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IMPROVED SAWING AND GROOVING MACHINE.

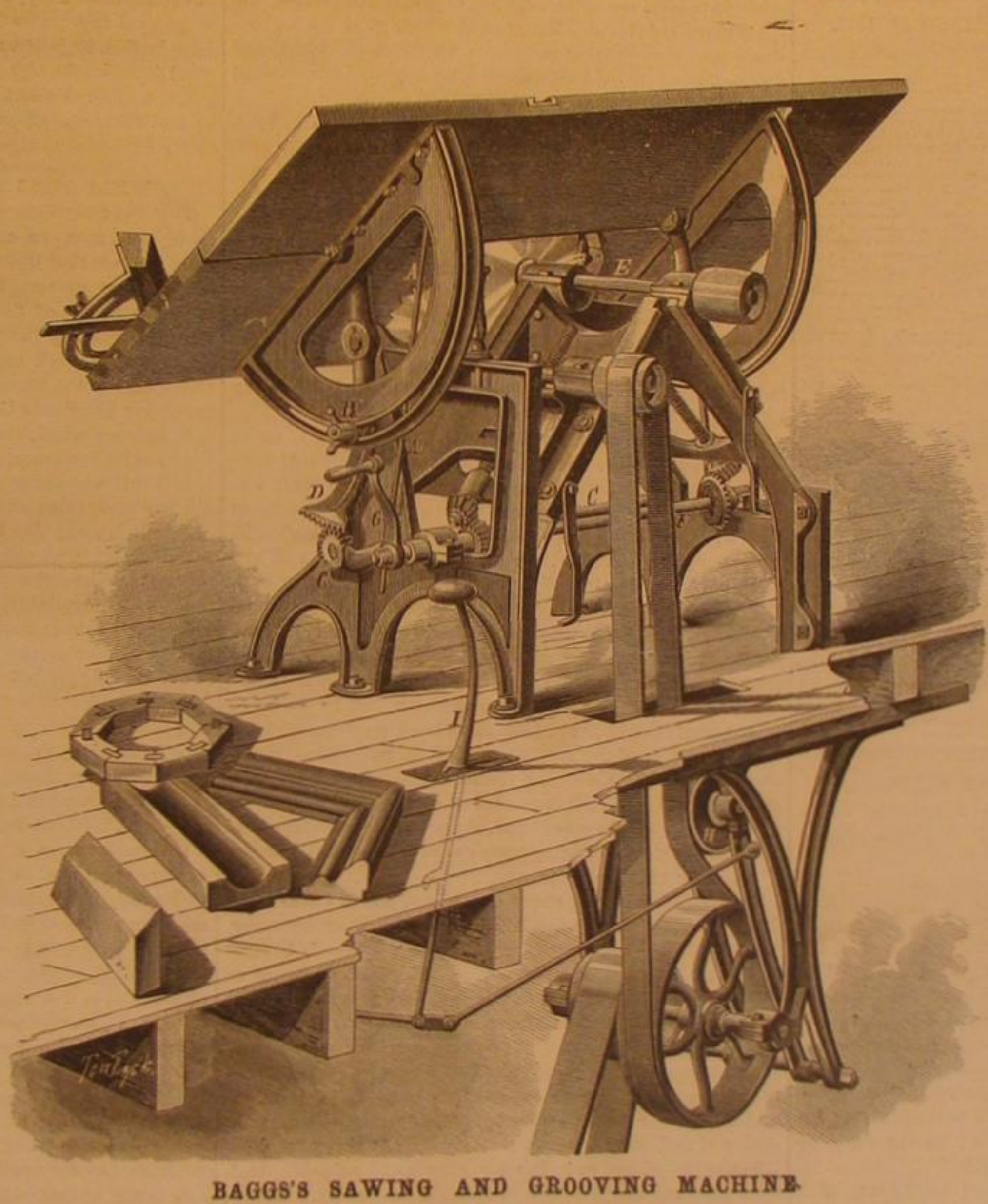
One of the principal difficulties which the inventor has sought to overcome, in constructing the new sawing and grooving machine represented in the annexed engraving, is to hinge permanently the oscillating table, while avoiding the necessity of a wide opening in the latter for the saw to work through, or of repeated adjustments of the table to the saw. The means adopted are simple and effective, and consist in causing the table, when it is placed at any required angle, to be at the same time moved laterally, so that the aperture, which is no larger than the opening in the ordinary stationary saw table, is thus automatically adjusted to proper position with reference to the saw.

As will be seen from the engraving, the table is made in two parts, the rear of which is bolted to the oscillating table bearers, and the front leaf attached to dovetail slides which move over corresponding surfaces on said bearers. The object of the moving part is to allow of enlarging the saw opening in order to use the grooving saw for plowing, rebating, etc., or cutter heads for cutting wide gains, chamfering, raising base-casing panels, plinth blocks, shanking cogs, cutting small tenons, etc. The table has also an independent lateral adjustment, so that the fixed leaf can be set to tange the saw at whatever size it may be placed to operate, and thus rebates can be cut where there is but little wood left to pass between the saw and the gage, without danger of the work being caused to drop through by the downward pressure of the blade. This adjustment is also of advantage when cutter heads are used, as it permits the table to be moved back so as to clear the head when the same is screwed against the fixed collar on the mandrel. It is accomplished very quickly by loosening the set screw in the outer end of a crank pinion wrist, and sliding the latter up or down on the rod, A, which connects it to the table bearer. The screw is tightened, as is also the clamp, B, which prevents the table from turning. The front is then adjusted to tange the saw or cutter head on the outside

The shaft, C, extending from end to end of the machine, carries the pinions which engage with the teeth of the vibrating arms, one of which is shown at D. By these arms the table is evenly moved and kept parallel to the direction of the saw. By means of the pinion and set screw on each end of the shaft, the table can be nicely adjusted to suit the draft of the saws, to prevent wedging or back cutting.

Beneath the table are two frames inclined at equal angles and meeting at their tops. These serve as slides and supports for the carriages which carry the two saw mandrels, E. Said mandrels are of steel, and run in self-oiling Babbitt metal boxes. To them are attached nuts through which pass long screws, which are secured in the inclined frames. By means of bevel gearing, these screws connect with the shaft, F. At one outer end of the latter is a crank, G, which by suitable means may be so placed as to turn either one or both of the screws, so raising either or both of the carriages, and consequently the saws. The latter can thus be set to cut to any required depth. The guide may be adjusted for use on either side of the saw or to any angle with the table; it is provided with adjustable holders for strips or molding. The grooving saw is adapted for plowing and rebating, and is made adjustable for any sized plow, varying in thickness from that of the saw plate to one and a half inches or the limits of the collars; the latter may be adjusted by set screws without unscrewing the mandrel nut.

The general advantages claimed for the machine, in addition to those mentioned, may be summed up as follows: It may be easily arranged to perform either square or angular sawing; the material lies flat on the table and close to the guide; the grooving saw will cut gains of any required size across the grain, either square or at any angle, and will do its work more effectually than heads and cutters, while needing much less time in adjusting and sharpening; the cross cut guide is adjustable for squaring, mitering, and for all kinds of angle work, the table and the guide giving both vertical and horizontal angles in one cut. The table turns toward the operator, the saw remaining at the same hight, so that the work is in full view and is convenient to hold; the saws overhang the frame so that they may be taken off or adjusted without removing any part of the top. The machine is readily adapted to faceplate turning; by placing the table at an angle, the front leaf serves for a rest. The rip saw is provided with a guard to prevent it from throwing sticks, which is arranged to move up and down with the saw, leaving the table clear for the use of the other blade



BAGGS'S SAWING AND GROOVING MACHINE.

In the engraving there is also represented the countershaft and pulleys, exhibiting the mode in which the tightening pulley, H, is operated. The lifting rod, I, has two hooks, which engage with an iron plate screwed to the floor. When the rod is drawn up, and the lower hook is caught, the binder stands clear of the belt, the latter being of sufficient length to allow the saw mandrel to remain at rest. When the hook is disengaged, the binder is, by the action of the weight on the rod, brought forward against the belt. The object of the upper hook is to prevent the binder from dropping in contact with the running pulley. But one mandrel is used at a time, the belt being lifted from one to the other as desired. The inventor informs us that he has devised another arrangement for the countershafting, which admits of the belt being brought to the machine from above instead of from below. Either device is furnished with the machine.

For small shops, using small circular saws, the machine is capable of extended utility, while for large establishments the fact of its being suited for a variety of operations, enabling it to be kept constantly employed, renders the invention equally well adapted.

Patent for improvements now pending through the Scientific American Patent Agency. For further information address the inventor, J. T. Baggs, Bridgeport, Ohio.

THE horse power of waterfalls is found by multiplying the number of pounds of water which fall per minute by the length of the fall in feet, and dividing the product by 33,000.

Aniline Black by Electricity.

"If we take a strong solution of sulphate of aniline and submit it to the action of two Bunsen elements, employing platinum electrodes, we soon see the positive pole become coated with a violet blue covering, greenish in places, a fact remarked by Letheby. If the experiment is prolonged for 12 or 24 hours, we find fixed to the positive pole a black mass, easily detached On treating this substance with ether and alcohol, and drying it, there remains a amorphous black body with some greenish reflections, insoluble in most solvents. If this body is treated with sulphuric acid, and spread out upon a porcelain saucer, it takes a greenish coloration, but on treatment with alkalies it resumes its jet black color. It is not affected by nascent hydrogen. To ascertain that the production of this black was due to nascent oxygen, and not to the platinum employed as electrode, I made use of electrodes of gas coke, and obtained in 12 to 24 hours identical results; a black adhesive mass was fixed to the carbon of the positive pole. Nitrate of aniline gave also a black deposit, which, on treatment with alkalies, took a velvet-like appearance; but in presence of sulphuric acid a decomposition took place, and I obtained a brown maroon coloration. The composition of this black is, therefore, different from that obtained with aniline sulphate. Muriate of aniline gave, around the positive pole, a black coagulum, but it is probable that, in this case, the action is complex, and that there may be at the positive pole, besides nascent oxygen, nascent chlorine, which complicates the results.

With the organic salts I have obtained differences which require mention. Aniline acetate gave, at the positive pole, a black glutinous substance, partly soluble in the surrounding salt. Aniline tartrate gave no result, not even the least coloration of the positive pole. Hence it appears that aniline blacks may be obtained without the intervention of any metal, and that the salts of aniline behave in different manners with the nascent oxygen."—*J. J Coquillon, in Comptes Rendus.*

Baryta Green.

Make a mixture of two parts of caustic soda and one part chlorate of potash, and add very gradually two parts of manganese in very fine powder. Raise the temperature gradually to very dull redness. On reaching that point allow the mixture to cool, and after having powdered it exhaust it with water. Filter the liquid thus obtained, and add to it when cold a solution of nitrate of baryta. There is formed a violet-colored precipitate of baryta, which is washed with care. It is then dried and treated with one half to one part of caustic baryta, hydrated, and gradually heated up to the commencement of redness, with consequent stirring. When this operation is at an end, the mass, on cooling, appears of a fine green. It is powdered and finally washed in order to remove any excess of baryta.—*M. Boettger, in Dingler's Journal.*

The Blasting of Diamond Reef.

Diamond Reef, an ugly ledge of rocks lying between Governor's Island and the Battery, in New York harbor, is rapidly disappearing before General Newton's dredging and blasting scow. Five blasts were exploded in the mass of rock during the month of October, which completely shattered what remained of the worst part of it, leaving, however, an immense heap of *débris* to be removed. The reef used to be 400 feet long, and at its highest point was 19 feet below low water. After the fragments are removed, there will be a minimum depth of 26 feet over an area of 6,000 feet of what was originally the highest part of the reef. Should the work proceed without interruption, the whole ledge will have been removed within seven months.

AMONG the best bearings for water wheels are those composed of good oak, rock maple, or lignum vitæ.

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Contents.

(Illustrated articles are marked with an asterisk.)

FILTH AS THE SOURCE OF PREVENTIBLE DISEASE.

In his charming little poem, preaching resignation to the stroke of the "Reaper whose name is Death," Longfellow says:

> "Let us be patient: These severe afflictions
> Not from the ground arise;
> For oftentimes celestial benedictions
> Assume this dark disguise."

This has ever been the sentiment of piety: beautiful in the abstract, comforting in times of personal bereavement, but a deadly delusion when applied in mass. Not patience but impatience, not resignation but resistance, is the proper attitude in the presence of disease and death, more especially in those cases—and they are in the majority—in which the causes of "these severe afflictions" are preventible or removable: causes which, poetry and piety to the contrary notwithstanding, do from the ground arise.

This is a question of fact, not one of sentiment. The Mussulman says: "It is the will of God," and impassively shuts his eyes to the palpable causes of plague, pestilence, and famine, which shorten the lives of millions. The Christian, quite as criminally, dreams of possible "celestial benedictions" in conditions which contribute to make the average death rate double what it ought to be, while he holds up his hands in holy horror at the apathy of the Turk.

It is appointed of all men once to die: so far we have to submit to natural law, and there may be virtue in accepting the event with resignation—provided it does not come untimely: but there can be no virtue in being resigned to a condition of things by which not ten persons in a hundred, in the healthiest countries in the world, are permitted to reach the standard old age of seventy-five years: by which the death rate of the first year of infancy is swollen from one in twelve, as it is in some districts, to one in three, as it is in others. And the excess of deaths is but an imperfect measure of the aggregate influence which preventible diseases exert against the efficiency and happiness of a people. There remains an incalculable amount of physical suffering and disablement, of sorrow and anxiety, of thwarted effort and straitened means, not to speak of destitution and pauperism and their terrible effects upon the physical virtue and moral stamina of the rising generations: all to be traced directly or indirectly to easily preventible causes.

