slats and thereby rupturing the stamp.

The introduction of the plan is vehemently opposed by the cigar makers, who assert that it is of no greater efficacy than the present mode, while it will prove a serious detriment to their trade.

CEMENTING METAL TO GLASS.—Take two parts finely powdered white litharge, and one part dry white lead, mix intimately, and work up with boiled linseed oil and lac copal to a stiff dough. One part of copal is taken to three parts boiled oil, and enough litharge and white lead added to make a dough similar to putty. The underside of the metal is filled with the cement, and then pressed upon the glass, the excess of cement being scraped off with any sort of instrument. It dries quickly and holds firmly.

Location of Standard Compasses.

For determining the deviation, due to ferruginous materials in their construction and cargoes and to other causes, of the steering compasses of vessels, a so-called standard compass is usually arranged on the upper deck, and at as high an elevation as convenient above the hull.

The position of the instrument is as nearly neutral as can be found—that is, at a point where the local attractions are evenly balanced. By causing the ship to swing in different directions, and noting the variation between the indications of the standard and that of the binnacle compasses a table is formed from which the deviation of the latter for various points is used as a correction to be applied when steering such courses.

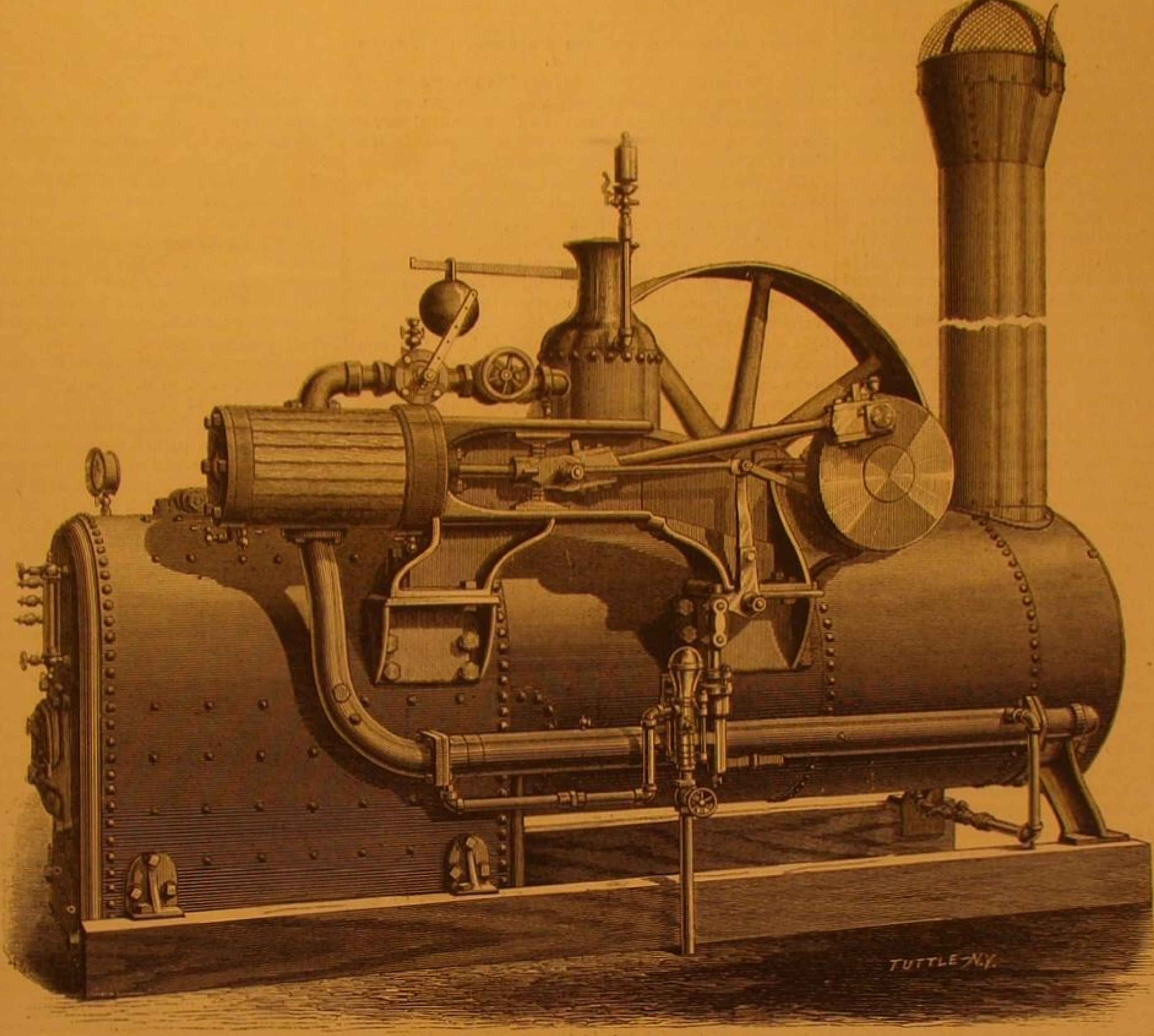
M. Gloesener, in referring to this subject in *Les Mondes*, suggests placing the standard compass out upon the bowsprit, at a distance previously determined to be without the sphere of attraction of the iron in the vessel. By this means, instead of the attracting substances being grouped around the instrument, perhaps unequally, they necessarily are all upon one side of the compass and symmetrically placed in regard to it. The latter is, of course, so fixed that the lubber's point and the foot of the needle pivot are in a line parallel to the longitudinal axis of the ship. To reflect a portion of the card, an inclined mirror is arranged above it, in which the indication is read from the deck by means of a spyglass.

BUTTER AND FATS.—Dr. J. Campbell Brown says that the proportions of the chemical constituents vary so greatly (from zero upwards) that no reliable evidence of purity or impurity can be obtained by estimating the different fats obtainable by decomposing butter. In fact, the distinction between pure butter and butter mixed with flesh fats is no more a chemical one than the distinction between different animals or different plants. The physiologist distinguishes one kind of tissue from another more readily by their microscopic characters than by their chemical composition; and microscopic examination with polarised light is the most reliable means of distinguishing pure butter from that which contains an admixture of less easily digestible and less palatable fats.

LEMONADE FROM CURRANTS.—Citric acid may be prepared from ripe currants in the following manner: The currants are first broken up by pounding or squeezing; the juice is then pressed out and allowed to ferment. When fermentation ceases, the alcohol is distilled off and the residue neutralized with fine chalk. In this way citrate of lime is formed, which is afterward decomposed by sulphuric acid and the citric acid set free. From 110 pounds of fruit there should be obtained about one pound of citric acid, beside a considerable quantity of alcohol. A dilute solution of citric acid furnishes a pleasant and healthful drink, and, although lemonade is usually made from lemons, we would not, says the *Journal of Applied Chemistry*, be far wrong in calling this drink lemonade, although prepared from currants.

THE COOPER PORTABLE ENGINE.

In our illustration is shown one of the latest designs of portable engines, composed of an engine, pump, heater, fixtures, and connections, all mounted on the boiler; the last being supported on side timbers which form the foundation for the whole structure. The apparatus comes complete from the shop, having been previously tried by actual tests with steam, and is ready for work. All that is required is to place it in proper position and connect it to such machinery as it is to drive. The boiler is then filled and the fire started. This arrangement, it is claimed, saves all the expense and time required to build the engine foundations, set the boiler in brick work, and make the connections, as would be the case with stationary engine and boilers, while it adds greatly to the facility with which the machinery can be moved from place to place.



THE COOPER PORTABLE ENGINE.

The construction of the device merits particular attention. The engine consists of a bed piece supported on lugs attached to the boiler. This piece contains the shaft, pillow block, slides, and cylinder head, and to it the cylinder is so attached as to allow of the expansion of the latter without strain on the joints. The valve gear connects directly, doing away with the rock shaft, and the valve is proportioned to use the steam expansively. The pump is a vertical plunger of short stroke, driven by direct attachment to the crosshead, obviating the use of a belt and making the feed positive, with easy work on the valves. The heater is of wrought iron, with cast iron sleeve and slip joint, proportioned to give a large heating surface to a thin sheet of water, thereby insuring a high degree of heat to the feed. All the moving parts are balanced so as to give steady motion at high speed. The journals and wearing surfaces are supplied with self-oilers, and the boiler with glass water gage, cocks, whistle, steam gage, etc.

The internal arrangement of the boiler and tubes, it is claimed, has been thoroughly studied, so that the highest degree of evaporation is obtained with the least consumption of fuel. A jet blower is supplied for increasing the draft, and the chimney is provided with a spark catcher.

We are informed that when the Japanese Government (in 1870) ordered samples of machinery, the agents, after examination and tests, gave the preference to this engine over all others, and ordered a twenty horse power machine, with circular saw mill, to be sent to Japan. Letters since received show that the apparatus gave perfect satisfaction.

The engine represented in our engraving is of twenty horse power, and is mounted with a slide throttle valve, in place of the governor as used with circular saw mills.

For further information address The John Cooper Engine Manufacturing Company, of Mount Vernon, Ohio.

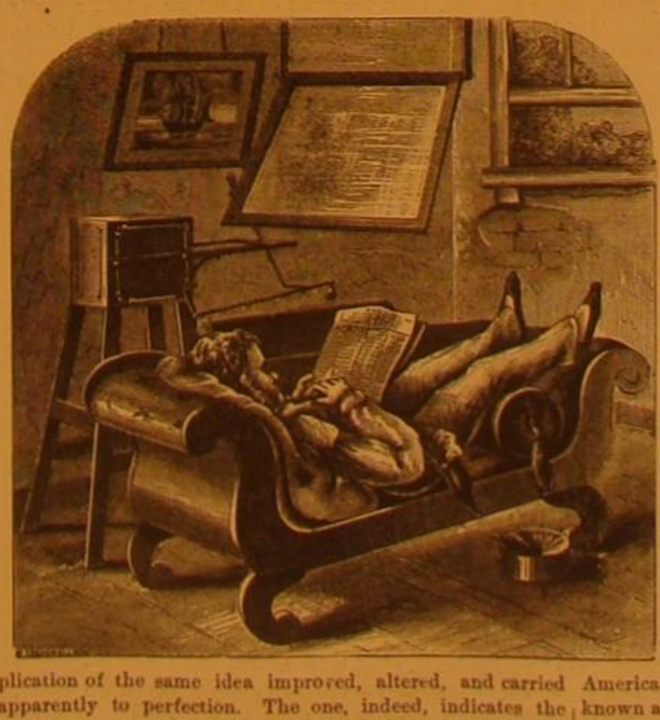
Lawns in Midsummer.

We have touched the renewing and improving of lawns time and time again, says the Cleveland *Herald*, yet every now and then we are button-holed on the street with: "I wish you would tell me what to do with my lawns." Well, we ask about it. "Why, somehow, the grass seems to have got thin, and don't look good and strong; the soil is rather light, although every year I have given it a top dressing of manure in the fall and raked it off in the spring."

Yes, we say, just as many another man, void of the knowledge of the wants of the grass roots, has done. You have supplied a little stimulus, and a very little one, to enable the plant to make a first start in the spring, by reason of the ammoniacal alkali obtained from the leaching of the manure during the winter; and as soon as that is exhausted, which generally is ere the heated season comes in, the plant has nothing but the poor old soil and its broken roots to support it. Now, if you would first sow over your lawn fine bone meal at the rate of eight bushels to the acre, then plaster at the rate of one bushel to the acre, then cover the whole half an inch thick with fine garden soil, leaf mold, or fine chip mold from an old wood yard pile, and then sow clean blue grass seed at the rate of two bushels to the acre, and rake the whole with a fine tooth iron rake, finishing by rolling, we guarantee a lawn that will stay fresh and green all summer, no matter how dry the season. We hope that some of our button-holing friends will read this, cut it out and keep it.