Foremost among the causes which affect the public health injuriously—causes not of local, but of general, almost universal, operation—the Medical Officer of the Privy Council finds most conspicuous these two "gigantic evils," which claim the "earliest attention in the sanitary government of England," and equally, we may add, of every other civilized government, namely:

First, the omission (whether through neglect or want of skill) to make due removal of refuse matters, solid and liquid, from inhabited places; and secondly, the license which is eprmitted to cases of dangerous infectious diseases to scatter abroad the seeds of their infection.

Very frequently these two causes coöperate, doing immense injury to the public health, through the special facility which certain forms of local uncleanliness provide for the spreading of certain specific infections: so that, on summing up the results of the extensive and very able investigations of sanitary conditions, made under his direction, Dr. Simon does not hesitate to say that, in total power, uncleanliness must be reckoned as the deadliest of our present removable causes of disease. This, even when the term is restricted to such degrees of uncleanliness as fall or ought to fall within the designation of filth, implying nastiness such as any average man or woman should be disgusted at. If the term were made to include all that it legitimately implies, as for example the foulness of air due to the non-removal of the volatile refuse of the human body, such as obtains in overcrowded and ill ventilated dwellings, a much stronger expression of its fatal influence would be justified.

That filth makes disease, meaning by filth putrescent refuse matter causing nuisance by its effluvia and soakage, must have been one of the earliest of social discoveries, for it is recognized in the oldest records which exist of legislation meant for masses of mankind: yet the more subtile and destructive effects of filth remained unsuspected almost until quite a recent period.

Filth kills in two ways. First, and most obviously, by a direct poisoning action, as when one succumbs to the concentrated fumes of organic decomposition from an old unventilated cesspool, or a long blocked sewer, or when the vigor of life is depressed by continuous breathing of a foul atmosphere in which the fetid gases have been largely diluted; second, with far greater and more subtile destructiveness, by means of the morbific ferments or contagia which it breeds or harbors. The chemical poisons of filth hurt by instant action, and in direct proportion to the palpable and ponderable dose: with contagia, on the other hand, indefinitely large ulterior effects are produced by, or by means of, doses which are indefinitely small.

The last named agents of disease and death consist, so far as known, in minute living organisms, indefinitely self-multiplying in their several spheres of operation. At least one sort, the ordinary septic ferments, seem always to be present where putrefactive changes are in progress; others, though not essential to putridity, are in different degrees apt, and some of them little less than certain, to be incidents of ordinary refuse. It is by these various agencies, essential and incidental, that filth produces the diseases classed by sanitarians as zymotic, and not by means of the usually accompanying stench. Hence, as Dr. Simon tersely observes, the question: What infecting powers are prevalent in given atmospheres? should never be regarded as a mere question of stink; and it is of the utmost practical importance to recognize, in regard to filth, that agents which destroy its odor may yet leave all its main powers of disease production undiminished. On the other hand, there may be prevalent fetid gases of the most sickening potency with an entire absence of septic ferment in the air.

Indeed filth ferments show no power of active diffusion in dry air. They may be passively wafted for short distances, but probably do not carry their vitality far if the air be freely open. Moisture is their normal medium. Currents of humid air, as from sewers and drains, lift them in full effectiveness; and if into houses or confined exterior spaces, the chances are that their morbific powers will be less preserved. Ill ventilated and low-lying localities, where refuse is allowed to lie, may especially be expected to have these ferments present in their common atmosphere, as well as teeming in their soil and ground water.

In the latter, too, as in the air, stench and palpable foulness afford no adequate test of zymotic malignity. Chemical demonstration of unstable nitrogenous compounds in water is a warning (and the disgust of healthy taste and smell equally so) which should never be disregarded: "but till chemistry shall have learnt to identify the morbific ferments themselves, its competency to declare them absent in any given case must evidently be judged incomplete, and waters which chemical analysis would probably not condemn may certainly be carrying in them very fatal seeds of infection."

Of the diseases distinctively due to filth, the most characteristic are those which, in respect to their leading symptoms, are called diarrhœal. These are of two general types—common diarrhœas, ascribed to the common septic ferments generated in all refuse, and specific diarrhœal diseases, such as cholera and typhoid fever due to specific infection. It is in regard to the latter that the labors of the British Medical Board have been especially searching and successful.

In every one of the cases investigated, the relations of water supply and excremental deposits were horribly close in very many instances, as for example at Annesley, of which the inspector, Dr. Buchanan, reports, "arrangements for excrement disposal and water supply such that people must drink their own excrement!" Truly the chief medical officer may well say that it is difficult to conceive, in regard to any causation of disease in a civilized community, any physical picture more loathsome than the way in which enteric fever spreads its infection. Though sometimes making its way by covert processes, yet far oftener in the most glaring way, it apparently has its source in that which is of filth the filthiest: "apparently its infection runs its course, as with successive inoculations from man to man, by instrumentality of molecules of excrement which man's filthiness lets mingle in his air and food and drink."

The distribution of an immense quantity of other diseases is traced to the same disgusting process. The argument which applies to the bowel discharges of enteric fever apply equally to cholera, and seems to extend, by extremely strong analogy, to every disease, whether nominally common or specific, in which the human intestinal canal is the seat of infected change.

But this does not limit the deadly influence of filth. The researches of Dr. Burden Sanderson and others have clearly shown that in the common septic ferment, so called, or in some ferment or ferments not hitherto to be separated from it, there reside powers of disease production as positive as those which reside in variolous or syphilitic contagia. By successive inoculations, it not only developes itself as one of the most tremendous of zymotic poisons, but becomes communicable from the sick to the healthy, producing diseases exactly corresponding to the infections chiefly known under the names of erysipelas, pyæmia, septicæmia, and puerperal fever: infections sometimes arising in unquestionable dependence on filth, yet becoming, when arisen, the most communicable of diseases. And further, it seems most probable that the ferment which destroys life so quickly by septicæmia in its stronger actions can in slight actions start, in the infected body, chronic processes which will eventuate in general tubercular diseases. In this way the mischief done by filth in generating diseases like erysipelas or puerperal fever on the one hand, or tubercular diseases on the other, may be of a sort entailing possibilities of extension, by accidental contagion or by hereditary transmission, indefinitely beyond the original filthy neighborhood.

WHAT FILLS THE INTERSTELLAR SPACE?

That the interplanetary and interstellar space cannot be a perfect vacuum, or consist of absolutely nothing, is clear from the fact that light and heat are propagated through it; and whether we accept the old theory of Newton, that light is an emanation of fine particles, or the now generally accepted undulatory theory of Huyghens, that it is propagated by waves through an existing medium, we are driven in either case to the conclusion that there must be a something pervading the whole Universe (outside of the luminous and dark spheres which are suspended in it at various distances apart) to its furthermost recesses. It has usually been agreed to call this something the celestial ether, and even different kinds of such ether have been supposed to exist: one to propagate light, one for heat, one for electricity, one for magnetic effects, and some philosophers have even suggested one to produce the phenomena of gravitation; and they have been respectively called the luminiferous ether, imponderable caloric fluid, electrical ether, magnetic fluid, etc., and even some of our foremost savants still indulge in the use of such hypothetical expressions.

It may be that this something which fills space is composed of a number of elements, in the same way as our atmosphere consists of nitrogen, oxygen, carbonic acid, and watery vapor; but it is also possible that it consists of a single substance, capable of transmitting various kinds of motions, as our atmosphere, without reference to its chemical constituents; it transmits waves of sound of various pitch and character, various pressures, currents of different velocities, etc. It is sufficiently well established that light, heat, and electricity are only modes of motion differing in character, being for instance progressive, circular, elliptical, to and fro, rotary, longitudinal waves, transverse waves, etc.; therefore it is possible that the same interstellar medium may transmit light, heat, attraction of gravitation, electricity, magnetism, and possibly other forces as yet unknown to man.

In the meantime, it forms an interesting subject of inquiry if this medium is absolutely without weight, and therefore of a nature different from what we call matter, of which weight is the first and fundamental property, or if it may be considered as very rarefied matter, so highly expanded that it is to our hydrogen as hydrogen is to platinum. The latter is, at the common atmospheric pressure, 250,000 times heavier than hydrogen, and we can easily reduce its density (by means of an air pump) to a one hundredth part, as is done in the Geissler tubes, which, when illuminated with an electric current, show the characteristic spectroscopic lines of hydrogen; and notwithstanding this still ponderable material has a density of only the twenty-five millionth part of that of platinum, it will, when condensed again, show all the characteristics of its nature, enter into chemical combinations, exert pressure, etc.

It is well known that our ancestors, a few centuries ago, had no conception of the gravity of gases in general, still less did they attribute weight to rarefied hydrogen, and even now, for the savage mind, such a thing has no existence; and it is a question whether even we, the enlightened and supposed to be well informed savants of the nineteenth century, do not stand in the same ignorance in regard to the gravity and other properties of the interstellar medium.

The modern theories of the conservation of forces and the transformation of heat into power, and *vice versa*, considered in connection with the velocity of the transmission of the solar rays and with the amount of heat poured out by the sun, which has been correctly measured (and which is the primary source of all motion and life on our planet, except the motion of the ocean tides), may give some light on this subject. As the heat of the sun is sufficient to melt half an inch of ice per hour, or 72 cubic inches for every square foot of surface, which is equivalent to $\frac{1}{24}$ of a cubic foot, or nearly $2\frac{1}{2}$ lbs., and as the melting of 1 lb. of ice consumes 142 units of heat, the solar rays exert a heating influence of $2\frac{1}{2} \times 142 = 355$ units of heat per hour on each square foot. But as 1 unit of heat is equivalent to 772 foot pounds, we have for the solar action a force of 274,040 foot pounds per square foot per hour, or 80 foot pounds per second. It has been demonstrated that light moves with a velocity of 192,000 miles, or very nearly 1,000,000,000 feet, per second; and calling the weight or mass of the molecules (which, according to the Newtonian theory, are emitted from the sun) $= x$, we must, to ascertain the mechanical momentum of the effect of this transmission, multiply the mass with the square of the velocity; and as this momentum is found equal to 80 foot pounds per square foot, we have the equation: $1{,}000{,}000{,}000^2 \times x = 80$, from which it follows that $x = 80 \div 1{,}000{,}000{,}000^2 = 0{\cdot}00000000000000008$ for the mass of a column of the interstellar medium 192,000 miles, or 1,000,000,000 feet, long and of 1 square foot section Dividing this value of x by 1,000,000,000, to find the weight of 1 cubic foot, we see that it will amount to 0·00000008 lb. As the weight of 1 cubic foot of hydrogen is, at the ordinary atmospheric pressure, 0·002 lb., we see that, if these calculations are worth any consideration, the weight of the interstellar medium is about a million times less than hydrogen; therefore it is utterly inappreciable by our most delicate balances, but still very appreciable by calculation and observation. If we accept the Huyghenian theory of light transmission by waves, the mechanical effect of the luminous waves, striking with the demonstrated velocity of light (notwithstanding that its calculation involves more complex and difficult questions), will give results not very different from the above estimates; and these make it highly probable that the specific gravity of this interstellar medium is not absolutely zero, but stands in about the same relation to rarefied hydrogen as rarefied hydrogen does to platinum.

FOREIGN PATENTS—SPLENDID OPPORTUNITIES FOR AMERICANS.

We would direct the attention of inventors to the large reductions which have been made in the expenses pertaining to the securing of patents in foreign countries, as fully set forth in the advertisement of Messrs. Munn & Co., published on another page. It is not realized as thoroughly as it should be that the world, and not any one political division of it, is the inventor's legitimate field; that an original and useful device is likely to be as valuable and as profitable in one civilized country as in another; and therefore for the possessor of the same to attempt to glean its full advantages, from its working only in the United States, is as shortsighted as would be the course of a wholesale merchant who should reject all trade except within the limits of the town or city in which he resides. Add to this that American inventions have acquired an enviable reputation abroad, and are eagerly sought after, and an opportunity is offered for making money infinitely superior to that presented in the territory from which a dealer in other men's wares must literally discover and extract the means of establishing a business.

But apart from all these considerations, it is certain that at no period since patents have been in existence has the acquirement of foreign protection for his device been more vitally important to the American inventor than at the present time and during the coming year. All the world knows that in a few months such a display of new and ingenious inventions as has never before been witnessed will be exhibited at Philadelphia. Every means of making this Exposition known has been adopted. The foreign newspapers are filled with preliminary accounts of the buildings, and with anticipations of the grandeur of their contents. Our home journals are constantly on the alert to give to the public the latest intelligence of the progress of the enterprise. Nearly all the great governments of the world are getting ready exhibits of the finest productions of their several countries, and, finally, thousands of people, including probably all most prominently interested in invention and in industrial progress, will personally make the journey to the Centennial. The machine builders of England and France, the iron producers of all the European countries, capitalists from abroad ready to invest in and promote the advancement of new and useful ideas, all will scrutinize with the utmost interest our national display, and seek to profit by it. Skilled foreign engineers will examine every detail of the mechanism, ingenious foreign inventors will contrast their devices with ours, and note the improvements, and, in brief, we may venture safely to say, of each and every American invention of merit in the Exposition, there will be many scores of people who will have its every feature impressed on their memories, if not accurately portrayed in their note books. What then is to prevent these people from returning to their own countries and, with all the data before them, reproducing every American device, and reaping a rich harvest in return? Nothing but the protection of the foreign patent, of which the American inventor may now avail himself; and if that patent is not secured, he must be content to stand aside and see his ideas appropriated.

The advantage of the foreign patent does not, by any means, end with the prevention of piracy at the Centennial, important as such effect may be. It renders every particle of the enormous amount of advertising done for the Centennial as valuable to the inventor as if it had been done for his individual benefit. It changes every foreign visitor, coming from the country where he has protection, from a possible pirate into a probable customer. It brings him a new clientage, limited only by the population of the nation; and if his patents are obtained in four great countries—England, Canada, France, and Belgium—a hundred million people are tributary to his monopoly. His interest will then be to display the new and original advantages of his productions, not to keep them back; to distribute descriptions and drawings broadcast, instead of nervously watching every stranger who dallies with pencil and notebook; to court inquiry relating to his invention, rather than to avoid the same.