THE FIRST AUTOMATIC FAN.

There is a peculiar interest which attaches to the first crude embodiment of any well known device, which renders it almost as much an object of curiosity as the most recent ap-



plication of the same idea improved, altered, and carried apparently to perfection. The one, indeed, indicates the higher attribute, originality; the other, in its relation thereto, forms but a mark on an onward path which, while serving as a limit of present advancement, attained through the aid of past experience, must, in its turn, be left behind and forgotten, as that experience, augmenting, enables the engrafting, upon the pristine stock, of newer, better, and more useful conceptions

To the vast array of quaint devices, with which the earlier archives of the Patent Office are replete, belongs the invention illustrated herewith. Our engraving, derived from the patent drawings, represents an individual not suffering under any painful malady, as might be inferred from his prostrate position, but "laying off," if the apt vulgarism be admissible, while calmly enjoying the luxury of a breeze raised by the oscillation of the fan above him. The latter, with its mechanism, is the first device of its kind ever patented in this country, and the inventor was Commodore Jas. Barron, of the navy, a name famous for gallant service in the war of 1812. The date of the patent is November 27, 1830, and from its specification we extract the following brief description of its operation: Within the box shown near the head of the couch is placed a train of clockwork, which moves a crank, shown in the left hand lower corner of the case. This crank actuates a pitman which, by means of a vertical arm, oscillates a rock shaft, supported as shown by two horizontal rods projecting from the box. To the upper arm, extending from the rock shaft, is connected the fan, which is thereby freely vibrated, while suspended from the ceiling, by suitable means.

In an old volume of the *Journal of the Franklin Institute*, we find an abstract of this patent, accompanied by editorial comment to the effect that "it is certainly a very complex mode of attaining the proposed object. We should find no difficulty in making a much more simple instrument for the purpose," a view which, perhaps, some scores of inventors have, since the date the above was written, demonstrated to their own, if not to the public's, perfect satisfaction. We need not add that, in this case, for obvious reasons, we omit our usual peroration beginning "for further information," etc.

Discovery of America--Columbus Anticipated

Interesting relics of the early discovery of America occasionally turn up. At a late meeting of the Mexican Geographical Society, Mr. Bliss stated that some brass tablets had been lately discovered in the northern part of Brazil, and not far from the coast, which careful examination had shown were covered with Phœnician inscriptions, telling of the discovery of America five centuries before Christ. The tablets had been acquired by the Museum of Rio Janeiro, with whose director he was personally acquainted, and the connection of this gentleman with the discovery of the tablets was in itself a guarantee of the correctness of the report. The inscriptions, so far as yet deciphered, relate that, from a port on the Red Sea, a Sidonian fleet sailed, and, following the east coast of Africa, doubled the Cape; thence following the African west coast, probably with the southeast trade winds of the southern latitudes, until the northeast trades, preventing further progress northward, forced the prows of the vessels across the broad Atlantic. At any rate, according to Mr. Bliss, the tablets record the fact of the Phœnician fleet having reached the Americas five centuries before Christ, at some point now known as northern Brazil; that the tablets give the number of vessels, the number of the crews, the name of Sidon as their home, and, indeed, various very interesting particulars. Mr. Bliss has promised, when he acquires further particulars, to hand them to the Society.

A GIGANTIC passenger depot, the largest in the world, is now in process of erection at Jersey city, N. J.

The Preservation of Wood.

When a country is first cleared, and timber is plenty, the only desire of the settler in regard to it seems to be to destroy as much as possible with the least amount of labor. Afterwards, however, the opposite course is taken, and endeavors are made to preserve it, and prevent waste and decay.

Many methods have been proposed for preserving timber, varying somewhat according to the use to which it is to be put, and the situation in which it is to be placed. These may all, however, be divided into two great classes; namely those which preserve the wood from external influences by forming an impervious coating on the outside, and those which consist in impregnating the wood with some substance which will enable it better to resist the action of fermentation and decay.

The first of these classes includes all paints and similar substances. In order to render paints effective, it is necessary that the wood shall be well dried before their application, as paint applied to the surface of wood which is filled with sap will tend to hasten, rather than retard, its decay. This it does by confining the juices of the timber and preventing the drying of the wood that would otherwise take place. The first paint that was used was most likely the native bitumen and asphalt that oozes from the ground in many parts of the world, and to this day we have not found any more effective substitute. But this is objectionable from its odor, the long time it occupies in drying, and its dark color; so that in the course of time other substances were substituted for it. Prominent among these are the so called drying oils. Certain oils, such as linseed and poppy, have the property of drying when exposed to air, and forming a gummy mass. This protects the wood from the action of air and rain. But oil alone has but little covering power, and a substance painted with it retains almost its natural color or at most is only darkened. In order to vary the color and more thoroughly cover up any defects in the work, and at the same time hasten the drying of the paint, it is customary to mix certain earthy substances with the oil. Chief among these is ceruse, or white lead. This gradually combines with oil and forms a hard mass. In order to hasten the drying of the oil, it is frequently boiled before being mixed with the lead. The lead paint made by mixing proper proportions of carbonate of lead with boiled and raw oil is undoubtedly one of the best and most permanent substances that can be applied to the surface of wood; but unfortunately it is expensive, and the use of the lead is objectionable on sanitary grounds, the workmen employed in putting it on being subject to severe colic and paralysis from the poisonous effects of the lead. On the ground of cheapness, sulphate of baryta is frequently substituted for part of the lead, and, in fact, in some cases for almost the whole. This, while it is not poisonous to use, possesses an inferior covering power; that is, it takes more coats to produce the same effect, and as it does not combine with the oil, it is liable after a time to chalk off.

Another substitute for lead is oxide of zinc. This is also not poisonous to the workmen, when free from arsenic, but it possesses little more covering power than baryta.

Quite frequently a mixture of lead, baryta, and zinc, is employed. Its chief recommendation is its cheapness. For painting in localities that are exposed to sulphuretted hydrogen, such as houses on the docks of large cities, a zinc or baryta paint is superior to one containing lead, as it does not blacken. Many attempts have been made to utilize various chemicals for painting purposes, and there is an endless variety of so-called chemical paints in the market. Prominent among these is the "Averill" paint, in which water glass or silicate of soda is a leading ingredient; but the general fault of all these paints is that, when made thin enough to work with ease, they do not possess sufficient body, so that what is saved in the original cost of the paints is expended in the labor necessary to put them on.

Paints of different colors generally depend upon white lead for their body, and derive their color from mixtures of various earths and oxides. For almost all the shades of red and brown, oxide of iron is used, under the various names of Venetian red, umber, terra di Sienna, brown ocher, yellow ocher, red ocher, etc., the various colors being due to the way in which it is prepared.

Oxide of chromium furnishes chrome green; oxide of copper, combined with various acids and with arsenic, gives various greens; lead combined with chromic acid forms the chrome yellows, the different shades being due to the manner in which they are prepared. For blue, we have Prussian blue, which is not very permanent, and of late years ultramarine, which is the best and most permanent of all colors.

Red lead, or oxide of lead, and sulphide of mercury give the most brilliant red; while for black, nothing is superior to carbon in the form of lamp black. For special purposes, such as painting the bottoms of ships or piles exposed to the action of the water, coarser kinds of paints are employed. The base of many of these is tar dissolved in naphtha; this is mixed with some substance such as oxide of copper, arsenic, or an alloy of copper and antimony, which is supposed to prevent the adherence of barnacles and other marine animals and plants. India rubber, dissolved in naphtha, has been used for the same purpose; lime soaps have also been proposed for this use. No substance has, however, been discovered that will resist the action of salt water more than a few months without requiring renewal; nothing that is known to chemists being absolutely insoluble in water. Lately there has been quite a flourish of trumpets over a certain compound invented in England by Count Szerelmy, and called *zopissa*. This is essentially a paint composed of boiled linseed oil, brown umber, lime water, sulphate of copper, Prussian blue, copperas, burnt clay, calcareous silex (whatever that may be), litharge, asphalt, red lead, gum animi, and turpentine. It was probably through mere modesty that the inventor stopped after adding these ingredients and did not continue through the drug shop. The paint is no better and no worse than one containing an impure oxide of copper for pigment, and linseed oil and asphaltum for the menstruum. It will no doubt protect the wood to which it is supplied in sufficient quantities, from external action, so long as it lasts.—*Boston Journal of Chemistry*.

Recent Researches on the Physiological Action of Light.

The arrangements by which the mind is brought into relation with the outer world are—(1) a terminal organ, such as the retina, or the intricate structures of the internal ear, or the touch corpuscles of Wagner, for the reception of impressions from without; (2) a nerve endowed with a special sensibility peculiar to the sense for the conveyance of influences from the terminal organ to the brain; (3) a sensorium or brain in which, on receiving these influences, changes occur which give rise to the phenomena of consciousness.

The nature of the specific change produced on the terminal organs by the action of external stimuli has not hitherto been experimentally examined. Let us take the case of the eye. Numerous hypotheses have been advanced. The action of light on the retina has been conjectured to be a mere communication of vibrations, an intermittent motion of portions of the optic nerve, an electrical effect, a heating effect, or a photographic effect like that produced by light on a sensitive surface; but up to this time there has been no experimental evidence in support of either of these views.

The result of investigations made by Mr. Dewar and Dr. McKendrick, of Edinburgh, communicated to the Royal Society of Edinburgh, has been to show that the specific effect of light on the retina and optic nerve is a change in the electromotive force of these organs. They have been able to demonstrate this by the use of the well known arrangement of Du Bois-Raymond for collecting electric currents from animal structures.

From each of the troughs a wire passes to a key so as to enable the experimenter to stop the current at pleasure, and thence the current passes to the galvanometer. They then lay the eye on a glass support between the cushions, and carefully adjust the points so that the one touches the cornea and the other the transverse section of the optic nerve, or the one may touch the surface of the nerve and the other its transverse section. When the optic nerve of the eye to be operated upon and the cornea are brought into connection with the galvanometer, and light is passed through the eye, there is at first an increase, then a diminution, and on the removal of light there is another increase, of the electromotive force.

The amount of change in the electromotive force by the action of light is about 3 per cent of the total. There has been no difficulty in demonstrating the effect in the eyes of the following animals, after removal from the body: reptiles, snakes; amphibia, frog, toad, newt: fishes, gold fish, stickleback, rockling; crustacea, crab, swimming crab, spider crab, lobster, hermit crab. The greatest effect was observed in the case of the lobster, in the eye of which Messrs. Dewar and McKendrick found a modification in the electromotive force by the action of light to the extent of about ten per cent. With the eyes of birds and mammals, they had great difficulty. It is well known that, in these animals, the great source of nervous power is abundant supply of healthy blood. Without this, nervous action is soon arrested. This law, of course, holds good for the retina and optic nerve. When, therefore, they removed the eyeball with nerve attached, from the orbit of a cat or rabbit recently killed, and placed it in connection with the clay points, they found a large deflection of the galvanometer which quickly diminished, but all sensitiveness to light disappeared within one or two minutes after the eye had been removed from the animal. This fact of itself shows that what has been observed is a change depending on the vital sensibility of the part. It was therefore necessary to perform the experiment on the living animal under chloroform. By so fixing the head that it could not move, and by removing the outer wall of the orbit so as to permit the clay points to be applied to the cornea and nerve, the same results have been obtained in the case of the cat, rabbit, pigeon, and owl.

Without going into minute detail, which the space allowed for this short article will not admit of, the results of this inquiry have been as follows:

1. That the specific effect of light on the eye is to change the electromotive force of the retina and optic nerve.

2. That this last applies to both the simple and to the compound eye.

3. That the change is not at all proportional to the amount of light in lights of different intensities, but to the logarithm of the quotient, thus agreeing with the psycho physical law of Fechner.

4. That those rays, such as the yellow, which appears to our consciousness to be the most luminous, affect the electromotive force most, and that those, such as the violet, which are least luminous, affect it least.

5. That this change is essentially dependent on the retina, because, if this structure is removed while the other structure of the eye lives, though there is still an electromotive force, there is no sensitiveness to light.

6. That this change may be followed into the optic lobes.

7. That the so-called psycho physical law of Fechner does not depend on consciousness or perception in the brain, but is really dependent on the anatomical structure and physiological properties of the terminal organ itself, inasmuch as the same results as to the effect of light are obtained by the action of the retina and nerve without the presence of brain.

The method of investigation pursued by Messrs. McKendrick and Dewar is applicable to the other senses, and opens up a new field of physiological research. The specific action of sound, of the contact of substances with the terminal organs of taste and of smell, may all be examined in the same manner; and we are in hopes of soon seeing results from such investigations.—*Nature*.

Saddle Trees.

A correspondent, R. C., of Texas, remarks that his State has always been famous for the production of saddle trees; and although California and other States have been rivals, Texas has always stood first on the list. "The ordinary plan of making a saddle tree is not only tedious but incorrect, owing to the want of an accurate plan, and the consequent use of guesswork. I claim to have produced a simpler plan, by which a man, using patterns, can make a good saddle tree. Within the last few years, several makers have conceived plans to make saddle trees that would allow the fastenings to rest on the front end of the side boards, and the front part of the seat on the side boards and on both sides of the prongs of the horn piece, forming not only the fastenings but a part of the rig also.

The tree was a desirable one on its claims; but there was a serious objection to it. The projecting part of the side boards in front of the horn tapered down straight with pointed or square corners so as to admit of the fastenings; and so the bottom part of the side boards had to be made straight, with a straight twist, and the ends in front would hurt the horse's shoulders. To remedy that defect, I cut the side boards tapering back towards the seat far enough to receive the prongs of the horn and the fastenings. This flaring or tapering twist also enabled me to change the entire shape and bearings of the tree, making a general improvement on the whole arrangement."

Uses of Waste Paper.

A writer in one of our exchanges (we have forgotten which) says that few housekeepers are aware of the many uses to which waste paper may be put. After a stove has been blackened, it can be kept looking very well for a long time by rubbing it with paper every morning. Rubbing with paper is a much nicer way of keeping the outside of a tea kettle, coffee pot or tea pot bright and clean, than the old way of washing it in suds. Rubbing them with paper is also the best way of polishing knives and tin ware after scouring them. If a little soap be held on the paper in rubbing tinware and spoons, they shine like new silver. For polishing mirrors, windows, lamp chimneys, etc., paper is better than dry cloth. Preserves and pickles keep much better if brown paper instead of cloth is tied over the jar. Canned fruit is not apt to mold if a piece of writing paper, cut to fit each can, is laid directly upon the fruit. Paper is much better to put under carpet than straw. It is thinner, warmer, and makes less noise when one walks over it. Two thicknesses of paper placed between the other coverings on a bed are as warm as a quilt. If it is necessary to step upon a chair, always lay a paper upon it, and thus save the paint and woodwork from damage.

Watering House Plants.

The English *Garden* is inclined to dispute the rule that water "should be given in moderately small quantities, and supplied frequently." If the causes of failure where plants are cultivated in windows were minutely investigated, the dribbling system of watering would be found to be the principal cause. A plant ought not to be watered until it is in a fit condition to receive a liberal supply of that element, having previously secured a good drainage, in order that all superabundant water may be quickly carried off. Those who are constantly dribbling a moderately small quantity of water upon their plants will not have them in a flourishing condition for any length of time. This must be obvious to all, for it is quite evident that the moderately small quantity of water frequently given would keep the surface of the soil moist, while at the same time, from the effects of good drainage, which is essential to the well being of all plants in an artificial state, all the lower roots would perish for want of water, and the plant would become sickly and eventually die.

A French writer, in estimating the future of science, points out that in fifty or a hundred years' time the English language will in all probability be spoken by eight hundred and sixty millions of individuals, while the German will be the language of one hundred and twenty millions and the French of sixty-nine millions only, and that in consequence science is likely to seek English channels of publication, scientific books having at best a limited sale and necessarily seeking the widest audience.

Narrow gage passenger cars, as generally constructed, stand thirteen inches nearer the rail, and have about fifteen inches less overhang at the side; hence, the center of gravity is considerably lower than on the standard gage, making the car ride very steadily, and with less oscillating motion than is usually observable upon the wide gage. The seats, thirty-six to a car, are arranged double on one side and single on the other, with the order reversed, midway of the car, to distribute the weight equally.

DECISIONS OF THE COURTS.

United States Circuit Court--Southern District of New York.

PATENT MAGIC RUFFLE—ELM CITY COMPANY *vs.* GEO. H. WOOSTER.

WOODRUFF, *Circuit Judge:*

The testimony in this case is very greatly conflicting or very much of it is not entitled to credit, either because, in my opinion, the witnesses exaggerate their asserted achievements, erroneously state the time, or describe inventions which did not in fact embrace the patented invention, or refer to crude or imperfect endeavors to imitate the "Magic Ruffle", which appears to have been popular at the time when, according to the evidence, many were seeking to compete with those engaged in its manufacture.

After a laborious examination of the evidence my conclusions are:

First, the patenters were the first inventors of the plaiting attachment mentioned in the patent described in the bill of complaint, and on which the suit is founded.

Second, the defendant has infringed the rights of the complainant, as assigners of the said patent, as alleged in the bill of complaint, by the use of a plaiting attachment embracing the said patent invention.

Third, the said patent is not void on the ground that there was any fraudulent misrepresentation in the specification annexed to the patent. No such fraudulent misrepresentation is proved. Nor is the patent void upon the ground that the invention was not the joint invention of the patentees. The testimony proves such joint invention most clearly and distinctly.

There was no such sale of the patented machine or apparatus two years before the application for a patent as renders the patent void. An agreement for the transfer of the invention for the joint benefit of the inventors and those who will advance money for the manufacture or use of the machines invented, not carried into execution, and unaccompanied by any public use of the machine, but being prospective in its character, not consummated until within the said two years, does not in my opinion affect the validity of the patent.

Fourth, I find no ground upon which to hold that a corporation, created by the law of a State without the limits of this federal judicial district may not maintain a suit here for an infringement of their rights committed here.

These conclusions necessarily require a decree in favor of the complainant, according to the prayer of the bill.

It is obvious that the defendant has introduced testimony which was not admissible as a defence, relating to the knowledge and use of the invention by persons not named in the answer, to some or all of which objection was made by the complainant on the taking of testimony. I have not, however, regarded the objection in my consideration, because the briefs submitted do not involve a motion to strike out such testimony, and my conclusions are therefore founded on all the proofs.

Let a decree be entered for the complainant awarding the relief prayed for.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From July 19 to July 21, 1873, inclusive.

DISTRIBUTING FLUIDS, ETC.—C. G. Wheeler (of Chicago, Ill.), London, Eng.

LIFE PRESERVER.—E. R. Coyswell, New York city.

SPINNING WOOL.—J. G. Avery, New York city.

NEW BOOKS AND PUBLICATIONS.

CHIMNEYS FOR FURNACES, FIRE PLACES, AND STEAM BOILERS. By R. Armstrong, C. E. No. 1 of "Van Nostrand's Science Series." Price 50 cents. New York: D. Van Nostrand, 23 Murray and 27 Warren Street.

We are pleased to see an issue of handbooks on practical subjects commenced with so excellent a specimen as the work before us. The chimney has always been the builder's puzzle and the occupier's torment; and some practical, well digested reasoning on the subject, by a thoroughly capable writer, will be found in this neat little volume. The reputation of the publisher will guarantee the continuance of the series with similarly excellent treatises.

THE CANADIAN ORNITHOLOGIST, a Monthly Record of Information relating to Canadian Ornithology. Edited by Dr. A. M. Ross Price 15 cents per month. Toronto: Willing and Williamson.

An excellent little magazine, entertaining to many who live beyond the borders of the British Provinces. It appears to be written by contributors well versed in the most interesting branch of natural history.

THE ART OF SHOOTING ON THE WING, with Hints and Recipes for the Use of Sportsmen. By An Old Gamekeeper. Price 75 cents. New York: The Handicraft Publication Company, 37 Park Row.

A practical and well written handbook, especially adapted for the use of young sportsmen, as it gives sensible advice on the manipulation of fire arms and the rules and etiquette of the field.

Recent American and Foreign Patents.

Improved Metallic Clasp.

Charles Marshall, Lockport, N. Y.—The object of this device is to furnish ready and convenient means for holding or supporting drawers or overalls when a button fails, for hanging up hats and other articles of clothing, or for supporting ladies' dresses, etc. The clasp is attached to the article by putting the teeth against the cloth to be fastened, when the slide is turned one side, and then back over the teeth. There is a slight spring to the slide, which holds it in place and makes the attachment secure. As manufactured for use, the clasp does not exceed the weight of an ordinary metal button.

Improved Sewing Machine.

John Albert Smith, Columbus, Ohio.—This improvement consists in a new combination of machinery, by which rotary motion is imparted to the shuttle. A rotary disk for carrying the shuttle carrier is mounted on the end of the pulley shaft and is arranged with its face, to which the carrier is pivoted, in the plane of the needle, so that the carrier will pass the needle close to its side, suitably for passing the shuttle through the loop. The carrier is connected to it by a pin which is fitted into the disk so as to turn therein, and is connected by a universal joint with a rod, which is similarly jointed to the frame so that it can swing with the pin around the axis of the shaft, but not turn itself, and thus prevent the carrier from turning as it swings around with the disk.

Improved Harvester.

Elgin M. Awrey, Caistor, Canada.—This invention has for its object to furnish an improved device by means of which the table or finger bar may be raised, when desired, by the advance of the machine, thus dispensing with the ordinary levers and keeping the machine free for the operation of the self rake.

Improved Hog Trap.

Aaron B. De Vore, Talkington Township, Ill.—This invention is an improvement in a crib or stocks for holding or confining hogs. The bottom inclines downwardly toward the head lock and falls considerably below the front beam, so as not to afford a foot rest by which the hogs can push back and pull out of the lock. For small shotes a secondary pen or crib is arranged in the large one to contract the space suitably for them.

Improved Washing Machine.

John W. Conroy, Terry, Miss.—By suitable construction, by adjusting a nut, a jointed rubbing board may be held up against a corrugated cylinder with any desired pressure, so that the said cylinder may carry the clothes along the rubbing board, and at the same time rub them, thus washing the clothes quickly and thoroughly.

Improved Rotary Hog Scraper.

Robert Fyfe, New York city.—This invention consists of a rotary scraper with blades adapted for scraping off the hair, bristles, etc., of scalded hogs, with handles by which to hold it when it is revolving, and a jointed driving shaft worked by a pulley or other driving gear. It is very simple in construction and said to be useful and convenient in action.

Improved Self Closing Faucet.

Alexander Brinckmann, New York city.—This invention relates to improvements on faucets of the kind having swivel discharge tubes, which tubes, when in one position, are closed and stop the outflow of water, while in the other position they communicate with the water supply, are open, and allow the water to flow out. Whenever it is desired to have the water flow out, the horizontal tube is turned by hand to open the aperture, and is held so as long as necessary; but as soon as this tube is let go, the pressure of water against another piston immediately causes the vertical tube to swing closed.