We think that there are few American inventors who will not appreciate the importance of this matter. It is a simple duty, easily attended to, and, as will be seen from Messrs. Munn & Co.'s announcement, the facilities of the largest patent agency in the world are now placed at every inventor's disposal, at an expense less than ever before, and certainly inconsiderable in view of the advantages to be gained.

"WRINKLES AND RECIPES."

We have never actually counted the number of questions which the SCIENTIFIC AMERICAN is called upon to answer through its "Notes and Queries" column; but it is no exaggeration to estimate these at several hundreds weekly. It is of course impossible for the editors to reply to all in full: first on account of the space at their disposal not being unlimited, and second because large numbers of the queries have been previously answered in its columns. Many readers, however, from various causes, either do not possess or have not access to the back files of the SCIENTIFIC AMERICAN; and it is to benefit these, as well as to place in the hands of mechanics generally a plain, precise, and practical handbook, in which the queries which form the very large majority of those constantly received at this office will be found fully and completely answered, that *Wrinkles and Recipes* has been projected.

The volume is divided into five departments, namely, Mechanics, Engineering, Practical Technology, the Farm, and the Household; and while embracing under these general headings a large amount of the most valuable and practical information which has appeared in the SCIENTIFIC AMERICAN, rewritten and condensed with care, it also contains a goodly proportion of entirely new material, prepared expressly for its pages. For example, under the division of Mechanics, will be found fine engravings of a set of master tools, forged at the request of the editor by Mr. Joshua Rose, and experimented upon by him until their form was such as to give the fullest possible duty. The perfected tools were placed before the artist and reproduced with the closest accuracy in point of size, etc., so that, with the complete instructions given in the letter press, any mechanic can make them for himself. These tools are adapted for metal turning, boring, etc. In the same department is also the cream of the series of papers on Practical Mechanism, which during the last two years have appeared in the SCIENTIFIC AMERICAN, also selected and rewritten by their author, Mr. Rose. In the Engineering department is a new paper on testing metals, expressly written by Professor Thurston, and also a series of illustrated articles, with practical rules on steam engineering topics, prepared by Mr. R. H. Buel. It is believed that the brief treatises on the slide valve, the indicator, on testing engines, and on the governor, are the simplest as well as the most practical expositions of these subjects extant. The department of Practical Technology, compiled under the supervision of Professor P. H. Vander Weyde, embraces recipes of all descriptions, for metal working, for cements, alloys, and glues, for electrical batteries, and on hundreds of other practical subjects. Under the head of the Farm are given suggestions of all kinds useful to farmers; and in the following department of the Household, the housekeeper is provided with an invaluable repertory of useful hints. Especial attention has been devoted to "trade wrinkles and secrets" of which a large number are presented in the Mechanical department.

Altogether the work is one of the most useful guides for the classes to which it is addressed that has come under our notice; and it is sold at a price ($1.50) which places it within almost everybody's reach. It comprises 250 pages, neatly bound in flexible grease proof covers for the pocket. Copies may be obtained, post paid, by mailing the price to H. N. Munn, publisher, P. O. Box 772, New York city. See advertisement on back page

VENEERED DIAMONDS AGAIN.

Sydney Smith once observed that it required a surgical operation to get a joke into a Scotchman's head. We do not know whether the anonymous individual who has just sent us a letter signed "A Friend" hails from the land o' cakes; but we fear such must be the case, in view of the merciless hauling over the coals which he inflicts upon us for our recent innocent remarks on a cheap jewelry swindle. We might endure the letter in silence and lock the suffering it causes in our lacerated breasts, but now the veneered diamond man himself twists our paragraph into a commendatory testimonial, and publishes it as such in his brazen advertisements.

Seriously, however, for the sake possibly of others who may also have misunderstood our meaning, and in order to furnish the diamond(!) merchant with a new paragraph for future advertisements, we may plainly state that the wonderful discovery is a miserable deception. Science has never been able to produce the diamond artificially, though countless attempts have been made. Professor Silliman, by the aid of an intense heat, has made little globules from plumbago, which were transparent, and which resembled the genuine stone; so also globules have been obtained from apparently fused charcoal, but close examination showed them to contain iron and carbon, which proved that the charcoal had never been perfectly fused. Dr. Hare, of Philadelphia, by means of a deflagrator, succeeded in obtaining a metallic luster from intensely heated charcoal. Cagniard de Latour pretended to have discovered the ingredients of the gem; but the small crystals shown by him turned out to be peculiar silicates, which polarized light differently from the diamond. M. Despretz has conducted experiments which are probably the furthest advanced of any. By voltaic action he prepared a pure carbon from sugar candy, which was deposited in the shape of microscopic crystals in black octohedrons, or colorless translucent plates, the whole of which had the hardness of the powder of the diamond, and which disappeared on combustion without leaving any perceptible residue. Being, however, only in powder, it was impossible to isolate and weigh these crystals, or to determine their index of refraction or angles of polarization, the two tests which infallibly distinguish the true diamond. It is reported, also, but we know of no confirmatory evidence, that a mixture of chloride of carbon and alcohol, when acted upon by galvanic currents for six months, is decomposed with a result similar to the above.

As regards the ridiculous theory of the humbug we have referred to, certainly no refutation of it is necessary. We have a better opinion of the scientific knowledge of the readers of the SCIENTIFIC AMERICAN, and of our journal itself as an educator, than to credit the idea that others, beside those few intensely matter of fact persons who have written, wondering that we could be so humbugged, will be deceived by so palpable a fraud.

SCIENTIFIC AND PRACTICAL INFORMATION.

ILLUMINATING GAS FROM CORK.

To the list of substances capable of furnishing illuminating gas of good quality, cork is now to be added. Recent experiments, made in Bordeaux, France, have given results both economical and satisfactory, and it has been definitely decided to use the material in the lighting of the city. Works for burning cork are now in process of construction. The fragments of cork, principally waste left after cutting bottle stoppers, are distilled in a close retort. The flame obtained is stated to be whiter and more brilliant than that of coal gas, while the blue zone is much smaller, and the density considerably greater.

A SOLAR ENGINE.

M. Mouchot has recently exhibited to the French Academy of Sciences a simple form of solar engine. It consists of a cone of polished tin, reversed and arranged so that its interior can be adjusted toward the sun. In the axis of the vessel is suspended a large flask of white glass, inside of which is a metal boiler covered with lampblack. The rays, concentrated by the mirror-like surface of the cone, traverse the glass easily, and are accumulated on the boiler, in which they speedily produce an ebullition of the water, and steam sufficient to drive a miniature engine. By increasing the dimensions of the apparatus, M. Mouchot has obtained a utilizable force, and produced, after three quarters of an hour exposure to the sun, a boiler pressure of 60 lbs. of steam.

NATURAL GAS FURNACES.

The constantly increasing utilization of natural gas for industrial purposes, throughout the oil region of Pennsylvania and its neighborhood, is attracting much favorable comment. The success of the puddling and heating furnaces at Erie, Leechburgh, and elsewhere in Pennsylvania, where the experiment has been thoroughly tried, seems to have attracted a widespread interest to the subject, and we now learn of schemes on foot to utilize the gas upon the large scale. Near Beaver Falls, the gas issuing from a well 1,100 feet deep is employed in a file factory at that place. It is also reported that the product of the great gas well in Butler county, Pa., will be brought to certain iron works in Pittsburgh. The work of laying a pipe, six inches in diameter and seventeen miles long, is said to be contracted for, to be finished within a month. It is further reported that a project is being mooted to purchase all the gas wells in Butler county, and bring their product to the Pittsburgh manufactories. This last scheme, if successfully realized, would work quite an industrial revolution. But, whether feasible or not, the agitation of the subject is an indication that the question, of utilizing the enormous volumes of valuable heating gas which have, until the present, been allowed to go to waste, is at length receiving the attention it deserves.—*American Exchange and Review.*

AN AUTOMATIC SWIMMING APPARATUS.

Under the auspices of the London Swimming Club, and at the City of London Swimming Baths, Golden lane, London, an invention for facilitating the acquisition of the art of swimming was recently exhibited. The invention, which was practically tested in the case of persons who could not swim, first consist in stretching across the bath, in any direction, a wire somewhat similar to a single telegraph wire, placed at some hight above the water and parallel to it. Upon this wire a grooved pulley is mounted, from the axis of which an elastic cord depends, terminating in an adjustable supporting belt for the body to rest on. The weight of the body when in the water is capable of receiving more or less support according to the degree of proficiency the learner has attained. The suspended weight from the axis of the pulley, being under the line of support, keep the pulley in a true vertical position, so that during the time the swimmer is striking out the supporting pulley travels along the wire at a rate proportionate to the speed of the swimmer. To suspend the body in water by a string is not a new idea; but this contrivance is self-acting. The members of the club, who are laudably offering to teach swimming gratuitously to all who lack the art, consider this invention the best that has yet appeared for helping the novice to attain proficiency in swimming.

POSPISIL'S CURTAIN FIXTURE.

We illustrate in the annexed engraving an improved curtain fixture, by means of which the curtain is retained at any hight at which it may be adjusted, and is raised or lowered by means of a single cord. The ends of the roller are held in spring brackets, A, and near such extremities are formed pulleys, about which a cord, B, is wound in opposite directions. The bight of the cord hangs down in rear of the shade and carries a heavy tassel by passing through an eye on the same, said tassel thus serving as a counterpoise for the weight of the curtain. It will be clear from the engraving that, when the cord on one side is pulled, the roller will be rotated in one direction, and that the same will be turned in the opposite

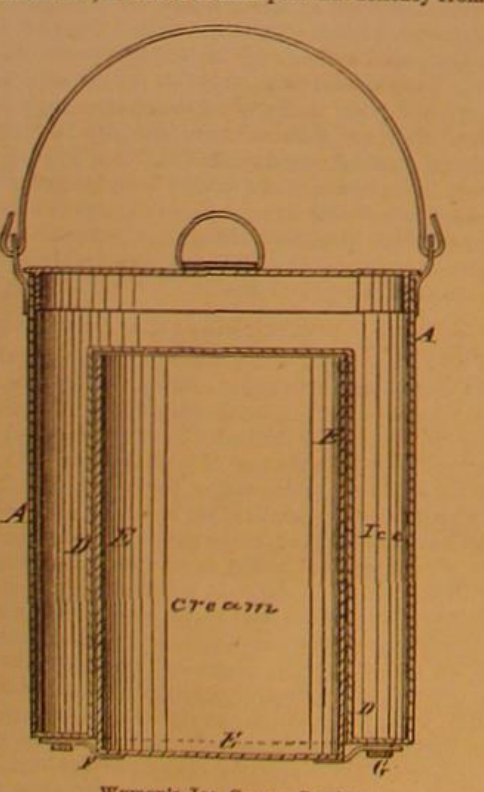
way when the cord on the other side of the tassel is drawn down. The shade is thus easily rolled or unrolled.

The fastenings, A, of the roller are provided with loops, which serve as guides for the cord. The device is simple and easily operated, and doubtless will be found an efficient substitute for the old-fashioned endless cord and single pulley.

Patent allowed through the Scientific American Patent Agency. For further particulars, relative to sale of exclusive right for the United States or for State rights, address the inventor, Mr. Rudolph J. Pospisil, 757 Allport street, Chicago, Ill.

A JUVENILE INVENTOR.

A bright eyed manly looking youngster made his appearance in our office, not long since, with a tin model under his arm, and announced to us the fact that he was an inventor and wanted a patent. We inquired with interest as to the nature of his production. He promptly replied that it was an ice cream carrier, intended to transport that delicacy from the



Wyman's Ice Cream Carrier.

place of sale to wherever it was to be eaten, without danger of melting. After examining his model, we were curious to know how so young a lad came to invent such an article, and this elicited his story. He was a district telegraph messenger, he said, one of those blue and red uniformed boys whom any one who has an instrument in his house can summon at any hour, night or day, to go on errands. It appears that a gentleman, desiring to indulge in ice cream on a hot evening, called our young friend and despatched him for a supply. The weather was warm, and doubtless the hands of the boy likewise, and so, despite the paper which enveloped the cream, by the time it reached its owner it was in a sadly demoralized condition. The gentleman, who had been luxuriating in anticipation of the frigid repast, forgetting the hot weather, was very exasperated, and vented his wrath on the messenger by a tremendous scolding. The unfortunate youngster felt the sting of the upbraiding, which he thought was unjust, for he said the fault was not his; and he set to work to invent something which would, on another and similar occasion, prevent his incurring another "blowing-up." The result was the ice cream carrier, for which a patent has now been granted. The device consists of an annular pail, having a cover and bail. The inner wall is not so high as the outer one, and is covered over. In this receptacle the ice and salt are placed. The ice cream vessel is a simple cylinder which is inside the annular pail, and which is held therein by clips on the bottom, as shown in the engraving

The device is practical, and we have no doubt will answer its purpose very nicely. The inventor is Master Henry W. Wyman, of this city.

PRESERVING GRAPES.

The preservation of grapes for winter and spring use is easily done; and by a little care and at moderate outlay, grape growers may keep our markets well supplied with fruit, in good condition, for months after the last bunch has been stripped from the vines. The system pursued at Ferrières, France, the princely domain of Baron Rothschild, head of the French branch of that celebrated family, is as follows: To preserve the fruit on a fresh stalk (*à rafle fraiche*) the grapes are cut with a portion of the branch attached, and the branch is put into a small bottle filled with water (see Fig. 1). These

Fig. 1.