Improved Manufacture of Wadding.

Andrew Chambers, Providence, R. I.—It is proposed to manufacture waddings of old delaines, and other part cotton and part wool goods, by picking the stock into sufficiently fine and soft particles to form a soft fine lap, and then passing it directly from the machine in which it is made through a bath composed of a solution of resin, caustic soda, and also coloring matter. The solution saturates the lap throughout and secures the fiber so as to make as good and strong an article as the ordinary long fiber and yet does not injure the fiber in respect to the light, crispy nature which it is necessary for all good waddings to possess. It is also proposed to apply a dressing of plaster of Paris to the surfaces of the wadding as it passes out of the bath, to glaze it and prevent it from sticking, by passing it between a couple of boxes containing the plaster, and brushes for throwing it on the wadding as it passes along. The claims cover both the manufactured article and the mechanism by which the wadding is made.

Improved Clothes Dryer.

Almeron Graves, Roscoe, Ill.—The central vertical standard upon which the device for drying clothes revolves has feet pivoted to a sliding socket collar and braces. The braces are also at their upper ends pivoted to a similar socket collar, which moves loosely upon the vertical standard. The lower ends of the feet are made fast to the ground by suitable pins driven through loops. The number of braces is equal to the number of feet employed. A series of semi-vertical brace arms, which at their base are pivoted to a socket collar similar to those above described, form a base for the drying apparatus. These brace arms are also at their upper ends pivoted to an equal number of radial arms which also are at their inner ends pivoted to another similar socket collar. The whole series of arms are provided with a network of clothes lines. Cords pass over pulleys having their outer ends attached to one of the radial arms at opposite sides of the dryer, and are used to fold up the dryer like an umbrella.

Improved Device for Manufacturing Jewelry Bases.

Shubael Cottle, New York city.—This invention consists in a peculiarly constructed former combined with a die burnisher and mandrel. A blank has a bottom and barrel at a sharp angle to each other. The former is made in sections. The female die is made with a detachable bottom for convenience in removing the blank, and with a shoulder in its cavity, leaving a space around the barrel of the blank, when said blank is inserted in said die. A plunger is made with a square edge, and a recess having a rounded angle. The former is placed in the blank and the blank is inserted within the shoulder of the die. The plunger is then brought down upon the edge of the barrel of the blank, turning the said edge inward over the former, producing the blank. The blank is now placed in a hollow mandrel, and while the mandrel is being rotated in a lathe, a burnisher is held against the turned over edge, which is thus pressed down upon the former until it has a sharp angle. The blank is now taken out of the mandrel, and the middle section of the former is removed, and subsequently the others, after which the bottom is cut out so as to produce a blank which consists of three curved strips, two being horizontal, and the other, which connects them, vertical.

Improved Tobacco Transplanter.

Clement E. Bates, South Deerfield, Mass.—This invention has for its object to furnish an improved machine for transplanting tobacco plants. In using the machine, one of the pans, a number of which have been previously supplied with plants, is placed upon the upper platform, the handle is grasped by the left hand, and a lever pushed forward so that a plant is dropped through a tube to rest in a cup formed by plates. The instrument is then pressed down upon the ground and the lever drawn to the rearward. This forces the plates outward and edgewise through the soil, and at the same time moves the paddles inward and sidewise through the soil, pressing said soil around the roots of the plant. The instrument is then raised from the ground, the lever pushed forward, another plant inserted in the tube, and so on.

Improved Vise.

Daniel S. Coe, New Hartford, Conn., assignor to Chapin Machine Company, of same place.—This invention has for its object to furnish an improved bench vise. Upon the inner ends of screws are secured small gear wheels, the teeth of which mesh into each other, so that by turning the right screw the left screw will be turned in the opposite direction, and the two screws will work together to carry the movable jaw back and forth, exactly parallel with the stationary jaw.

Improved Dress Protector.

Adolph Herrmann, New York city.—This invention is designed to furnish an improved dress protector which shall be so constructed that when an edge becomes worn it may be reversed, and thus made to do double service. The invention consists in folding the material longitudinally so that its edges may meet or overlap each other along the central line, plaiting it transversely, and securing the plaits by two rows of stitching about equally distant from the edges of the protector and from each other.

Improved Iron Railway Tie.

Charles W. Gulick, New Brunswick, N. J.—This invention furnishes an improved cross tie and fastening for railroad rails, which shall support and firmly secure the rails in place. The invention consists in wrought iron ties for railroad tracks, having transverse flanges formed solid upon them to form grooves to receive the rails, and having holes formed through them to receive the clamps.

Improved Dies for Plain Finger Rings.

George Krementz, Newark, N. J.—This invention is an improved device for enlarging and finishing plain finger rings. The lower or stationary die, which has a hole formed through it of such a size as to allow a plunger to pass through it freely. In the upper end of the hole is formed a rounded recess to receive the ring. The plunger is made tapering or conical, and with its upper part of exactly the size required for the ring. Upon the upper end of the plunger is formed a tenon to enter a hole in the lower end of the holder, by which the said plunger is forced through the ring. In using the device the ring is placed in the recess of the die, and the plunger is forced through it by the holder, bringing the ring to exactly the required size, and leaving it perfectly true. The same inventor has also patented an improved mode of making plain finger rings without a joint. The invention consists in two sets of dies for forming a jointless ring from a solid ring plate. The half round ring plate is laid, rounded side downward, in the flaring upper end of the cavity of a die, and the plunger brought down upon it, which forces it into the lower part of the cavity of the die, giving it a somewhat conical form, and producing the conical ring. The latter is placed, larger edge downward, in the cavity of the die, and the tapering part of the plunger forced into it, which forces the smaller edge of the ring outward, while the taper of the cavity of the die forces its longer edge inward, and produces a ring convex upon its inner surface and half round upon its outer surface. The ring may then be finished, enlarged, and sized in the ordinary manner.

Improved Pencil Case.

Samuel S. Rembert, Memphis, Tenn.—This invention is an improvement in calendar pencil cases; and consists in providing the case with a perforated cap and a scale of lineal measurement, whereby the same is adapted to be applied to pencils of any length and to be used as a rule or measure in determining the length or other dimension of any object.

Improved Machine for Sawing Laths.

Alexander Rodgers, Muskegon, Mich.—This invention consists of a gang of circular saws on a horizontal arbor, in different sizes, with an inclined table and feed rollers so arranged that lath and other like stuff may be sawn obliquely to the sides, to produce bevel edged strips by saws on a horizontal arbor. The invention also consists of one or more feed rollers made slightly conical, and provided with spiral ribs arranged to force the piece to be sawn to the guide and keep it there, as well as to feed it to the saws.

Improved Glove Fastening.

Horace P. Carver, Binghamton, N. Y.—This invention is intended to produce a new fastening for kid and other gloves, and it consists of a pin supported firmly by the projecting parts of a plate attached to one side of the glove, which catches between coiled parallel springs of a plate attached to the other side of the glove, so that they, in combination with the action of the supporting side plate of the pin on the ends of the springs, firmly hold the parts together.

Improved Adjustable Scaffold.

John S. Tilley, West Troy, N. Y.—For adjusting the scaffolds of wall plasterers and ceiling decorators, high or low, according to the hight of the room, it is proposed to have short trestle heads mounted on three legs, with a vertically adjusting standard in each head having a fastening to hold it at any hight, and having a couple of plates clamped to it at each side near the top, so that they can be readily adjusted to form, with the standard, a T head whereon the scaffold boards may rest flatwise, when, as in the case of decorating ceilings, it is desirable to build broad scaffolds by laying the scaffold boards or planks, extending from one trestle head to another, and arranged edgewise to support the scaffold boards. In order to pack the benches the legs are jointed to them so as to fold over on the sides. When in use the ends of the legs bear against the walls or shoulders of the notches, and so transmit the force directly from one to the other without injury to the joints.

Improved Box Scraper.

Abraham Tester, Brooklyn, N. Y., assignor to himself and John Cunningham, of same place.—This invention has for its object to construct a scraper which is used on packing boxes, ships, etc., with a movable blade, so that the same may be sharpened when worn, and adjusted to a suitable angle for use in any desired position. The invention consists in pivoting the blade to the bifurcated handle of the instrument and in connecting it therewith by means of a pivoted brace, so that it can be swung into suitable position and rigidly held therein.

Improved Invalid Bedstead.

John Robinson, Madison Station, Miss.—This invention consists of an improved bedstead, which is so constructed that the head part of the bed bottom may be raised and lowered gently and gradually to any desired extent, so as to change the position of the person lying upon the bed. To the head parts of the slats is secured a cross bar, to the lower side of the ends of which are attached sockets to receive the upper end of rods, the lower ends of which are pivoted to nuts, through which pass the end parts of another rod, upon one half of which is cut a right screw thread, and upon the other half a left screw thread, so that when the latter rod is turned in one direction the nuts may move toward each other; and when the said rod is turned in the other direction, the said nuts may move from each other, thus lowering and raising the head part of the bed bottom as may be desired.

Improved Metal Window Sash.

John D. Moran, New York city.—This invention consists in making the oval headed T shaped moldings for show windows by first forming an oval or semi-elliptical bar of lead with a groove in the flat side for the base of the head of the molding, by forcing the head through a die of suitable form in the manner of forming lead tubes. Second, in drawing the silver plated cover of sheet metal upon the said lead bar, by forcing a flat strip of the covering metal and the lead bar through a die plate together. Third, in soldering the iron bar which constitutes the vertical portion of the T to the lead bar by heating one edge of the iron bar in a bath of solder and tinning it at the same time, and then laying the tinned and heated edge in the groove of the lead bar, whereby they become united, the iron bar heating the lead bar sufficiently to cause the union of the lead with the tinned surface of the iron when they become cool. Fourth, in making a cheap bar or molding for inferior work, where the plated molding will be too expensive, by uniting the lead and metal bars, as above described, without the plated metal covering for the lead bar.

Improved Mirror Holder.

William Simpson, Berlin, Canada.—The object of this invention is to supply a neat and simple device by which a mirror may be suspended at any desirable inclination toward the wall. The invention consists of a V shaped holder, of strong wire, bent forward and attached to the sides of the frame of the mirror in such a manner that the same may be inclined at pleasure.

Improved Apparatus for Scraping Hogs.

Orison McNeil and Peter W. Dalton, Jersey City, N. J.—This invention consists in an arrangement of carrying rollers with scraping blades and a chain, the last being used for drawing the hogs over the rollers and between the blades.

Improved Heating Stove.

Jacob L. Ring, Mt. Pulaski, Ill.—This invention consists in a novel mode of combining the main parts of a heating stove. A central upright tube extends from beneath the stove hearth into the hot air chamber, which is surrounded by the drum, leaving a space between the two, from which the smoke and gaseous products escape to the chimney. On top of the air chamber is a perforated cylinder covered by a cap, surrounded by a perforated ring. A lug is on this ring, by means of which it is turned to allow the discharge of air from the chamber. The air tube may extend up from the hot air chamber and conduct a current of heated air to any part of the dwelling. It is surrounded by the fuel in the fire box, and an active current, through it and through the chamber, is produced by the intense heat to which it is exposed.

Improved Paper File.

John F. Winter, Brooklyn, N. Y.—The object of this invention is to furnish an improved paper file for binding letters, bills, newspapers, pamphlets, sheet music, etc., in a simple, elegant, and quick manner, without tearing, defacing, or otherwise injuring the papers or documents. This invention consists of a square, round, or polygonal piece over which strings are longitudinally stretched in suitable manner, which, in connection with lateral binding strings placed over a grooved or recessed part of the main piece and a thread and needle, bind the sheets in a manner similar to that of binding books.

Improved Cotton Gin Knife Roller.

Thomas H. Rushton and William Dobson, Bolton, England.—This invention consists in a cotton gin knife roller provided with blades having two or more angles arranged in line with each other in the direction of the shaft, their inclined parts being parallel to each other.

Improved Sap Protector.

Henry C. Cole and Edgar D. Sabin, Wallingford, Vt.—The object of this invention is to provide means for protecting maple sap, as it is caught in buckets from the tree, from snow, rain, leaves, etc.; and it consists in a screen or cover attached to the tree and to the sap bucket, and covering the latter.

Improved Toy.

Laurance Bryan, New York city.—This invention is a toy for children, which will furnish not only amusement but exercise; and it consists in what is known as the "child's wheel runner" combined with a whistle, the wheel being made to operate and blow the whistle as the child propels it.

Improved Apparatus for Moistening the Atmosphere.

James G. Garland, Biddeford, Me.—For moistening the atmosphere in weaving and other rooms, it is proposed to employ an atomizer, air chamber, and condensing pump, a water cistern, reservoir, and an automatic apparatus for supplying the cistern and the atomizer from the reservoir regularly and uniformly, to be expelled to the atmosphere by the air from the air pressure chamber, in which it is condensed by the pump. In combination with the reservoir and cistern is a filter to separate from the water any solid particles that might obstruct the pipes of the atomizer also to purify it. The pump will, in practice, be run by power, and as many atomizers will be applied to one air chamber and cistern as may be demanded by the capacity of the room to be charged.

Improved Machine for Cutting Tobacco.

Francis S. Kinney, New York city.—This invention has for its object to furnish an improved machine for cutting tobacco, the same being constructed with a single knife working upon inclined bearings, and operating with a sliding shear cut upon the tobacco, which is placed in a box with sides at right angles and bottom parallel with said knife.

Improved Die for Making Watch Case Caps and Backs.

Silas C. Lewis, Brooklyn, N. Y.—This invention consists of a die of the usual form and material, but having, instead of a flat surface, an elevation, which gradually increases from the circumference toward the center adjusted to the elasticity of the gold and the thickness of the covers, producing a perfectly flat even plane, more accurate than if spun out. It is an important improvement in the manufacture of gold caps and backs to watches.

Improved Double Acting Force Pump.

John P. Flanders, Vergennes, assignor to *himself*, Eli B. Hayes, of same place, and H. M. Mitchell, Burlington, Vt.—The cylinders are arranged on each side of a wide bed frame, and between them suction pipes are arranged, rising vertically from the well and connected to the cylinders by horizontal branches at the upper ends above the check valves. Four discharge pipes rise vertically a short distance above the cylinders, and there continue by curves above the check valves into a discharge box at the bottom, where the check valves are arranged to prevent the back flow. These pipes support the discharge box and the air chamber. For packing the pistons, the barrels in which they work are divided in longitudinal parts with lap joints at the edges, so that they can contract and expand a little without opening seams for the escape of water. A small annular channel surrounds the barrel, in which is maintained a high degree of pressure by water admitted through a pipe connection. To hold the barrel in position and allow them to be free to expand and contract, notches are formed in the shell in the cylinder, and lugs in the barrels, which project into the notches and hold the barrels against the end motion.

Improved Table Dish Stand.

Florian Grosjean, New York city.—The essential feature of the invention is a stand or tray for dishes, of which the top or plate is composed of metal with a porcelain cover or enamel, the enamel being to conceal the iron or give it a fine finish, and form the ground work for fine picture ornamentation by the decalcomanic or other process.

Improved Stop Valve.

George W. Eddy, Waterford, N. Y.—This invention relates to that class of stop valves in which two disks are arranged to move forward and backward at right angles to the water channel in a chamber through which the channel passes at openings on opposite sides whereat the seats are formed for the disks, and on which they are caused to press tightly when moved upon them.

Improved Egg Carrier.

John A. Beam, California, Mo.—This invention consists of a strong wood box in ten compartments, or tiers of paper cells, adapted to hold an egg upright, on the large end, the cells being formed of a paper cylinder and pasted or otherwise fastened together at the sides. Between each tier of the cells, also between the upper and lower tiers and the box sides, are cushions to soften the shocks. The rows of cells along the sides of each tier are protected from the shocks against the side walls by springs. The sides of the box are provided with projections, which prevent the box from resting on them, so that the eggs are secured against lying on the sides while in transit. Some of the end projections of the case constitute handles for handling it.

Improved Horse Power.

William Gilfillan, Speier, Minn.—The object of this invention is to furnish a horse power for thrashing grain and other purposes. The cogs of a bed wheel are on the upper side and engage with vertical internal and external gear wheels, which are on a horizontal cross shaft. The power is applied, to a revolving frame attached to the cross shaft by stands, by means of levers. arms connect the rim of the frame with the central cap. Traverse wheels attached to the frame revolve through slots in the rim of the frame and rest upon the top of the bed wheel, and thus prevent friction. The internal part of the vertical wheels engage with other wheels. The exterior cogs of the vertical wheels engage with the cogs of the bed wheel, and thus impart motion to the central vertical shaft.

Improved Washing Machine.

Moses L. Hawks, Kinderhook, Mich.—This invention has for its object to furnish an improved washing machine of that class in which the washing is done by passing the clothes back and forth between rollers, and which shall wash the clothes quickly and thoroughly and without injuring them, and without becoming clogged. A large upper roller is corrugated longitudinally, and to it is attached the crank by which the machine is operated. Four small rollers are placed beneath the large roller. By suitable construction, as the clothes pass in, the upper roller and outer small rollers yield so as to accommodate themselves to the thickness of the clothes. As the latter pass out, the outer small rollers upon that side yield, thus preventing clogging. By proper devices the machine is held in the tub in which it is desired to operate.

Improved Washing Machine.

Jacob Sheffler, Deselm, Ill.—In using the machine, the clothes are placed upon a false bottom around a rotating vertical cylinder. The handle is grasped in the left hand to apply pressure, and a vertical roller, held between pivoted bars, to which the handle is attached is revolved with the right hand by means of the crank. The cylinder holds the clothes out so that they will be in proper position to be operated upon by the roller, the flange of the said cylinder pushing the lower part of the clothes in beneath the mass, so that they will be continuously turning over. The outer part of the bottom, as it is rotated by the roller, moves faster than the inner part, so that the clothes will be rubbed as well as pressed.

Improved Last Block Fastener.

David Huard, Ashland, Wis.—This invention consists of a clasp-like fastener, pivoted to the main block of the last, which closes over the other block in connection with pin fastenings of the same.

Improved Water Elevator.

Sylvester Bennett, New Orleans, La.—This invention consists of a stationary case in the form of a hollow inverted truncated cone, inside of which is a revolving inverted cone with one or more spiral flanges extending from bottom to top, and apparatus for revolving the inner cone for raising water short distances in large quantities, for draining purposes and the like.

Improved Seed Planter.

William J. Saffery, Bremen, Ohio.—This invention consists in combining a furrow opener, a seed dropper, a rolling coverer, and a guano or manure dropper, so that, between the seed and the guano, there will always be a small layer of fine dirt to prevent the destruction of the vitality of the seed.

Improved Pump.

Charlie D. Rathbone, Belpre, Ohio.—This invention consists of a novel construction and mode of applying a bush or lining of glass or other hard and durable wearing substance in the pump cylinder or stock to sustain the wear of the sucker or pump barrel.

Improved Bed Bottom.

Jonathan V. Taylor, La Cygne, Kansas.—This invention consists of two pairs of bars about half as long as the bed, fixed at one end on a transverse pivot at the middle of the bed, one pair extending to the head and the other to the foot, and connecting with cross bars thereat. One cross bar at the head and one at the foot are each connected by several tension straps of strong flexible material arranged above the pivot, and sufficiently short to support the arms and cross bars, and any weight that may be placed on them above the horizontal plane of the pivot. At each end there is a stop bolt which limits the hight to which the end may be raised, and thus prevents the other end from falling too low. In connection with the above are the arms provided with springs at the pivot to increase the range of the springing action of the bottom.

Improved Floor.

Levi S. Wood, Marion, Iowa.—The object of this invention is to provide means for strengthening floors, roofs, etc., and it consists in truss rods passed through the joists of the floor or rafters of a roof in combination with bridge blocks fitted between the joists on one or both sides of each rod. Nuts on the rod are turned up, giving the rod any required degree of tension, and binding the blocks and joists firmly together.

Improved Sharpening Machine.

James P. Kealy and Joseph Bigney, Bridgeport, Conn.—This invention is a machine for dressing lathe centers, and consists of a traversing grinder actuated by an automatic feed screw and placed in a frame adapted for being supported in the tool post of a lathe.

Improved Equalizing Attachment or Plows.

David H. King and William M. Hulse, Palmyra, Ill.—This invention consists in an improved metallic loop attachment for holding the equalizing apparatus of a plow, and also in applying a guard bar to the chains used in equalizers

Improved Fireproof Shutter.

Isaac S. Mettler, Jersey City, N. J.—The object of this invention is to protect buildings *from fire*, and it consists in a metallic shield composed of sliding sections formed of an inner and an outer sheet of metal secured together at top and bottom by plates. The sections are confined in grooves on the inner sides of the casings, each section having grooves of its own. Across the top of the shield, beneath the cap of the cornice, is a shaft having a pulley near each end, over which are cords attached at one end to the lower section and at the other end to a weight. An inwardly projecting flange extends from each section into the groove of the adjacent section, so that, when the lower section is raised, its top strikes the flange of the next above and raises that, and so on, each section being raised by the section below, so that all may be securely packed beneath the cornice and back of the frieze plate. The weights are intended to balance the sections in that position. At night, or whenever there is danger from fire from the burning of adjacent buildings, the shield is drawn down, thus forming a fire protector to the window or door.

Improved Waste Removing Device for Carding Machines.

George W. Craner, Darby, Pa.—This invention consists of a brush and an endless carrier for it combined with the burr box of a carding machine, in such manner that it brushes out the burrs, and, by keeping it clear of them, prevents it from filling and the burrs from overflowing upon the main card.

Improved Insect Destroyer.

John A. Finney, Nashville, Ohio.—An axle is turned by drive wheels, and by suitable gearing actuates an endless belt which carries the insects forward. From the belt the insects drop into a hopper placed beneath a roller to receive them, and which has a slot or opening in its bottom, through which the insects drop into the angle between the revolving axle and the roller, where they are crushed and drop through an opening in the bottom of the box to the ground. A reel operated by the advance of the machine pushes off the insects. As the reel arms come in contact with the plants, the ends of the hammer handles slip from a stop bar, and the hammer heads are drawn by springs against the reel arms with a sudden blow, knocking the insects from the plants upon the inclined apron whence they pass to the endless belt.

Improved Dredging and Ditching Machines.

Hyacinthe Gonellaz, Vermilionville, La.—In the dredging machine, a bucket wheel and discharging pan similar to those represented in patent of same inventor, No. 130,213, dated August 6, 1872, are arranged so that the wheel mounted at the bow of the boat revolves in a plane at right angles to it, and delivers the earth at one side, and the pan carrying it in the same direction delivers it on the bank of a canal or river. They are by virtue of such arrangement specially adapted for dredging rivers and canals. In this case also the colters used for cutting and loosening up the earth preparatory to the taking of it by the buckets are arranged on the advancing side of the wheel, and so inclined as to draw the boat forward at the same time that they loosen the earth. The ditching machine, the subject of a separate patent, consists of a series of intermittingly rotating colters preceding a rotating wheel with spoons or buckets, behind which is a receiving and discharging pan, combined in a portable machine, and provided with operating devices, all so contrived that, as the machine advances along the ground, the cutters loosen and even up the ground, the buckets raise and discharge it into the pan, and the pan discharges it on the bank at one side of the ditch.