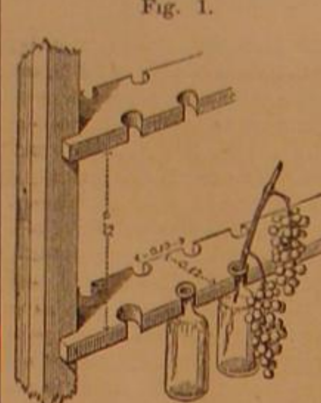
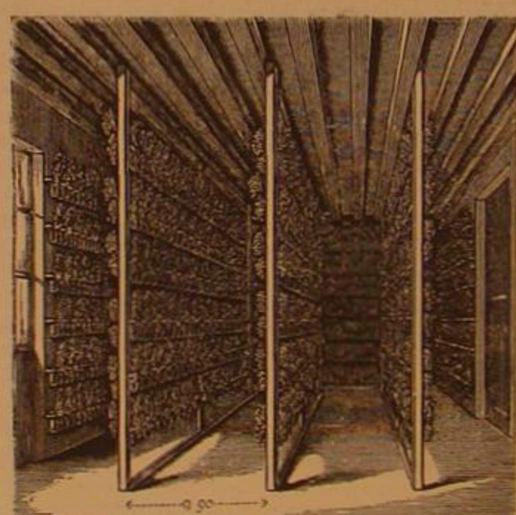


Fig. 2.



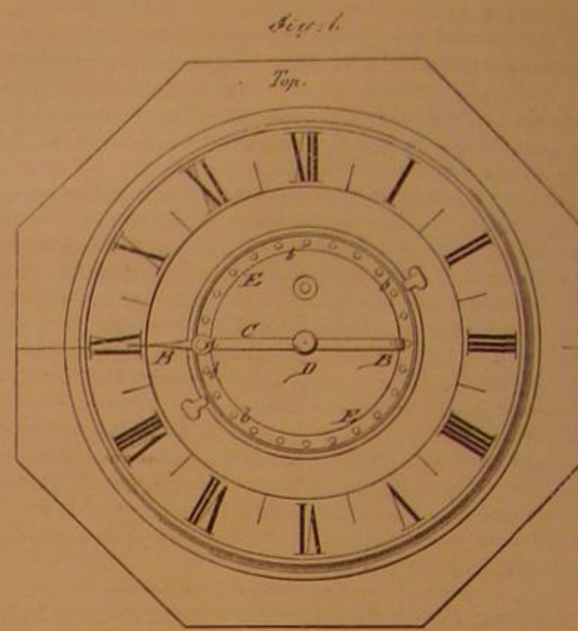
bottles are then arranged in racks, being placed just so far apart that the clusters do not touch. They should be looked at occasionally, and the bottles filled with water Some growers recommend putting a little powdered charcoal into each bottle of water. The racks are arranged in a dark room (see Fig. 2), properly ventilated.

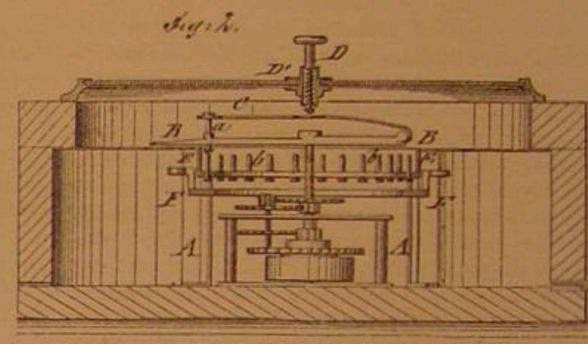
Fig. 3.

Large quantities of grapes are preserved in France on the dry stalks (*à rafle sèche*). The bunches are put away on trays made of slips of wood (see Fig. 3), placed a little asunder for the circulation of air. Fern leaves or barley straw is laid in the trays, and the bunches are laid away when the first frosts arrive. They require very careful watching, and every single berry that shows symptoms of decay, from whatever cause, must be carefully removed with a pair of scissors.

IMPROVED WATCHMAN'S TIME CHECK.

Messrs. T. D. Osborne and W. W. Le Grande, of Louisville, Ky., have patented (September 21, 1875), through the Scientific American Patent Agency, a new and simple form of detector, for attachment to an office or other clock, by which it may readily discovered whether a watchman does or does not faithfully perform his duties. We give an illustration of the device herewith, Fig. 1 being a view of the front of the clock, and Fig. 2 a section. The glass front of the time piece has a central sleeve for a sliding spring pin and button, D. This pin acts upon a spring, C, Fig. 2, that





is applied to one end of one of the clock hands, the other end carrying a pin, *a*, which passes through the eye of the hand to be brought successively in contact with a series of sliding pins, *b*, on a guide ring, E, attached to the clock frame. The position and number of the pins correspond to the periods of time at which the watchman is compelled to register, the spring pin of the hand allowing the pressing back of the pins only when the hand indicates the proper time. Any one of the pins not depressed shows at a glance the neglect of the watchman. A sliding base ring, F, serves to restore the pins to their normal position.

The Components of Coal.

Dr. Hofmann, of the University of Berlin, furnishes, in *Percy's Metallurgy*, the following list of the compounds generated by the destructive distillation of coal, the new atomic weights being used

Hydrogen	H
Water	H_2O
Carbonic oxide	CO
Carbonic acid	CO_2
Sulphurous acid	SO_2
Hydro-sulphuric acid (sulphuretted hydrogen)	H_2S
Bisulphide of carbon	CS_2
Hydrocyanic acid	HCN
Hydrosulphocyanic acid,	HCNS
Acetic acid	$C_2H_4O_2$
Carbolic acid (phenol)	C_6H_6O
Cresylic acid (cresol)	C_7H_8O
Phlorylic acid (phlorol)	$C_8H_{10}O$
Rosolic acid	$C_{20}H_{16}O_3$(?)
HYDROCARBONS.	
Methane (marsh gas)	CH_4
Sextane (propyl)	C_6H_{14}
Octane (butyl)	C_8H_{18}
Decane (amyl)	$C_{10}H_{22}$
Duodecane (caproyl)	$C_{12}H_{26}$
Paraffin	$C_{n}H_{2n+2}$(?)
Ethene (olefiant gas)	C_2H_4
Tertene (propylene)	C_3H_6
Sextene (caproylene)	C_6H_{12}
Septene (œnanthylene)	C_7H_{14}

Ethine (acetylene)	C_2H_2
Benzol	C_6H_6
Toluol	C_7H_8
Xylol	C_8H_{10}
Cumol	C_9H_{12}
Cymol	$C_{10}H_{14}$
Naphthalin	$C_{10}H_8$
Anthracene	$C_{14}H_{10}$
Phenanthrene	$C_{14}H_{10}$
Fluorene	$C_{13}H_{10}$
Pyrene	$C_{16}H_{10}$
Crysene	$C_{18}H_{12}$
BASIC NITROGEN COMPOUNDS.	
Ammonia	H_3N
Aniline	C_6H_7N
Pyrodine	C_5H_5N
Picoline	C_6H_7N
Lutidine	C_7H_9N
Collidine	$C_8H_{11}N$
Parvoline	$C_9H_{13}N$
Corindine	$C_{10}H_{15}N$
Rubidine	$C_{11}H_{17}N$
Viridine	$C_{12}H_{19}N$
Chinoline, Leucoline	C_9H_7N
Lepidine	$C_{10}H_9N$
Cryptidine	$C_{11}H_{11}N$
Pyrrol	C_4H_5N

SOFT and pliable woods, such as pine, willow, alder, etc., require the use of large saw teeth with acute points and considerable pitch; whereas hard woods or those of a tougher and denser consistence, such as oak, mahogany, rosewood, etc., necessitate the adoption of teeth of perpendicular pitch and diminished space. Yellow deal, pitch pine, larch, etc., are of so gummy and resinous a character that the teeth not only require more set, but the blades themselves have to be smeared with grease to keep them cool, and to decrease the friction arising from the adherence of resin during motion. Similar results are experienced in working soft woods; the teeth become choked by the damp consolidated sawdust, and obstinately refuse to perform their duty without extra force.

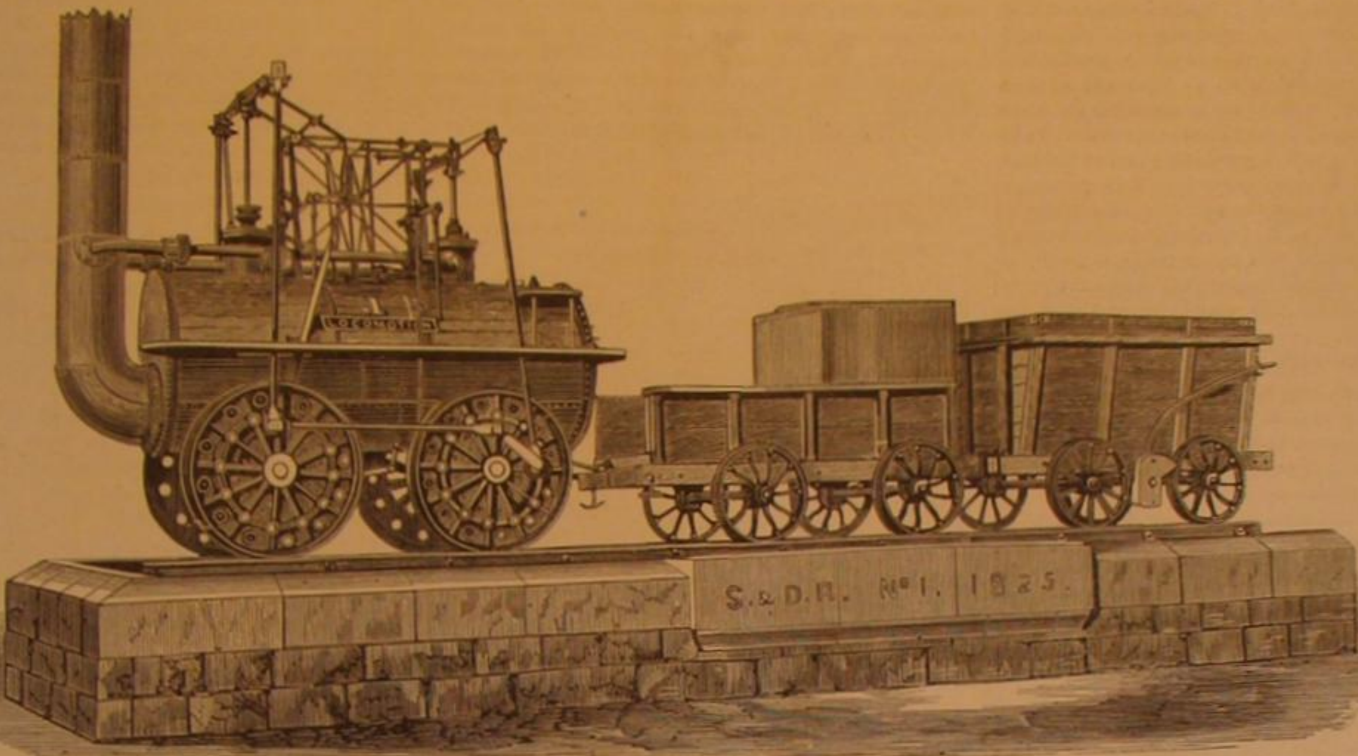
THE LOCOMOTIVES OF 1825 AND OF 1875.

There are few great inventions of modern times regarding the original conception of which there is not considerable difference of opinion. The sewing machine and the screw propeller have been credited to various inventors according as the weight of evidence, in favor of one man or the other, has impressed different chroniclers, and the same is the case with the steamboat and the locomotive. Regarding the last especially, there are sharply marked differences of opinion, amounting in many instances to conviction, strengthened perhaps by the dispute partaking something of an international character. In this country it is customary to ascribe the origination of the steam carriage to Oliver Evans, who, in 1787, obtained from the Maryland legislature a patent for steam carriages, which he designed as a means of transport of flour to and from mills. Evans found, however, that his engine, which by the way was the first ever built on the high pressure principle, worked better in mills than in carriages, so the initial vehicle upon which he was engaged at the time of this discovery, it appears, was not finished. In 1794, Evans sent his plans to England, and there, it is reported, Vivian and Trevithick gained access to them and pirated some of the ideas, a statement vouched for in the new edition of Appleton's *Cyclopædia*; but which the reader, conversant with the lives of these eminent inventors, will hardly credit. Unfortunately for Evans' claims, his invention had been anticipated and practically carried out in France eighteen years previously; and the ancient locomotive built by Cugnot in 1769, noticeable for its crude though ingenious mechanism, antedating the introduction of the crank, and necessitating the odd ratchet-like device for moving its wheels, still exists, standing in the same hall with the looms of Jacquard and Vaucanson in the Conservatoire des Arts et Métiers, in Paris. Besides, in 1784, Watt and his assistant Murdoch both patented locomotive carriages in England, so that, much as it has possibly gratified some authors to prove the locomotive an American invention, their views do not stand the test of recorded fact.

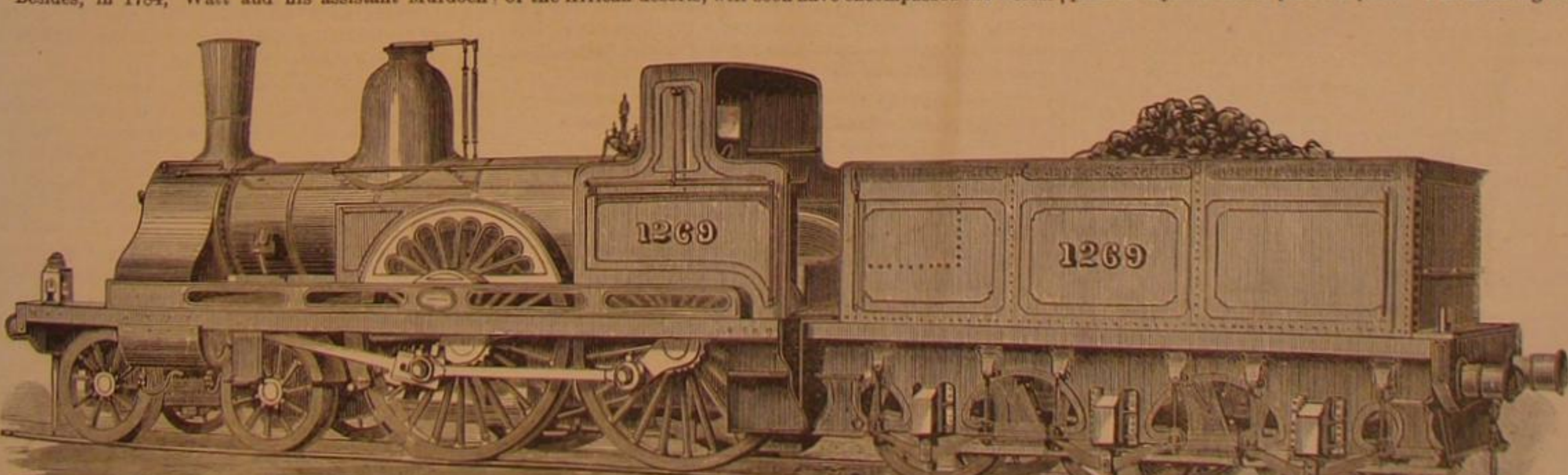
At the risk of being considered as having diverged from our subject, we prefix the above brief scrap of history as of interest in connection with the two engravings given herewith, the quaint old machine in one of which marks the beginning of the development of the now vast railroad system. From the period above referred to, up to the year 1825, nothing was done with the locomotive other than to apply it as a traction engine for coal and ore. Sometimes it was used on rails; again, it lumbered over the king's highway, to the unalloyed astonishment of the travelers thereon. It was reserved for Stephenson to conceive of its application to the drawing of stage coaches on a road provided with metal rails, and practically to test his theories on that September day, the fiftieth anniversary of which has just been so enthusiastically celebrated in England. Rails were placed between Stockton and Darlington, and the Locomotion ran over them at the astounding speed of eight miles per hour. The reader, in our first engraving, has before him a representation of this first passenger locomotive, as it now appears, placed as a monument upon a massive pedestal. The plain straight boiler, ten feet in length by four feet in diameter, has a single flue and sixty square feet of heating surface. The safety valve lifted at twenty-five pounds pressure. Above the generator are two cylinders, ten inches in length by twenty-one inches stroke, their pistons working cross beams which were coupled to the connecting rods, which in turn rotated the wheels. A loose eccentric sheave and bell cranks operated the flat slide valves; and from a crosshead on the piston rod, the pump was worked. Add a wooden framework, no brakes, a litte tender capable of holding 240 gallons of water, and the picture of the machine which annihilated the pet theories of the majority of the skilled engineers of its day is complete.

Fifty years have gone by since this machine was built, years that have seen a greater progress in civilization and in the arts than decades before. The few miles of track between the out of the way little English towns have grown and ramified until their iron network, already pushing its way into the wildernesses of Siberia and the burning sands of the African deserts, will soon have encompassed the world. For the old stage coach bodies, deprived of their wheels and mounted on trucks, which constituted the first railway cars, there have been substituted elegant saloons where one may eat and sleep in luxury over journeys from ocean to ocean; instead of the slow, wheezing machine, typical of childhood in its fragility and incapacity, now exists the magnificent engine, equally typical of the strength and might of manhood. Six tuns of rude machinery crawling along at eight miles per hour: sixty-five tuns of the highest efforts of the artisan's skill rushing over an iron road at a mile a minute; such are the contrasts the lapse of half a century brings together.

We add a second engraving, for the sake of the comparison, of one of the most powerful locomotives ever used on a narrow gage railway. It was built in England in November, 1874. Its boiler is 10 feet long by 4 feet in diameter, and contains 210 tubes of Low Moor iron, 1¾ inches in diameter. The cylinders are 17 inches in diameter by 30 inches stroke. The boiler carries 140 pounds per square inch pressure; and with a train of fourteen cars, the locomotive has accomplished a speed of sixty miles per hour.



THE LOCOMOTION, THE FIRST PASSENGER LOCOMOTIVE.



A MODERN LOCOMOTIVE.

Practical Painting.

Everybody knows that the painting of first class passenger railway cars is a work of skill and experience. Good directions for painting of this kind ought to be found useful wherever the brush is employed for first class work, and we therefore give the following:

The sixth annual convention of the Master Car Painters' Association was held at the Grand Central Hotel in this city, on the 8th and 9th of September. Mr. R. McKeon, the Secretary and Treasurer, delivered the following address on the "Process of Car Painting," which we find in the *National Car Builder*.

"I make no great profession of my ability, but I certainly should have acquired some knowledge, and that of a practical nature, some twenty-five years having been exclusively devoted to the business. My long experience and constant practice, bringing me in contact with others of the profession, have given me that knowledge of the art which can only be secured by close attention and some study.

A first class railway coach, on any of our main roads, costs, when complete, about $6,000. To protect this work, the painter expends from $300 to $600. The latter figure will make a first class job. The car has been completed in the wood shop, and is turned over to the painter, who is responsible for the finish. He is expected to smooth over all rough places or defects in the wood, which requires both patience and skill to make the work look well. Twelve weeks should be the time allowed to paint a car, and it cannot be done in any less time, to make a good job that will be a credit to the painter and all other parties interested in the construction and finish of the car. Too much painting is done in a hurry; proper time is not given the work to dry or become thoroughly hardened before it is run out of the shop, and consequently it does not always give the satisfaction it should; nor can it be expected that hurried work will be so lasting or durable as that which has the necessary time given to finish it.

THE PRIMING PAINT.

The priming coat of paint on a car is of as much importance as any succeeding one, and perhaps more. I have seen good work ruined in the priming by little or no attention being given by the painter to the mixing and applying of the first coat. The foundation is the support, and on that rests your success or failure. The priming should be made of the proper material, mixed with care from good lead and good oil, and not picked up from old paints, which have been standing mixed and must necessarily be fat and gummy, for such are unfit for use on a good job, and will have a decided tendency to spoil the whole work. Special care should be exercised, both in mixing and applying the priming, and it should be put on very light, so that it may penetrate well into the wood. Too much oil is worse than not enough. Good ground lead is by far the best material for the under coats on a car; and although I have tried other materials for priming, yet I have failed to find anything equal to the lead. Two coats should be given to the car before it is puttied, as it is best to fill well with paint the nail holes and plugs, as well as defects in the wood, so that moisture may not secure a lodgment, which otherwise will cause putty to swell, although sometimes unseasoned lumber will swell the putty; and as it shrinks, the nail remains stationary, and of course the putty must give way.

THE BEST PUTTY.

In mixing putty, which may be a small matter with some, take care to so prepare it that it will dry perfectly hard in eighteen hours. Use ground lead and japan, stiffening up with dry lead, and whatever coloring you may require in it to match your priming coats.

The next coats, after the work is well puttied, should be made to dry flat and hard. Two coats should be applied, and, for all ordinary jobs or cheap work, sandpapering is all that is necessary for each coat; but when a good surface is required, I would recommend one coat to be put on heavy enough to fill the grain; and before being set, scrape with a steel scraper. The plain surface is all that requires coating and scraping with the heavy mixture; for this coat, which we call filling, I use one half ground lead and any good mineral which experience has shown can be relied on. This scraping of the panel work will fill the wood equal to two coats of roughstuff, and it saves a great amount of labor over the old process, when so much rubbing with lump pumice stone was done. Sandpaper when the filling is thoroughly hard, and apply another coat of paint of ordinary thickness, when, after another light sandpapering, you have a good surface for your color.

Rough coating on cars has gone almost out of use, and I believe that but few shops are now using it to any extent. My experience is that paint has less tendency to crack where roughstuff is left off. I do not claim that the filling was the principal cause of the cracking, if it was properly mixed; but I believe the water used in rubbing down a car with the lump pumicestone injures the paint, as it will penetrate in some places, more particularly around the moldings and plugs.

THE FINISHING COLOR.

The car being ready for the finishing color, this should be mixed with the same proportion of dryer as the previous coat, or just sufficient to have it dry in about the same time. A very great error with many car painters is using a large portion of oil in the under coats, and then but little, if any, in the finishing coats; this has a decided tendency to crack, the under coats being more elastic. I always aim to have color dry in about the same time, after I have done my priming; by this plan, I secure what all painters should labor to accomplish—namely, little liability to crack. Work will of course crack sometimes, after being out a few months, or when it has repeated coatings of varnish; and using a quick rubbing varnish on work will cause it to give way in fine checks quicker than anything else. Many of the varnishes we use are the cause of the paint cracking, and no painter has been wholly exempt from this trouble.

CAUSE OF CRACKING.

The most common cause of cracking is poor japan, which is the worst enemy that the car painter has to contend with; the greater part of the japan that we get is too elastic, and will dry with a tack, and the japan gold size we have has generally the same fault, although the English gold size is generally of good quality, but its high price is an objection to its use. A little more care in the manufacture of japans would give us a better dryer, and few would object to the additional cost. Japan that I have frequently had, I found to curdle in the paint; it would not mix with it, but would gather in small gummy particles on the top. Work painted with such material cannot do otherwise than crack and scale, and the remedy lies only in getting a good pure article of turpentine japan.

In regard to using ground lead, car painters differ, as some prefer to grind their own in the shop. I use the manufactured lead, and my reasons for doing so are that it is generally finer than any shop can grind it with present facilities, and it has age after grinding, which improves its quality. You can also get a purer lead and one with more body than you can by grinding in the shop, which is a fact that I think most painters must admit; I have tested it very fully, and am convinced on this point.

MIXING THE PAINTS.

Permit me to make a few suggestions here in regard to the mixing of paint, which may not fully agree with others' views. There is just as much paint that cracks by putting it on too flat as by using too much oil. I have seen some painters mix their finishing color so that it was impossible to get over a panel of ordinary size before it was set under the brush, and consequently the color would rough up. Color should be mixed up so that it will not flat down for some time after leaving it, and then you have got some substance that will not absorb the varnish as fast as it is applied to the surface. This quick drying of color is not always caused by want of oil in it, but because there is too much japan, and a less quantity of the latter will do better work, and make a smoother finish. Give your color forty-eight hours to dry between coats; I always give that time, unless it is a hurried job, and we have very few such jobs in our shop, as experience has fully demonstrated that it is poor economy to hurry work out of the shop before it is properly finished.

OILS, DRYERS, AND COLORS.

In car painting, both raw and boiled oils are used, and good work may be done with either, but I would recommend oil that is but slightly boiled in preference to either the raw or the boiled. After it is boiled, if it is done in the shop, let it stand twenty-four hours to settle, then strain off carefully; this takes out all the impurities and fatty matter from the oil, and it will dry much better, nor will it have that tack after drying that you find with common boiled oil. Use the proper quantity of dryer in mixing your paint, and a good, reliable job will be the result. In car painting, I would never recommend the use of prepared colors which are ground in oil, as nine tenths of such colors are ground in a very inferior oil, and they may have been put up for a great length of time, in which case they become fatty, and will invariably crack. These canned colors do not improve with age, as lead and varnish do. Finishing colors should all be ground in the shop, unless special arrangements can be made with manufacturers to prepare them; and the color should be fresh, not over six or eight days old after being mixed and open to the air. Enough may be prepared at a time to complete the coating on a job; but when color stands over a week, it is not fit to use on first class work, as it becomes lifeless, and has lost that free working which we find in fresh mixed colors; such color may, however, be used upon a cheap class of work, or on trucks, steps, etc., so that nothing need be wasted in the shop.

VARNISHING.

Three coats of varnish over the color are necessary on a first class coach. The first coat should be a hard drying varnish put on the flat color; the quick rubbing that some use I would not recommend, but one that will dry in five days (in good drying weather) sufficiently hard to rub is the best for durability. After striping and ornamenting the car, and when thoroughly washed, give a coat of medium drying varnish; let this stand eight days; then rub lightly with curled hair or fine pumicestone, and apply the finishing coat, which is "wearing body": this will dry hard in about ten days, after which the car may be run out of the shop. It should then be washed with cold water and a soft brush, and it is then ready for the road. In varnishing, many will apply the varnish as heavy as they can possibly make it lie, when, as a consequence, it flows over and runs or sags down in ridges, and of course does not harden properly; this also leaves a substance for the weather to act on. It is better to get just enough on at a coat to make a good even coating which will flow out smooth, and this will dry hard, and will certainly wear better than the coat that is piled on heavily.

Varnishing, we claim, can be overdone, some painters' opinions to the contrary. We have heard of those who put two and a half gallons on the body of a fifty foot car at one application, and we have also listened to the declaration, made by a member of the craft, that he put two gallons on the body of a locomotive tank. Such things are perhaps possible, and may have been done; but if so, we know that the work never stood as well as it would if done with one half the quantity to a coat. In varnishing a car, care should be taken to have the surface clean; water never injures paint where it is used for washing; and a proper attention to cleanliness in this respect, and in the care of brushes used for varnishing, will insure you a good-looking job.

Perhaps your shop facilities for doing work are none of the best, but do the best you can with what you have; select, if possible, a still, dry day for varnishing, especially for the finishing coat. Keep your shop at an even temperature; avoid cold drafts on the car from doors and windows; wet the floor only just sufficient to lay the dust, for, if too wet, the dampness arising will have a tendency to destroy the luster of your varnish. Of course we cannot always do varnishing to our perfect satisfaction, especially where there are twenty-five or thirty men at work in an open shop, and six or eight cars are being painted, when more or less dirt and dust are sure to get on the work.

A suggestion might here be made to railroad managers, which is that no paint shop is complete where the entire process of painting and finishing a car is to be done in one open shop. A paint shop should be made to shut off in sections by sliding doors, one part of the shop being used exclusively for s riping and varnishing. I know from experience that nine tenths of the railroad paintshops are deficient in this particular, and still we are expected to turn out a clean job, no matter what difficulties we are compelled to labor under. Many further hints might be given in regard to this matter of shop facilities and conveniences; but as it is not here my object to argue the point, I leave it with this brief mention.