Improved Furniture Spring.

William T. Doremus, New York city.—This invention has for its object to furnish an improved spring for application to other parts of a chair, spring bed, or other piece of furniture where a yielding connection is required. Upon the lower side of one edge of two plates are formed inwardly projecting flanges, in which are formed a number of holes to receive the screws by which they are secured in place. In the plates are formed holes to receive the bar, which has a pin in a recess formed in the upper side. A rubber block, of any suitable form, is interposed between the plates, through which is a rod which forms the hinge, and which is provided with a nut to regulate the tension of the spring. The same inventor has also patented another form of chair spring which consists in flanged plates, hinged together by a transverse bolt passing through suitable lugs. An India rubber block is placed beneath the axis of the hinge. These are only two patents out of more than one dozen applications, all of which have been granted to Mr. Doremus through the Scientific American Patent Agency within the past five weeks.

Value of Patents,

AND HOW TO OBTAIN THEM.

Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Larger inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe, and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years acted as solicitors and Publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN *Patents*.

This is the closing inquiry in nearly every letter, describing some invention which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them; they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his rights.

How Can I Best Secure My Invention ?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, New York, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office. Such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

Rejected Cases.

Rejected cases, or defective papers, remodeled for parties who have made applications for themselves, or through other agents. Terms moderate. Address MUNN & Co., stating particulars.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York.

Reissues.

A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

A patentee may, at his option, have in his reissue a separate patent for each distinct part of the invention comprehended in his original application by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co. 37 Park Row, for full particulars.

Design Patents.

Foreign designers and manufacturers, who send goods to this country may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in this market.

A patent for a design may be granted to any person, whether citizen or alien, for any new and original design for a manufacture, bust, statue, alto relievo, or bas relief; any new and original design for the printing of woolen, silk, cotton, or other fabrics; any new and original impression, ornament, pattern, print, or picture, to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture.

Design patents are equally as important to citizens as to foreigners. For full particulars send for pamphlet to MUNN & Co., 37 Park Row, New York

Foreign Patents.

The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, while business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension, except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co., 37 Park Row.

Trademarks.

Any person or firm domiciled in the United States, or any firm or corporation residing in any foreign country where similar privileges are extended to citizens of the United States, may register their designs and obtain protection. This is very important to manufacturers in this country, and equally so to foreigners. For full particulars address MUNN & Co., 37 Park Row New York.

Canadian Patents.

On the first of September, 1872, the new patent law of Canada went into force, and patents are now granted to citizens of the United States on the same favorable terms as to citizens of the Dominion.

In order to apply for a patent in Canada, the applicant must furnish a model, specification and duplicate drawings, substantially the same as in applying for an American patent.

The patent may be taken out either for five years (government fee $20) or for ten years (government fee $40) or for fifteen years (government fee $60). The five and ten year patents may be extended to the term of fifteen years. The formalities for extension are simple and not expensive.

American inventions, even if already patented in this country, can be patented in Canada provided the American patent is not more than one year old.

All persons who desire to take out patents in Canada are requested to communicate with MUNN & Co., 37 Park Row, N. Y., who will give prompt attention to the business and furnish full instruction.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specification.

Any patent issued since November 27, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent. Address MUNN & Co., Patent Solicitors, 37 Park Row, New York city.

MUNN & Co. will be happy to see inventors in person, at their office, or to advise them by letter. In all cases, they may expect an *honest opinion*. For such consultations, opinions and advice, *no charge is made*. Write plainly do not use pencil, nor pale ink; be brief.

All business committed to our care, and all consultations, are kept *secret and strictly confidential*.

In all matters pertaining to patents, such as conducting interferences procuring extensions, drawing assignments, examinations into the validity of patents, etc., special care and attention is given. For information, and for pamphlets of instruction and advice

Address

MUNN & CO.,
PUBLISHERS SCIENTIFIC AMERICAN.
37 Park Row, New York.

OFFICE IN WASHINGTON—Corner F and 7th streets, opposite Patent Office.

Notes & Queries

A. M. C. asks: Is there anything which will as effectually protect iron from rust, etc., as the galvanizing process, but which is less expensive?

H. J. H. asks: What is the best composition to preserve pickets set in the ground?

T. B. C. wants a recipe for sticking emery on tin. "There is a constant jar on the tin, and glue will not hold."

H. F. U. asks for the exact proportion of ingredients requisite to make a wholesome self-raising flour.

M. C. asks: What is the process of graining oak root, and what colors are used by painters in doing it in distemper?

Answers to Correspondents

C. T. S. can preserve his composing stick or other steel articles from rust by following the directions on p. 27, volume 25.—F. can attach leather or cloth to galvanized iron by using the recipe given on p. 167, vol. 28.—J. W. J. should try the method described on p. 406, vol. 25, for preserving eggs.—F. A. will find a recipe for shoemaker's ink on p. 75, vol. 27.—R. H. L. will find his question as to the weight on a safety valve answered in the reply to W. A. S. on this page.—E. R. D. should consult the makers of windmills. His query about slip of belts is answered on page 390, vol. 28.—J. L. R. can try the much recommended tannate of soda in his lime water.

W. C. F. asks: At what velocity will steam issue through a round hole, one eighth inch long and one sixteenth of an inch in diameter, under a pressure of 100 lbs. to the square inch; and what would be the difference in the velocity provided the diameter of the hole be increased to one eighth inch, the pressure and length of hole remaining the same? Answer: See editorial pages of this issue.

W. H. S. asks how to precipitate gold, silver, copper, nickel, and platinum from solutions. Answers: To precipitate gold, add a strong solution of ferrous sulphate, or sulphate of iron, to a solution of any salt of gold, as the chloride, prepared by dissolving gold in *aqua regia*. The gold is precipitated as a brown powder. Silver is precipitated in the metallic state from the chloride, made by dissolving silver in *aqua regia* by iron. Add clean pieces of iron to a solution of the chloride of silver. For copper, add clean scrap iron to a solution of blue vitriol, sulphate of copper. For metallic nickel, first add a strong solution of oxalic acid to a strong solution of sulphate of nickel. Collect the pale bluish green precipitate. Heat the precipitate in a covered crucible, lined with charcoal. For platinum, dissolve the metal in *aqua regia* (a mixture of muriatic and nitric acids), precipitate with a solution of sal ammoniac, and heat the precipitate red hot. The result is spongy platinum.

N. J. N. asks: 1. How can I calculate the difference between the steam pipe and exhaust pipe of a stationary engine? Is a three inch exhaust large enough for an engine of 12 inch bore and 20 inch stroke, with a 2 inch steam pipe, running at 104 revolutions per minute, 80 lbs. pressure to the square inch in the boilers? 2. What is the accompanying specimen composed of? 3. Will it affect the water in the boiler to put in the carcass of a dead mule, in pieces? 4. How can I compute horse power? Answers: 1. Consult "Link and Valve Motions," by W. S. Auchincloss. 2. Some compound of lime, probably the carbonate. 3. We never heard of the plan before. 4. See answer to M. C., on this page.

J. R. K. says: 1. We want to carry the condensed steam from an engine into a tub eight feet deep, for the purpose of boiling straw. What per centage of power do we lose on the engines? 2. We have a tubular boiler 42 inches in diameter, 80 two inch tubes, 14 feet long, with stack 18 inches diameter and 50 feet high, with very poor draft. The boiler is situate in a hollow; the hill on one side is about as high as the stack, the other twice as high. Can you suggest a remedy for the bad draft? Answers: 1. None, if the condensed steam does not have to be raised, to be put into the tub. 2. Probably a mechanical draft, by a blower, will remedy the trouble.

J. P. C. says: I use a small vertical portable engine and boiler, and sometimes I have to carry 100 lbs. steam to do the work. The boiler is 56 inches high 28 outside diameter, with 24 one and a half inches tubes. The firebox is 18 inches diameter x 22 inches high. The middle gage is 39 inches from bottom of boiler, and she steams best with water at that hight. I use fir wood for fuel, which makes an intense heat. Am I safe from heating the tubes too hot with the firebox full of wood, and water at middle cock, 18 inches above crown sheet? Evaporation is rapid and steam is pretty wet if carried higher. The boiler foamed so badly that I could not tell anything about the hight of the water. I fancied that the oil which got in around the plunger of the force pump had something to do with it. I got the idea from something I once saw in the SCIENTIFIC; since then I have been very careful to keep all oil out, and have never been troubled with foaming in the least, at any pressure from 30 to 100 lbs. Answer: If when the engine is in motion, the water issues solid from the lower gage cock, there is no danger. It is only when boilers have such a bad circulation that the tubes or crown sheet are left bare that there is danger from heavy firing.

H. B. & K. ask what kind of dryer is best to put in coal tar, in making a gravel roof. Answer: Try boiled linseed oil, or litharge.

T. S. S. asks how to make and bleach skeletonized or phantom leaves. Answer: Boil the leaves in a weak solution of caustic soda for some hours, wash thoroughly and then expose to the fumes of burning sulphur.

E. C. C. says: I want to make springs 4 inches long x ⅜ inch wide by one thirty-second thick, to be pressed from sheet metal or otherwise. They are required to spring ⅜ inch and not to rust, and to be as cheap as possible. Is there any metal cheaper and better than sheet spring steel? They can be tinned or galvanized to prevent rust. Answer: Spring steel will probably be the best material for you to use.

G. says: Some bins containing soft crushed sugars are full of little red ants; I would like to know why they select that sugar from the other kinds, and how we can get them out? Answer: A plentiful supply of what is known as Persian powder, around (not in) the sugar bins, will prevent the inroad of ants. Sugar bins should be made of hard stout plank, with closely fitting covers, and kept perfectly clean. If they could be lined with earthenware or stoneware, and made air-tight, so much the better. The only way we can suggest to you, for getting rid of the ants already in the sugar, is to spread it out in thin layers and pick out the ants by hand. The ants prefer the brown sugar, probably on account of its greater sweetness and moisture.

R. W. W. asks how to clean a carpet which has been soiled by accident. It was washed with soap suds: and to remove a sour smell, it was washed with soda water. "The color remained good until, to remove further odor, I poured on bay rum; that operation turned it a light green color. The original colors are two shades of brown, red, green and black, on a white ground." Answer: We advise you by all means to discontinue the use of soda water and bay rum on the carpet. The alcohol in the bay rum has probably so dissolved and spread the colors that there is no remedy. To remove the smell, try a very dilute solution of carbolic acid.

W. H. R. asks: 1. How great a vacuum can be produced with an air pump with one inch bore and 3½ inch stroke? 2. Can an article be held on a trap by such vacuum fast enough to lift 16 lbs.? 3. Will soluble glass answer for artificial stone exposed to the weather? 4. What sudden pressure will a cast iron tube stand safely, if given by a quantity of gunpowder or other combustible? Answers: 1. It depends on the relative size of the receiver and connections. With the cylinder alone, if the piston is tight, a nearly perfect vacuum can be produced, with reference to the air. 2. No, if the trap is the size of the cylinder. 3. Correspond with the manufacturers. 4. The tensile strength of cast iron is about 18,000 lbs. per square inch. Take ¼ of this for a safe strain, and then the pressure per square inch that it will safely bear may be found by multiplying the thickness in inches by the safe strain, and dividing it by the diameter of the tube in inches. This is for thin cylinders. For thick ones, see article in SCIENTIFIC AMERICAN for June 21, 1873.