IMPORTANCE OF WASHING VEHICLES.

In regard to the care of a car after it has left the shop, I think more attention should be given to this than is done on many roads. The car should not be allowed to run until it is past remedy, and the dirt and smoke become imbedded in the varnish, actually forming a part of the coating, so that when you undertake to clean the car you must use soda or soap strong enough to cut the varnish before you succeed in removing the dirt. Cars should be washed well with a brush and water at the end of every trip; this only will obviate the difficulty, and these repeated washings will harden the varnish as well as increase its luster. We know that, in washing a car, where soap is required to remove the dirt and smoke, it is almost impossible to get the soap washed off clean; and if it is not quite impossible, the hot sun and rain will act on the varnish and very soon destroy it.

RE-VARNISHING.

Cars should be taken in and re-varnished at least once in twelve months; and if done once in eight months, this is better for them, and they will require only one coat; but where they run a year, they will generally need two coats. Those varnished during the hot months will not stand as well as if done at any other time. Painting done in extreme cold weather, or in a cold shop, is more liable to crack than if done in warm weather.

HOW TO DRY PAINT.

Paint dried in the shop, where there is a draft of dry air passing through, will stand better than that dried by artificial heat; and you will find, by giving it your attention, that work which has failed to stand, and which cracked or scaled, was invariably painted in the winter season or in damp, wet weather. I have paid some attention to this matter, and know the result."

Brewing Beer in New York City.

New York is now, paradoxical as it may seem, one of the largest German cities in the world. Our one hundred and fifty-one thousand Teutonic citizens outnumber those of Frankfort and of Bremen, and approach very nearly the number of the population of Dresden or of Munich. It is to this circumstance, perhaps more than to any other, that the constant increase of the number of breweries in the city, and the frequent improvements in the manufacture of that popular beverage "lager bier," are due. As to the quality of the "bier," connoisseurs say that that made in this State is the best. The *Buffalo Express* asserts in the following positive terms that beer made in Buffalo is unapproachable. We will not question the editor's experience, as our own is scanty; but still for the credit of the metropolis, we venture the remark that New York breweries are larger and include more refinements in beer-making than others elsewhere in the country. The *Express* writer talks over his beer thus: "Cincinnati beer is good, Milwaukee beer is better, but Buffalo beer is alone and unapproachable. It is the *ne plus ultra* of lager. You may wander east and wander west, and you will find none like it. Rochester beer is execrable. A glass of it is a stronger argument for temperance than any which has yet been invented. A careful temperance advocate has accurately estimated that every barrel of ordinary beer contains half a suicide, three fourths of a murder, and a half dozen free fights. Rochester beer contains all these evils in a "schuper," besides other miseries too numerous to mention. Hence it is that when peaceable Rochester folks want a glass of beer, they come to Buffalo after it, or have it sent in bottles to them. The essence of comfort is a summer night at Schenkelberger's, with a glass of Herr Ziegle's lager to moisten the music of the Union Cornet Band. Then it is that one begins to appreciate life."

Against this, we set off the following description, from the *Evening Post*, of a big malthouse which has just been erected in the upper portion of New York city.

The malthouse consists of three buildings. The main building is 130 feet x 92 feet 8 inches in ground dimensions, and ten stories in hight, with a deep basement. The first and second stories are respectively 13 and 12 feet in hight in clear, while the remaining stories are but 6 feet in hight. The lower stories will be used for storing grain, and have a capacity of a quarter of a million bushels. The walls of the basement are of stone, three feet in thickness, and the superstructure is of brick and of the most substantial character. The lower floors are of yellow pine, while the malting stories are floored with a pavement of concrete, with the exception of one story, on which is laid a flooring of Solenhofer stones, resembling those used by lithographers, imported from Germany. On these floors the grain is allow to grow after its removal from the steeping vats in the cellar. At the top of the building is a tank holding five thousand gallons of water, which supplies the entire building. At the west end of the building, separated from the main part by a three feet partition wall, are two large storage rooms and the kilns. These are fiveproof, eighteen feet deep extending across the width of the building, and are constructed on a plan invented in Germany, by which the grain is more rapidly treated than formerly. By an ingenious contrivance it is turned mechanically at frequent intervals, so as to allow the hot air from the furnaces to reach it uniformally, with a saving of time and an economy of grain.

The building containing the offices, engine, and boiler rooms, and storage bins for forty thousand bushels of grain, is triangular in shape. It is of brick, 57x37x36 feet, and five stories in hight.

The malting season begins about the 1st of October and lasts for from thirty to thirty-two weeks. It is estimated that in that time this malthouse will produce at least three hundred and fifty thousand bushels of malt.

The cost of the building, with fixtures, machinery, and appliances, will be between $100,000 and $150,000.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NUMBER XXXV.

DRIFTS.

Of drifts there are two kinds, one being a smooth round conical pin, employed by boiler makers to make the punched holes in boiler plates come fair, so that the rivets may enter, which may be aptly termed a stretching drift, and the other the toothed or cutting drift. Of the first, it may truly be said that it is utterly destructive of the safety of any work to which it is applied, because the punching of a plate considerably weakens its strength at the narrowest section of metal, namely, between the hole and the edge of the plate, where the latter, being the weakest, gives way to the pressure of the punch. If one closely observes the surface of a piece of iron which is being punched, he will find that the scale on the surface of the iron round the hole, and especially between the hole and the edge of the plate, will be sensibly disturbed, showing a partial disintegration of the grain of the metal beneath, even if the punch is very sharp; but if the punch is dull, or the edge is in the least rounded by wear, the scale will fly off the surface of the metal in small particles, evidencing a considerable disturbance of the metal beneath and an equivalent weakening of the substance between the edge of the hole and the edge of the plate. If then, after punching, the holes do not come fair, and the plain drift is employed to still further stretch the metal, not only is the weakening process greatly augmented, but the holes are stretched oval, so that the rivets do not completely fill them, however well the riveting may be performed. The use of the plain drift is therefore totally incompatible with first class workmanship; hence a description of this tool will be altogether omitted.

Of cutting drifts, there are two kinds, the first being that shown in Fig. 156. A is the cutting edge, the width and

Fig. 156.

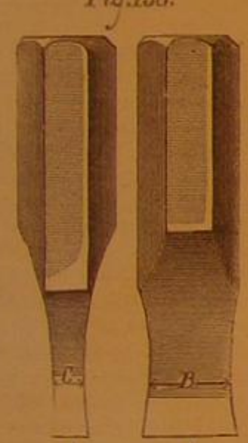


Fig. 157.

Fig. 157a.

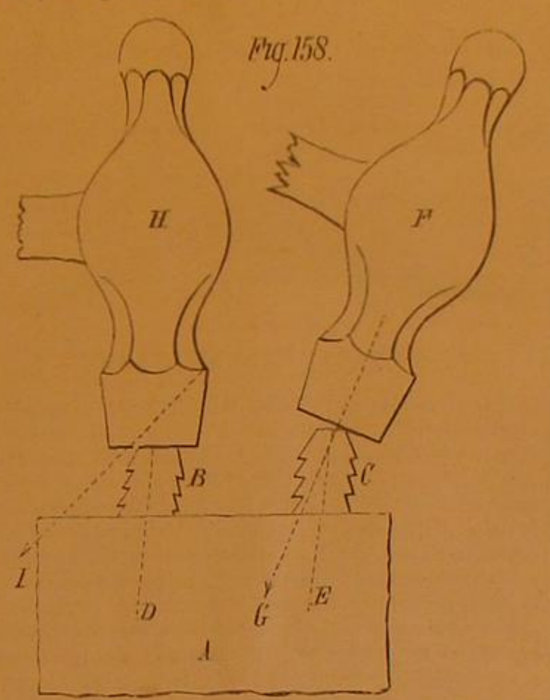
thickness at C and B being reduced so that the sides of the drift may clear the sides of the hole. The tools are filed at A A, to suit the required hole, and tempered to a brown bordering upon a purple. The hole or keyway is then cut out roughly, to nearly the required size, and the drift is then driven through with a hand hammer, cutting a clean and true hole. Care must, however, be taken to have the work rest evenly upon a solid block of iron or (for delicate work) lead, and to strike the punch fair and evenly, otherwise a foul blow may break the drift across the section at C. This class of drift is adapted to small and short holes only, such as cotter ways in the ends of keys or bolts, for which purposes it is a very serviceable and strong tool. It must be freely supplied with oil when used upon wrought iron or steel.

For deeper holes, or those requiring to be very straight, true, and smooth, the drift represented by Fig. 157 is used. The breadth and thickness of the section at A is made to suit the shape of the keyway or slot required. The whole body of the drift is first filed up, parallel and smooth, to the required size and shape; the serrations forming the teeth are then filed in on all four sides, the object of cutting them diagonally being to preserve the strength of the cross section at A A. The teeth may be made finer, that is, closer together, for very fine work, their depth, however, being preserved so as to give room to the cuttings. To attain this object in drifts of large size, the teeth should be made as shown in Fig. 157a, which will give room for the cuttings, and still leave the teeth sufficiently strong that they do not break. The head, B, of the drift is tapered off so that, when it swells from being struck by the hammer, it will still pass through the hole, since this drift is intended to pass clear through the work.

The method of using this tool is as follows: The hole should be roughed out to very nearly the required size, leaving but a very little to be taken out by the drift, whose duty is, not to remove a mass of metal, but to cut a true and straight hole. To assist in roughing out the hole true, the drift may be driven lightly in once or twice, and then withdrawn, which will serve to mark where metal requires to be removed. When the hole is sufficiently near the size to admit of being drifted, the work should be bedded evenly upon a block of iron or lead, and oil supplied to both the hole and the drift; the latter is then driven in, care being exercised that the drift is kept upright in the hole. If, however, the hole is a long one, and the cuttings clog in the teeth, or the cut becomes too great, which may be detected by the drift making but little progress, or by the blow on the drift sounding solid, the drift may be driven out again, the cuttings removed, the surplus metal (if any there be in the hole) cut away, the hole and drift again freely oiled, and the drift inserted and driven in as before, the operation being continued until the drift passes entirely through the hole; for the drift will be sure to break if too much duty is placed upon it. After the drift has passed once through the hole, it should be turned a quarter revolution, and again driven through, and then twice more, so that each side of the drift will have contacted with each side of the hole (supposing it to be a square one), which is done to correct any variation in the size of the drift, and thus to cut the hole true.

The great desideratum in using those drifts is to drive them true, and to strike fair blows, otherwise they will break. While the drift is first used, it should be examined for straightness at almost every blow; and if it requires drawing to one side, it should be done by altering the direction in which the hammer travels, and not by tilting the hammer face (see Fig. 158).

Fig. 158.



Suppose A to be a piece of work and B and C to be drifts which have entered the keyways out of plumb, as shown by the dotted lines, D and E. If, to right the drift, C, it was struck by the hammer, F, in the position shown and traveling in the direction denoted by G, the drift, C, would be almost sure to break; but if the drift, B, was struck by the hammer, H, as shown, and traveling in the direction denoted by I, it would draw the drift, B, upright without breaking it; or in other words, the hammer face should always strike the head of the drift level and true with it, the drawing of the drift, if any is required, being done by the direction in which the hammer travels. When it is desired to cut a very smooth hole, two or more drifts should be used, each successive one being a trifle larger in diameter than its predecessor. Drifts slight in cross section, or slight in proportion to their lengths, should be tempered evenly all over to a purple blue, those of stout proportions being made of a deep brown bordering upon a bright purple. For cutting out long narrow holes, the drift has no equal, and for very true holes no substitute. It must, however, be very carefully used, in consequence of its liability to break from a jarring blow.

REVERSE KEYS.

Crossheads, pistons, and other pieces of work which are keyed to their places upon taper rod ends, and are therefore apt to become locked very fast, are easily removed by means of reverse keys, which should always be employed for that purpose, because striking such work with a hammer, even supposing the work to be well supported underneath and copper interposed between the hammer and the work, is liable to bend and otherwise damage it with every heavy blow.

Reverse keys are simple pieces of steel, so shaped as to reverse the draft of a keyway, and are made male and female, as shown in Fig. 159, A representing the male, and B the female. The manner of using them is to insert them into the keyway, as shown in Fig. 160, in which A repre-

Fig. 159.

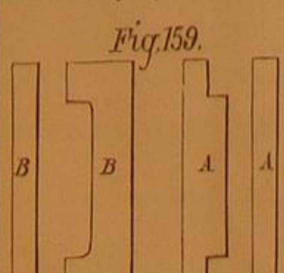
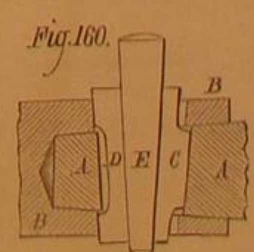


Fig. 160.



sents a taper rod end, B the socket into which A is fitted or keyed, C the male and D the female reverse key, and E an ordinary key. It will be found, on examination, that the insertion of C and D have exactly reversed the position of the draft of the keyway, so that the pressure due to driving in the key will be brought to bear upon the rod on the side on which the pressure was previously on the socket, and on the socket on the side on which the pressure was on the rod; so that driving in the key will key the socket out of instead of into its place.

The keyway in Fig. 160 is shown to have draft: that is, the proper key, when driven in, will bear one edge upon the edge of the keyway in the rod only, and not on the edge of the keyway in the socket at the small end of the cone; while at the large end, the natural key would bear against the edge of the keyway in the socket only. If, however, this condition does not exist, and the edges of the key bear equally upon the cone and the socket (on both edges and all the way through), the keyway being a solid one, that is to say, having no draft, the reverse keys may be employed, providing that C is placed so as to bear upon the edge of the keyway on the large end of the cone only, and that D is placed to bear on the edge of the keyway at the small end of the cone on the socket only, thus producing a back draft, or clearance, as it may better be termed. The key, E, should be made long, and both it and the reverse keys should be made of steel and left soft.

Carbonic Acid as a Fire Extinguisher.

Messrs. Connelly and Naylor, patentees, recently fitted up an apparatus, near the grounds of the gas works, in Pittsburgh, where, according to the *Commercial*, they conducted experimental tests in the presence of a number of citizens. In general terms, the machinery consists of a generator, where the gas is evolved; three receiving tanks, thirty inches in diameter by ten feet in length; and the connecting pipes. Some fifty feet distant was an excavation, twenty by thirty feet, partially filled with water, upon the surface of which was a skim of crude oil, to test the efficacy of the gas in extinguishing an oil fire. A pipe, about an inch and a half in diameter, and supplied with small jets every few inches, was extended along each side of this tank, a little above the surface of the water.

The first experiment consisted in lighting the crude oil, and letting it burn until the flame covered the entire surface. Immense volumes of black smoke rolled upward, the flames shot up ten or twelve feet into the air, and the heat was so intense as to drive the spectators back some fifty or sixty feet. At a signal from Dr. Connelly, when the fire was at its hottest, the engineer turned a valve, the carbonic acid rushed from the receivers with a hissing noise, through the jets in the pipes, and in two or three seconds the flame was cut off as effectually as though a coating of ice had instantly formed on the surface of the oil. As soon as the gas struck the flame, it was changed to a white steam, which made a striking contrast with the dense black smoke above it, as these two dissimilar vapors floated away and were gradually dissipated in the upper atmosphere. The second experiment was but a repetition of the first, and in both cases the extinguishment of the great volume of flame was as sudden and effectual as the snuffing out of a candle. A third experiment consisted in setting fire to a pile of shavings, kindling wood, oil barrels, etc., rendered highly inflammable by the addition of crude oil. When the fire had taken a firm hold, and was rapidly consuming the woody fiber, the gas was turned on, and the fire was out. The wood continued to smoke for a few moments, but there was no fire. The experiments were highly successful, and Dr. Connelly was warmly congratulated on his achievement.

The pressure on the receiving tanks was about 200 lbs. per square inch.

Progress of the East River Bridge.

The work on the East River Bridge thus far has cost $5,800,000; it is estimated that at least $10,000,000 more will have to be raised. This done, the bridge will probably be completed by July, 1879. The expenditure for labor and material averages about $78,000 per month.

The tower on the Brooklyn side was finished two months ago. On the New York tower, work will be suspended on December 1, for the winter; but it is stated that the structure will be completed and everything made ready for the throwing over of a temporary bridge early in the summer of next year. On this temporary structure the workmen will weave the wires into the permanent supporting cables. The galvanized ropes for the foot bridge are to weigh 12 lbs. per foot, and are to be 2¾ inches in diameter, with a breaking strength of not less than 240 tuns. As yet no contracts for wire work have been made. The work of demolishing buildings for the New York anchorage will be undertaken in May next.

St. Gothard Tunnel.

The present state of the works here has been reported on by M. Caillaux, in connection with M. Léon Say. On the side of Switzerland they are being pushed energetically forward. The tunnel is 9·3 miles long; 2,700 yards are bored on the side of Switzerland, and 2,100 yards on the side of Italy, leaving 6·21 miles to get through. According to present calculations 1,400 days will be required for finishing the works, which it therefore is possible will be competed by the end of 1880. The approaches to the tunnel are not yet begun: they will give a great deal of trouble. The tunneling is performed by the force of falling water setting in motion compressed air machines. These attack the rock, and drill blast holes of 40 or 48 inches in depth, which are afterwards charged with dynamite. Before the discovery of dynamite it is hardly possible to suppose that more than half a yard a day could have been bored from each side, and 15,000 working days, or more than forty years, would have been required, for a work which it is now supposed will not take more than ten. In the week from September 17th to September 24th, the whole amount bored was 54 yards, an average of 7·8 yards per day; the average of the preceding week was 7·9 yards.

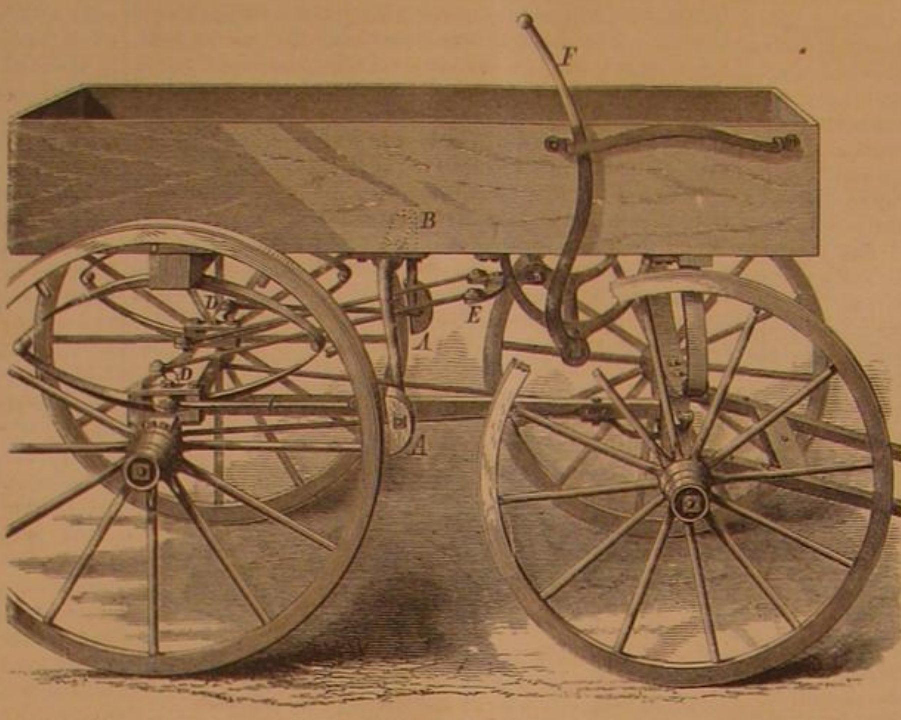
IMPROVED WAGON BRAKE.

The improved wagon brake, illustrated herewith, while strongly constructed, is so contrived as to prevent any racking effect upon the under portions of the wagon. Its arrangement is also such as to render its pressure equal on every wheel to which it is applied, even if said wheels be of different diameters, thus comprising one of the best inventions of its kind that has come to our knowledge.

The brake shoes, A, are suspended in front of the hind wheels by arms of shafts, the inner ends of the latter being secured in a sleeve, B (dotted lines), underneath the wagon. The shafts not being connected together, and working independently in the sleeve, B, it follows that either brake shoe may be pushed against its wheel without causing a like movement of the opposite shoe. To each shoe is attached a rod, C, which is attached to pivoted lever, D, and these last by rods to the evener, E. The levers, B, it will be observed, are pivoted to the rear axle, so that the direction of the forces, imparted by them to the axle and by the shoes to the wheels, will oppose and neutralize each other through the wheels and the axles.

The evener, E, is pivoted to the end of a rod which is connected to an arm of an oscillating shaft suspended from the bolster or front part of the wagon box, and provided with a hand lever, F, for operating the mechanism. The arrangement throughout is quite simple, and is doubtless efficient in operation.

Patented through the Scientific American Patent Agency, June 25, 1875. For further particulars address C. M. Howell, Andover, N. J.



HOWELL'S WAGON BRAKE.

IMPROVED DRAWING PRESS.

In the annexed illustration is represented a new drawing press for the manufacture of hollow metal ware. It possesses great power and is solidly and durably constructed, though occupying but small space and weighing but little. In making articles of moderate size, it cuts the metal into proper shape before forcing it into the die, accomplishing this operation by new and ingenious mechanism, detailed reference to which is made below. It is also provided with novel means for accurate adjustment and a new device for self-adaptation of the drawing parts to metal of varying thickness. In Fig. 1 is given a perspective view of the apparatus. Figs. 2 and 3 are sections of the dies and punches From the first engraving it will be seen that power is communicated to a large pulley which, by means of a simple clutch, operated by the treadle shown under the bed, is thrown into or out of gear at will. From this pulley, by the interposition of suitable mechanism, power is transmitted to a horizontal shaft passing through the lower portion of the frame, on which shaft is a heavy cam, A, and also two cranks, B. The cam, in its revolution, acts upon a roll above it, and so elevates the carrier C, of the cutting and drawing dies, which travels in slides in the frame. To the cranks are connected pitmen, D D, which connect with a wrought iron yoke, to which is secured the drawing punch rod, E. At F is a cross connection between the two sides of the frame, to which connection is attached the cutting punch.

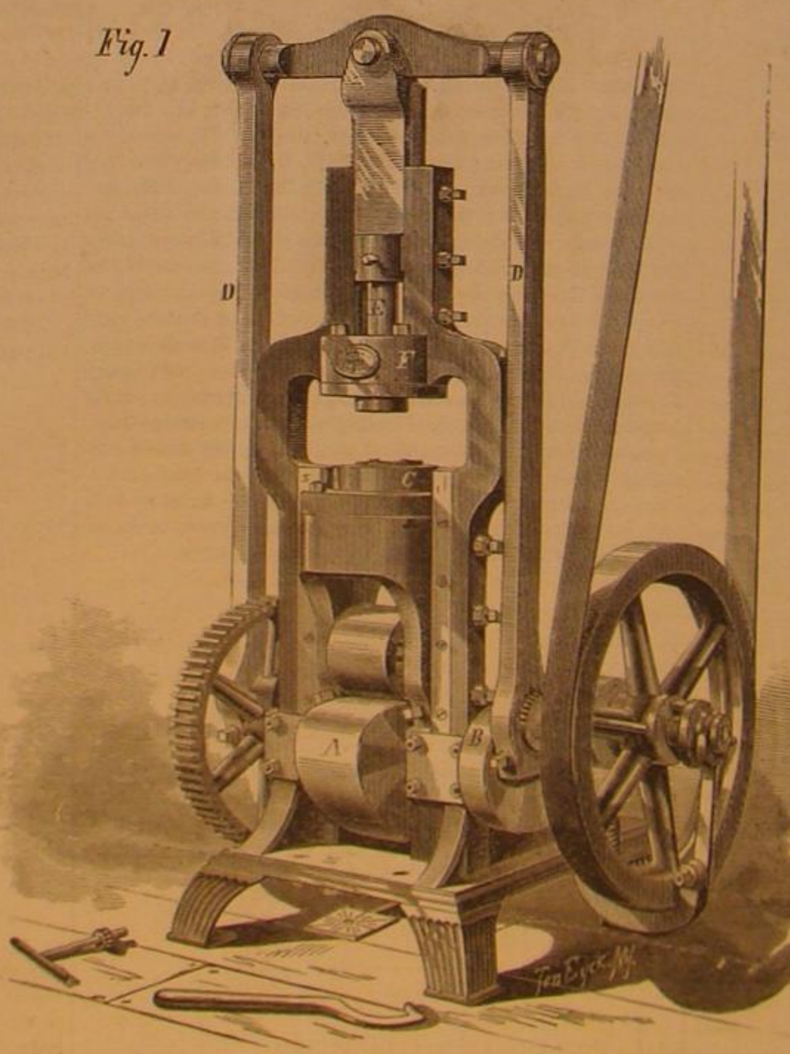
When the cam shaft is rotated, the cam, as above stated, raises the die carrier; and the cranks, pulling down the pitmen, force the cutting punch against the metal and into the die below. This will be more clearly understood from the section, Fig. 2, in which G is the drawing die, H the cutting die, I the cutting punch (stationary), and J the drawing punch. As the die carrier rises, the metal is first pressed against the cutting punch, I, between the outer edge of which and the cutting die, H, it is quickly cut, and the punch, I, entering the die, then holds the edges so cut out very firmly, as in a vise. At this point the drawing punch, J, comes down and forces the metal into the drawing die, G, thus completing the operation.

It sometimes happens that the metal is not of uniform thickness, in which case it may be easily imagined that, through the lack of a close hold between the cutting punch and die, a portion of the edge would be forced down into the drawing die on the descent of the punch. To obviate this, the lower portion of the drawing die is made hemispherical, and it sets in a corresponding socket in the bed so as to form a ball and socket joint, which of course adapts itself to the thickness of the metal pressed above it. This is a very ingenious and novel arrangement, and one which insures the tight grip of the edge of the metal without chance either of its wrinkling or of its escape. Fig. 2 shows more especially the device used for small ware, such as cups, etc., for larger articles, pans and like objects, a different arrangement is employed, which is exhibited in Fig. 3.

In this there is no cutting of the metal by the machine, that operation having to be performed previously, and hence there is neither cutting die nor punch. The drawing die is a simple concavity, without peculiar features, the essential points of the device being found in another means of holding the edge of the blank. The punch, K, passes directly through the ball portion, L, which is confined by a ring, M, held by the screw bolts, one of which is shown on the left. The edges of the blank are compressed and held between the surface of the die and a lower ring, N, which is upheld by another set of screw bolts, one of which is shown on the right. These bolts pass through a large bore in the ball portion, L, thus allowing the latter its free play and shoulder in said ball, as shown, so that the latter and the ring are closely united. The ring, N, therefore, follows the play of the spherical portion, and consequently automatically adapts itself to the thickness of the metal. The punch then descends in manner similar to that already described.

Referring again to Fig. 1, at the crank pins of the pitmen, and also on the lower roll actuated by the cam, are eccentric devices for adjusting both slides. By these the latter, as necessarily is required from the relation of punch and die, can be adjusted with the greatest nicety. The instrument shown in the foreground is used for manipulating the eccentrics. It may also be noted that the heaviest strain comes on the wrought iron pitmen and yoke and the steel shaft, thus relieving the cast frame and allowing of the use of less metal therein. The shape of the lower cam, which is such as to hold the lower slide stationary after the blank is cut and until the drawing punch descends, is a neat piece of mechanical construction worth noting, and attention may also be called to the bowing out of the frame at the points where the drawing takes place, thus giving to the former the very slight spring which it requires, and at the same time affording a wider space where the same is needed. We have seen the machine operate, and examined samples of its products. The latter were well made. The reader will find the press itself in motion at the American Institute Fair. For further information address the manufacturers, The Stiles & Parker Press Company (N. C. Stiles, agent), Middletown, Conn.