A. S. asks how to bleach and cure palmetto grass. Answer: Steep or boil the leaves in a weak solution of caustic soda, wash thoroughly, and then expose them to the fumes of burning sulphur in a close chamber; or instead of the sulphur fumes, soak in a weak solution of chloride of lime and rinse well afterwards.

H. R. asks: Is there such a thing as scagliola? If so, where can I get it, how can I make it, and what is it used for? Answer: Scagliola is a species of stucco made with the best plaster of Paris and a weak solution of Flanders glue; it is colored according to taste. This composition is often applied upon hollow columns of wood, and the surface, when hard, can be smoothed in a lathe or polished.

A. H. C. asks: What is the cause of white sugar flashing like a glow worm when you run the scoop into it? Answer: The cause of sugar flashing, as you describe, is probably owing to the electricity developed by the friction between the scoop and the sugar.

C. E. asks: What is the difference between true north and magnetic north in the city of New York for the year 1873? Answer: The magnetic north is 7° W. of the true north.

P. D. asks: By what means flowers, leaves and other vegetable matters are deprived of their colors, that is, bleached or whitened, for introduction into what I think are called "skeleton bouquets?" Answer: Expose the flowers for a few minutes to the fumes of burning sulphur in a close vessel, care being taken to prevent the heat from reaching them.

W. A. S. asks: 1. What formulæ are used in measuring safety valves of different sizes? 2. How do you go to work after you get the figures? Answers: 1. Measure the diameter of the valve, in inches—square this and multiply it by the decimal ·7854; this will give the area of the valve in square inches. Find the weight of the lever, and the distance of its center of gravity from the fulcrum. This can be found by balancing the lever on a knife edge. We call the distance, the lever arm of the lever. Weigh the valve, and measure the distance from the center of the valve stem to fulcrum, noting that all distances are to be measured horizontally. This is the lever arm of the valve. Find the number of pounds in the weight. The distance of point of suspension of weight from fulcrum is called the lever arm of the weight. 2. Having obtained these figures, make an equation, thus: Pressure of steam in pounds per square inch × area of valve in square inches × lever arm of valve = (weight of ball × lever arm of ball) + (weight of lever × lever arm of lever) + (weight of valve × lever arm of valve.) It is evident that if all the parts but one are known, this equation will determine that part.

E. M. K. says: 1. How quickly can a 35 horse power engine be stopped if it is making 75 revolutions per minute with 75 lbs. steam? 2. How can I Babbitt a governor on a high pressure engine? 3. The oil or tallow cup that was on the cut off-chest was changed and put above the governor in the steam pipe; is that right? 4. How can I reverse an engine? 5. The boiler is to carry 75 lbs. steam. There is a 4½ lbs. iron weight added to the safety valve. When it is off, steam blows off at 75 lbs. by steam gage. Is this right? 6. Is there water or oil used on emery stones and wheels, and how are they turned off? 7. Are the toads that stay around gardens poisonous? Answers: 1. It depends in a great measure on the weight of the moving parts, but under ordinary circumstances such an engine could be safely stopped in 15 seconds. 2. If it is a box, closed at both ends, heat the journal, cover it with a piece of oiled writing paper, place it in the box, and pour in the molten metal. If the place is open at the bottom, after putting in the journal stop the opening with clay, and proceed as before. 3. Yes 4. Arrange stops for the eccentric so that it will be loose on the shaft, between the positions for forward and backward motion. 5. We think you had better remove the extra weight. 6. There are emery wheels made to run in oil and water. Unless they are specially prepared, they should be run dry. 7. So far as we know, such toads are not poisonous.

J. K. S. asks: 1. How can I construct a storm glass? 2. How can I expel fleas from a cat that is filled with them? Answers: 1. Put the following ingredients into a long and narrow bottle: one quarter ounce camphor, one sixteenth ounce niter, one sixteenth ounce muriate of ammonia, dissolved in 2 ounces of alcohol. Cover the mouth of the bottle with a piece of bladder, containing a puncture made by a fine needle. 2. Boil tobacco leaves in water, and wash the cat in the decoction.

M. W. H. asks: 1. What is nitro-glycerin made from? 2. Does it, when ignited, leave any sediment or ash? 3. Can gunpowder be ignited by a current of electricity without the conducting wire touching it? 4. What will be the pressure of one ounce of common gunpowder, when ignited in a cubic foot of space? 5. What is the pressure of nitro-glycerin per ounce, in a cubic foot of space? 6. What the pressure of white or fulminating powder per ounce, in a cubic foot of space? 7. How many cubic feet will one ounce of common gunpowder fill, if exploded in a cylinder or tube one foot square, it standing upright, so that there will be only the atmospheric pressure of one square foot to sustain? 8. Will sulphuric acid keep ink from molding? 9. Will a pocket compass lose its magnetic power? If so, how long will it take, and can it be made good again, and how? Answers: 1. Made of nitric acid, sulphuric acid and glycerin. 2. No. 3. Yes, if the powder be confined. 4. One ounce gunpowder equals about 1 cubic inch space, and expands at the moment of explosion, as estimated by competent chemists, 2,700 times, or to about 1½ cubic feet. Therefore the pressure in a confined cubic foot space, will be 22½ lbs. above the atmosphere per square inch. 5. Nitro-glycerin has 13 times the explosive force of gunpowder, therefore the pressure of one ounce may be estimated at 293 lbs. per square inch above the atmosphere. 6. No known experiments have determined. 7. At moment of explosion 1½ cubic feet. After the gases have cooled, however, probably from ⅛ to ¼ of this. 8. The effect will be to corrode steel pens. 9. It will not, if not tampered with. When lost, the magnetic power is easily restored by rubbing on another magnet.

C. G. G. says: I wish to dig an ice cellar near my well of excellent water. If I drain the cellar through a filter, into the well, will the water be affected hurtfully? Answer: We would advise you by no means to drain your ice house, even through a filter, into your well. Filtered water may look perfectly clear and taste pure, and yet be poisonous, though that from your ice may be harmless. Let no drain come near your well.

M. C. asks: 1. How can I find the power of a steam engine by plain arithmetic? 2. I want a plain rule for finding the horse power of a tubular boiler. 3. Will the same rule apply to all boilers? 4. Is there a rule for finding the capacity of a plunger pump? 5. Which would be the proper place for an air chamber of plunger pump, on suction or force side? I propose to attach it to relieve a very heavy thumping. 6. What causes a vacuum in steam cylinder, and how can it be prevented? Answers: 1. Multiply the diameter of the cylinder in inches by the decimal ·7854; multiply this by the number of revolutions per minute, and by twice the length of stroke in feet, and divide the result by 33,000. 2. Divide the number of square feet of heating surface by 15. 3. Only approximately to any. We do not know of any absolute rule, except a practical test. 4. Multiply the diameter of plunger in feet by the length of stroke in feet, and by half the number of strokes per minute, and you will get a rough approximation of the number of cubic feet delivered per minute. So much depends upon the construction and location of the pump that it is difficult to give a general rule that is reliable. 5. On delivery side generally. 6. The condensation of the steam. It can be destroyed or prevented by letting in air.

J. H. says: You repeatedly advise young mechanics to study mathematics. Will you tell me how long it will take to make a person sufficiently posted on the subject, provided that he has an average amount of brains, a good general knowledge of arithmetic, no knowledge of algebra (or very slight), a fair amount of perseverance, his nights only to study, and no funds to employ a teacher? What work would you advise me to commence with? Answer: A great deal depends upon making the right kind of start, so as to know how to study, as well as what to study. In algebra, we would recommend Davies' "Bourdon," and in geometry, trigonometry, and the use of logarithms, Davies' "Legendre." Each book costs from $1.50 to $2.00, and to master their contents thoroughly will require, with the limited time afforded you for study, from nine months to a year. But you will have gained a recompense; for avenues of great benefit to your business will be opened to you, which would otherwise have been as sealed chambers. In commencing your studies, remember that it is not so much rules, as methods, that you wish to acquire. Always proceed on the principle that the book is wrong and must be proved right; and get practice continually in the interpretation of formulas and results.

A. A. D. says: I am constructing a rotary engine with 4 vanes, each of which has 2·8125 square inches area; it is constructed on the eccentric principle, and is to work on expansion, with 50 lbs. steam pressure, and to make 200 revolutions per minute. Would more vanes create more power? What sized boiler would it require, and what kind of boiler, of plate iron or copper for efficiency and cheapness? How much fire surface ought it to have to make the most steam and be the most economical? Please rate the power of the above engine, and give a reliable mode of calculating power of rotary engines. Answer: We cannot answer these questions without receiving more data. To calculate the power developed by a rotary engine, multiply the piston area that is acted on continuously by the mean pressure of the steam throughout the stroke. Multiply this by the mean piston speed in feet per minute, and divide by 33,000.

E. A. W. asks: How is the black varnish or lacker applied to small articles of wire, such as fish hooks, hair pins, etc., and of what is it composed? Answer: Add to 2 lbs. asphaltum (fused in an iron pot) hot boiled oil 1 pint; mix thoroughly, remove from the fire and when cooled a little add 2 quarts oil of turpentine Apply with a varnish brush.

F. B. T. asks: What should be the size of a water wheel, and of the stream of water to run a sewing machine? The water is supplied through hose to a tank 8 feet above ground. Answer: There are a number of sewing machine motors, driven by water, in the market. Correspond with their manufacturers.

W. R. H. asks: How can I make india rubber impervious to kerosene oil? Answer: You cannot prevent kerosene attacking india rubber where it comes in direct contact with it. Still good rubber, well vulcanized, ought to last long enough to make its renewal at intervals not very expensive.

G. A. H. asks: Is nickel plating a success as a general thing, and can zinc be successfully plated with nickel? Answer: Nickel plating is a success, but there is no known method of plating zinc. The acid bath used is an obstacle, the acids attacking the zinc at once.

A. P. G asks if the dry heat of the Turkish bath is less penetrating than moist heat. Answer: The human body can withstand for some time a heat far above that of the Turkish bath, 220° Fahr., if the medium be that of hot dry air. The rapid evaporation from the surface of the body prevents the internal heating of the blood. If the air be moist, however, or the medium of heat be steam, a temperature considerably below 112° Fahr. would be sufficient to, in a short time, effectually kill a man.

G. F. A asks: 1. How can I melt old composition printers' rollers, so as to pour into molds for casting plaster in? 2. What are the exact proportions of the ingredients used in making the composition rollers now in use? 3. Can you inform me how the composition used by decorators for looking glass frames, etc., is made? Answers: 1. You can melt composition rollers by placing them in a vessel surrounded by boiling water, as in the ordinary glue pot. When melted, you can pour it into molds. 2. Dissolve, in two pounds of molasses (pure) at heat not above that of boiling water, one pound of good glue, previously soaked over night in cold water. 3. Decorators use for gilding, what is known as "mosaic gold", a bisulphuret of tin. This is mixed with varnish and applied to wood.

W. S. B. asks how to recover diamonds from the debris of a fire. Answer: You can get rid of plaster and lime, or any substance that will remain for a length of time suspended in water, by the following means: Provide a large tank, fitted with a stirrer at the bottom. Let a stream of water enter the tank at the bottom; and when the tank is full of water and the stirrer in motion, add the debris in as fine powder as possible. Let a pipe carry off the surplus water at the top of the tank. In this way, with plenty of water, you can wash free from plaster and lime.

A. E would like to know the rule for finding the speed of shafts or pulleys. Suppose a 22 inch pulley is making 420 revolutions per minute with a belt running on a 10 inch one; what would be the number of revolutions of the small one? What is the rule for such cases? Answer: The speeds of two pulleys, under such circumstances, are inversely proportional to their diameters. In the case mentioned, the speed of the smaller pulley, if the belt did not slip, would be 420×22÷10=924 revolutions a minute.

W. H. D. asks: 1. Is an engine shop the best place in which to learn the machinist's trade? 2. If so, what manufacture would you recommend? 3. Would you recommend me to work at what my mind and heart is set upon, in preference to anything else? Answers: 1. Probably a large machine shop would be best for acquiring a general knowledge of the work, on account of the great variety of machinery constructed in such a place. 2. We cannot recommend any particular establishment. Try and get in a shop where the men are encouraged by the owners to study and improve themselves. 3. If you are so situated that you can follow your favorite pursuit, by all means do so. That is one of the greatest steps towards success in life.

T. S. L. F. says: Can you refer me to any book that will tell me how to ascertain the exact power it will take to force water up 250 feet high, at the rate of 100 gallons per minute? Answer: See article on "Friction of Water in Pipes," on page 43 of our current volume. The power required in your case will be that used in lifting the water, and overcoming the resistance due to friction.

G. C. C. asks how to take off window glass that bluish appearance said to be caused by using creosote and sulphur. It makes its appearance while the glass is going through the flattening process. Answer: The bluish appearance on your glass is probably caused by some defect in its mode of manufacture. Too much potash would be apt to cause it. If only on the surface, dust well with whiting and rub off with a linen cloth.

O. R. C. asks: Will a railway head, constructed to run a section of six cards, run a section of nine cards without alteration? Answer: It will probably be necessary to change the trough and gearing.

G. O. S. says: I have a small sailing boat and wish to convert it into a steamer. She is 22 feet long and of 8 feet beam. What number of horse power do I want to run her 12 or 15 miles an hour? What should be the size of wheels and what the length, width, and number of buckets? Answer: See dimensions published in SCIENTIFIC AMERICAN for May 10, 1873.

L. I. O says: We had a new engine cylinder put in this spring, 14 by 24 inches, with circular valve of a new pattern. The supply pipe and governor are 3½ inches in diameter, or about 10 inches area, and the steam passages between the ports and cylinder are about 9½ inches area, but the passages above the ports are only 5½ inches area, and still the designer of the valve persists in saying that the valve and passages are exactly right. We carry 70 pounds of steam and run 96 revolutions per minute. I claim that the steam is wire drawn, and that we cannot obtain the full power of engine. Please say if the valve is properly constructed. Answer: We think the ports are sufficiently large, and that the cylinder ports have more area than is absolutely necessary to prevent wire drawing.

L. F. I asks: What is the effective power of a 10 by 24 inches cylinder stationary engine, running at 100 revolutions per minute with 60 pounds steam pressure in boiler as shown by gage? By effective power, I mean the power that would be available for driving other machinery after deducting that necessary to run the engine itself. Answer: We could not answer this question otherwise than approximately without a practical test, but we think the engine would develope from 30 to 35 horse power.

R. K. says: The joint between the cylinder and valve jacket of my engine is badly eaten away, so that I am unable to make a tight joint with rubber cloth. I have tried red lead and iron borings, but it will stand but a short time. It appears to be eaten away by the steam or tallow. How can I make a joint that will hold? Answer: You can probably make a permanent joint by cutting a groove and driving a rust joint; but it will be difficult to break the connection if this is done. If you wish to make a joint that can be readily broken, have the parts filed off. If you think the tallow causes the trouble, try some other lubricant; but we have an idea that, if you will get the joint perfectly tight, you will have no farther trouble.

J. H. H. says: I am using a horizontal cylinder boiler, 4 feet in diameter, 12 feet long, with mud drum across back end, 22 inches diameter. Said boiler drives a compound engine, working high pressure in upper cylinder and condensing in lower. Feed water is taken from condenser for boiler. The inside of mud drum deteriorates by something eating holes in the surface, some of which are large enough to place the end of a finger in, and the bolts which protrude into drum from check valve, blow-off, etc., are eaten off. The boiler makes a moderate amount of scale which becomes mostly detached when about ⅛ inch thick. Pressure of steam is 30 pounds. Please give your opinion as to the cause of this corrosion or deterioration of mud drum. Answer: We have known cases of this kind in which the trouble was caused by the lubricating material used in the cylinder, which passed into the condenser and thence into the boiler. We cannot say positively that the corrosion in your boiler occurs in this way, but it is quite probable.

T. E. C asks: How much resistance is required to stop an ordinary full steam car going at 30 miles an hour? 2. Which is the best patented steam car brake, the cost of the same, and the cost of keeping it in running order? 3. In how short a space of time can a car running at the rate of 30 miles an hour be stopped by the best brake? Answers: 1. The moving force of the car can be ascertained by multiplying its weight by the square of its velocity, in feet per second, and dividing by 64·4. Suppose a car, moving 30 miles an hour, weight 48 000 pounds. A speed of 30 miles an hour corresponds to 44 feet per second, and the power required to stop the car will be sufficient to raise $[48,000\times(44)^2]\div64\cdot4=1,442,981$ pounds one foot high. 2. With so many competitors for public favor, it would be out of place for us to name any one as the best. We advise you to correspond with the different manufacturers. 3. In about 10 seconds.

A. W. I. says: I differ from J. E. E. in his reply to H. B., concerning the power required for different sized circular saws. He says that "a saw just large enough to cut through a board will require less power than a saw larger, the number of teeth, speed and thickness being equal in each." Now I am running three saws, one 48 inches with 44 teeth, one 52 inches with 42 teeth, and one 64 inches with 56 teeth, all 8 gage in thickness; and I find the 64 inches saw will cut through a 12 or 14 inches cut with less power than either of the others. I differ with him concerning the saw with few teeth cutting the easiest, as my 52 inches saw with 42 teeth takes more power than either of the others; and I run the same hook in the teeth, and file them all exactly alike. My engine is small and timber large, so that I have every facility for finding out which cuts with least power.

W. E H. says, in reply to S. N. G., who asked for a recipe for crystal gold for dental uses: Take any gold, the purer the better, roll into thin ribbons and dissolve in aqua regia, or 1 part nitric acid and 3 parts hydrochloric acid, by measure. After action has ceased, pour off into a deep glass jar, leaving the silver alloy in form of a chloride. Dilute the clear solution of gold with an equal quantity of water, and slowly add a saturated solution of protosulphate of iron in water, which precipitates the gold as a brown powder. Pour off the water, etc., wash the powder with several waters, dry it and amalgamate it with mercury to the consistency of thick cream. Wash out the oxide found during amalgamation with alcohol or salt water, and put the mixture into pure nitric acid, setting the dish into a hot sand bath. The acid dissolves the mercury, leaving the gold in form of a sponge, which wash with water and anneal at a red heat for half an hour to expel any traces of acid or mercury. The porosity will depend on the thickness of the amalgam. The softer the amalgam, the lighter the sponge. There are difficulties attending the process, owing to impurity of chemicals, mercury, etc., which are so great as to make it impracticable for an amateur to make the gold as cheaply as he can buy it in the market; but the above directions are reliable, as the writer has made several lots from this formula.

A. M. asks for an explanation of the word "penny" as used to describe the size of nails. Answer: In the early history of our country, all nails were wrought (forged by hand); our currency then was pounds, shillings, pence and farthings. Each sized nails were sold by so many pennies per hundred. The usual way was to ask for fourpenny nails, sixpenny, tenpenny, etc. Hence in mercantile circles, the sizes are designated by the price in pennies per hundred. When cut nails were introduced, the sizes were still designated by pennies; and this has been continued and in all probability will be, as long as nails are used.—J. E. E., of Pa.

C. F B says: In filing hand saws, the majority of mechanics file toward the handle: that leaves the teeth with more bevel on the back side than on the front, which is caused by the taper of the file. A few persons file their saws towards the point, which gives more bevel to the front or cutting side of the teeth. I think that the back side of the teeth should be filed nearly square across; the saw will cut equally well and remain sharp much longer. The front side of the teeth should be beveled to suit the timber; soft wood requires more bevel than hard wood. Answer: The correspondent is perfectly correct in his idea of filing a hand saw, as it is only intended to cut one way.—J. E. E. of Pa.

COMMUNICATIONS RECEIVED.

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

On Steam and Compressed Air. By——.
On Retrogression of the Sun. By J. A. B.
On the Patent Right Question. By R. H. A., by M. J., by T. W., and by L. G. J.
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On the Multiplex Telegraph. By J. T.
On Steam on the Canals. By S. W. H.

Also enquiries from the following:

F. J. H. Jr.—R. D. L.—P. A. M.—M. P. J.—Z. S.—P. R.—Y. Z.—E. B.—J. L. McL.—P. A. S.—T. P. P.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL.]

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APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending, for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

25,874.—BRONZING MACHINE.—G. H. Babcock. Oct. 8.
25,893.—GLASS COFFIN.—J. R. Cannon. Oct. 8.
25,975.—TACKLE BLOCK.—I. E. Palmer. Oct. 15.
25,904.—BIT STOCK.—N. Spofford. Oct. 15.

EXTENSIONS GRANTED.

24,963.—FLOUR PACKER.—S. Taggart.
21,915.—CASTING COPPER CYLINDERS.—F. Adams.
24,523.—ELEVATOR.—A. Betteley.
24,952.—MEAT CUTTER.—J. G. Perry.

DISCLAIMERS.

24,963.—FLOUR PACKER.—S. Taggart.

DESIGNS PATENTED.

6,776 to 6,778.—NUBIAS.—H. Boot, Philadelphia, Pa.
6,779.—HANDLE TIP.—G. W. Bunnell, West Meriden, Ct.
6,780.—HAND BELL.—E. G. Cone, East Hampton, Ct.
6,781 to 6,783.—CHAINS.—V. Draper, N. Attleboro', Mass.
6,784.—CARPET.—J. Powell, Kidderminster, England.

TRADE MARKS REGISTERED.

1,371.—SAWS.—E. C. Atkins & Co., Indianapolis, Ind.
1,372.—SCARFS, ETC.—Brownson Bros., Chicago, Ill.
1,373.—MEDICINE.—D. Dick, New York city.
1,374.—MINERAL WATER.—C. & E. E. Dunbar, Waukesha Wis.
1,375.—STOVE POLISH.—Fletcher & Co., Lynn, Mass.
1,376.—BRANDY.—H. Imhorst, New York city.
1,377.—STEEL AND IRON.—Long & Ogden, New York city.
1,378.—TOBACCO.—Loewenthal & Co., Chicago, Ill.
1,379.—SOAPSTONE PACKING.—Sellers Bros., Phila., Pa.
1,380.—STEEL AND IRON.—Sweet & Co., Syracuse, N. Y.
1,381.—HEATERS.—Gold Heating Co., New York city.
1,382.—STEAM GAGE.—Utica Steam Gage Co., N. Y.

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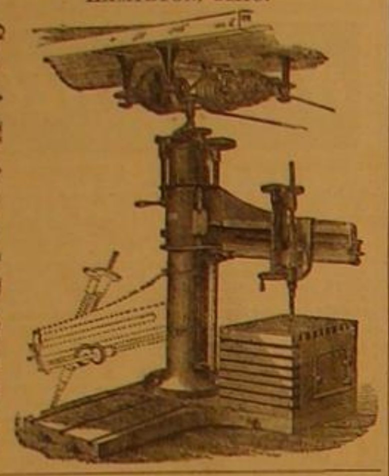

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