Fig. 1



STILES AND PARKER'S DRAWING PRESS.

Fig. 2

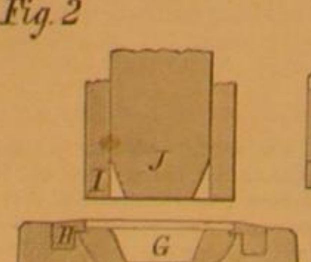
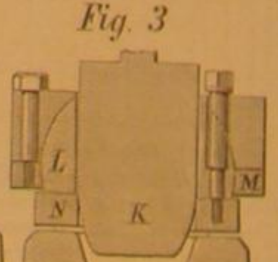


Fig. 3



Crape.

The article of chief value in the production of crape is the finest Italian silk, prepared, spun, and woven in a peculiar manner. Some of the processes are held in secrecy. Crape is sometimes made of cotton, and passes under the names of "Albert" and "Victoria," for such uses as do not require the more expensive article.

The use of this emblem of woe is so on the increase that many stricken ones indicate their grief by dense folds of crape, that seemingly envelope them in clouds of inconsolable sorrow.

National Differences as to Whistling.

One of our English contemporaries, in a lengthy article concerning the whistler, winds up as follows:

"Considering the vast annoyance caused to men and women by the prevalent vice of whistling, we may well ponder on the question: Why do men whistle? Women do not, although we could well tolerate anything from their lips but determined refusals. What impulse leads a man to enclose a circular space with his lips, and then by sheer pneumatic force to make the noise called whistling? If the lips looked more elegant in this form, there would be a plea for whistling. But this is very rarely the case. Granted a moderate-sized mouth, with upper lip rather small, the personal appearance of the whistler may be tolerated. But take a big mouth and a pent roof under lip, and the whistler presents to you a facsimile of the extremity of an elephant's trunk. Strange to say the latter class of whistlers are by far the more prevalent; and if whistling be a fine art, and not one of the ills that flesh is heir to, the big-mouthed are the most efficient though the most persevering performers. We could read with greater comfort and interest between two large saws that were being sharpened than near an inveterate whistler."

Just after reading the above, we were looking over a pile of American exchanges, when we came across the following in one of our agricultural newspapers:

"An old farmer once said that he would not have a hired man on his farm who did not habitually whistle. He always hired whistlers; said he never knew a whistling laborer to find fault with his food, his bed, or complain of any little extra work he was asked to perform Such a man was generally kind to children and animals in his care. He would whistle a chilled lamb into warmth and life, and would bring his hat full of eggs from the barn without breaking one of them. He found such a man more careful about closing gates, putting up bars, and seeing that the nuts on his plow were all properly tightened before he took it into the field. He never knew a whistling hired man to kick or beat a cow, nor drive her on a run into a stable. He had noticed that the sheep he fed in the yard and shed gathered around him as he whistled, without fear. He never had employed a whistler who was not thoughtful and economical."

This leads us to ponder and wonder if the foreign whistler is less an artist than the American, or if the difference in opinion between the English and the home writer is owing to their individual tastes. There seems to be a principle involved. Which shall be accepted, the opinion of the foreign or the American editor? It seems to be of national consequence to have the matter decided.

IN referring to the new carbonic acid motor recently patented by Mr. John Westcott (see page 266, current volume), the types made us state that the absorption of charcoal is equal to five times its volume of gas. The absorption is fully thirty-five times the volume, and the sentence should so read.

THE ARTIFICIAL COLORING OF PLANTS.

A simple and well known chemical experiment, showing the action of sulphurous acid on vegetable coloring matter, consists in placing in that gas violets, which become almost instantly bleached. Sulphurous acid, by its deoxidizing properties, destroys the color of a large number of other flowers, such as roses, periwinkles, etc., and its effects may easily be noted by the little apparatus shown in Fig. 1. This consists of a capsule in which sulphur is ignited to generate the acid, covered by a conical metal chimney, at the orifice of which the flowers to be bleached are placed.

Fig. 1.—Discoloration of flower petals by sulphurous acid.

Quite recently M. Filhol has exhibited, before the members of the French Scientific Association, new results, obtained through the action of a mixture of sulphuric ether and a few drops of ammonia upon flowers, from which it seems that a large number of the latter, normally of a violet or pink color, become, when immersed in the mixture, an intense green. The editor of *La Nature*, from which journal we extract the engravings herewith given, has continued the investigations of M. Filhol, and deduces an interesting series of experiments, the description of which we present below.

Into a wine glass, Fig. 2, pour a quantity of ordinary ether, and add about one tenth its volume of liquid ammonia. Into this the flowers are to be plunged. The purple and pink tinted

Fig. 2.—Turning blossoms green by ammoniacal ether.

flowers, which become bright green, appearing as if dyed by a copper salt, are the red geranium, the violet periwinkle, lilacs, roses (red and pink), gillyflowers, thyme blossoms, blue bells, heliotropes, and myosotis. Other flowers of different shaded colors acquire different tints. The upper petal of the violet sweet pea becomes a dark blue, while the lower petal turns to a light green. Sweet William changes to brown and light green. White flowers usually become yellow, this being the case with the white poppy, the snapdragon, which turns yellow and dark violet, the white rose, which changes to a straw tint, the white columbine, the chamomile, the syringa, the white daisy, and the white rocket, the honeysuckle, the bean, the white potato blossoms, the meadowsweet, and the white foxglove. In the pink sweet pea, the upper petal becomes blue, and the lower one a soft green. The pink geranium turns blue in a remarkable manner. The red snapdragon becomes of a fine metallic brown, the valerian of a grayish color, and the red wild poppy of a fine violet. Yellow flowers in the ammoniacal ether remain unaltered. Red turns green in a very curious way when put in the mixture. The action of the chemical is so rapid that the merest sprinkling of it on the leaf is sufficient to cover the latter instantly with green spots. In the same way flowers may be spotted with white, even while they are growing.

The most interesting changes of color are those which take place in flowers which are variegated. Thus particolored fuchsias become yellow, green, and blue. All flowers which have taken a new hue may be kept from changing back again for several hours by plunging them in pure water. Eventually, however, they regain their natural colors.

Another curious fact to be noted in the present connection is that the flowers of asters, which are naturally inodorous, acquire an agreeable perfume under the influence of the ammonia. The same flowers, when violet, become red when wet with nitric acid diluted with water.

MELON CUCUMBERS.

Considerable interest has recently been manifested in the fruiting of a cross effected between *cucumis melo* and the Telegraph cucumber, a well known variety of *c. sativus*. This presumed cross or hybrid was lately seen at Kew, London, fruiting in a house, and the following are our notes on them, made at the time, together with the accompanying reduced representation of the plant: Stems slender, scabrous; leaves and flowers like those of the cucumber in size, as well as in other respects; fruit from 6 to 10 inches in length, and from 2 to 3 inches in diameter, of a dull brown russet color, or profusely dotted with whitish lines; but we observed no spines. In fact the growth and flower resemble those of a cucumber, and the fruit that of a melon. The female parent is the *concombre de Sikkim*, of Naudin, described in the *Annales des Sciences Naturelles* as a variety of *c. sativus*, so that, if the pollen from the Telegraph cucumber has taken effect (which now seems doubtful), the cross is simply one between two extreme forms of the common cucumber, and not a cross between the cucumber and melon, as the Kew label would lead one to believe. Cucumbers and melons are extremely variable in size, color, habit, and flavor; we have seen, indeed, a figure of a cucumber of the ordinary form and a globular fruit, half cucumber and half melon, growing on the same branch. This was supposed to have been brought about by a cucumber flower having become accidentally fer-

tilized with pollen from some Little Heath melons which were growing in the same house. In Darwin's "Animals and Plants under Domestication," we read that there is a race of melons of which the fruit is so like that of the cucumber, both externally and internally, that it is scarcely possible to distinguish the one from the other except by the leaves.

Major Trevor Clarke, by whom the seeds of the supposed hybrid under notice were sent to Kew, says: "This curious plant was sent to me from India as a cucumber. The remarkable scabrous coating of the ripe fruit attracted my attention, and induced me to send it to Kew, where it was at first thought to be a melon. It is now, however, thought to be a true cucumber. From the appearance of the figure the Kew plant hardly looks as if the cross with the Telegraph cucumber had taken effect. I have now growing here two plants from the (supposed) crossed and uncrossed seed. They have set fruit, but were late plants, and are not yet in a condition to be described. Many years ago I raised a cross between a melon and the Snake cucumber (*cucumis flexuosis*); but the latter, I believe, ranks among the melons. A cross, real or supposed, between a cucumber and a melon, was shown at South Kensington, some years ago. A neighbor of mine has a plant from the big pumpkin crossed by a cucumber. It was fertile, and is now growing for the second generation."

Analysis of the Human Breath.

An account published in *Nature* of some experiments, made with a view to determine the organic matter of the human breath in health and disease, presents some facts of a peculiarly interesting nature. The breath of eleven healthy persons and of seventeen affected by disorders was examined, the persons being of different sexes and ages, and the time of day at which the breath was condensed varying. The vapor of the breath was condensed in a large glass flask surrounded by ice and salt, at a temperature of several degrees below zero, the fluid thus collected being then analyzed for free ammonia, urea, and kindred substances, also for organic ammonia. Among the various results of this examination may be mentioned the fact that, in both health and disease, the free ammonia varied considerably; the variation, however, could not be connected with the time of day, the fasting, or the full condition. Urea was sought for in fifteen instances—three healthy persons and twelve cases of disease—but it was only found in two cases of kidney disease and in one case of diphtheria; and a faint indication of its presence occurred in a female suffering from catarrh. The quantity of ammonia arising from the destruction of organic matter also varied, possibly from the oxidation of albuminous particles by the process of respiration; but in healthy persons there was a remarkably uniformity in the total quantity of ammonia obtained by the process.

THE SKIMMIAS.

Skimmia japonica was for a long time the only variety known to Europe and America. Now, however, we have five recognized species, namely *skimmia japonica*, *oblata*, *Veitchii*, *laureola*, and *fragrans*, of the first and last of which

Skimmia Japonica.

we furnish illustrations. *S. japonica* is valuable on account of its brilliant red fruit, about the size of a pea, which, growing in profusion, remains on the bush all the year round, thus giving it a very ornamental appearance, especially in winter, and perhaps not less so in the following spring when, through this strange tenacity of adhesion, it is not unusual for the plant to be seen, as in our illustration, laden with both fruit and flowers at the same time.

Skimmia fragrans, which bears a sweet smelling white flower tinged with yellow, possesses this peculiarity—that though its buds appear before winter sets in, the flowers do not open till the following April. With the exception of *laureola*, which is indigenous to Nepaul, India, all the varieties of skimmia come from Japan; they are well worthy of extended cultivation, being very hardy and adapting themselves readily, when young, to almost any soil or climate. They may easily increased by means of cuttings struck under glass, or in some cases from seed. Siebold and Zuccarini

Skimmia Fragrans.

state says *La Revue Horticole*, that the Japanese and Chinese class *s. japonica* among poisonous fruits.

L. W. Pond.

The mystery attending the disappearance of Mr. L. W. Pond has been to all appearances cleared up in a manner which few could have suspected. When we penned the few lines which we intended as a brief tribute to a character regarding which no blame had ever reached us, we believed that we did but scanty justice to their unfortunate subject. It is excessively sad for us now to learn that we, in common with his other friends, have been grievously mistaken in our estimate, and that in lieu of the model of integrity we find the forger and defaulter. A careful examination of the missing man's papers has brought to light forged evidences of indebtedness, reaching as high as $100,000. The plan adopted was to take an old note, already paid and bearing on its back several indorsements, erase the figures and date with a chemical preparation, fill in new date, etc., and obtain cash for it. The microscope, which showed the effects of the chemical on the paper, and a solution of nut galls which restored the erased ink to its original blackness, were the means of detection. The loss falls on those who have cashed the notes.

The Chinese Oil Tree.

Elæococca vernicia, the oil tree of China and Cochin China, is a plant of the family of the *euphorbiaceæ*. Its seeds, when submitted to strong pressure in the cold, yield about 35 per cent of a liquid oil, colorless, inodorous, and almost insipid. Its specific gravity at 59°Fah. is 0·9362. At —32° it thickens, without losing its transparency or crystallizing. By treatment with ether, 41 per cent of oil can be extracted from the seed, slightly colored, but presenting otherwise all the character of the oil obtained by pressure. If, instead of ether, purified bisulphide of carbon is employed, the fatty matter remaining after the solvent has been evaporated off at 212° solidifies on cooling, forming a number of small reniform masses, which present under the lens a decided crystalline texture. This solidified fat has the same elementary composition as the liquid oil obtained by pressure, and melts at 93°. The oil extracted by pressure in the cold is rapidly solidified by light in the absence of air, an effect which, on further experiment, was found due to the more refrangible rays of the spectrum alone. The oil of *elæococca* is the most drying of all oils. If spread on a plate of glass or metal, it dries in a few hours, on exposure to the air.—*M. S. Cloëz.*

ENGINEERING STRUCTURES.

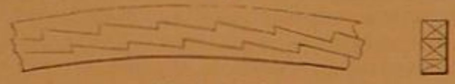
Under the above heading we classify the following descriptions of caissons and arched edifices, extracted from the pages of Knight's "New Mechanical Dictionary."*

The modern or pneumatic caisson, sunk through quicksands or submerged earth or rock, is the invention of M. Triger, who contrived, by the aid of air pumps, to keep the water expelled from the sheet iron cylinders, which he sunk through quicksands in reaching the coal measures in the vicinity of the river Loire, in France.

ARCHED ROOFS.

The largest roof of one span in its day was that of the Imperial Riding House, at Moscow, built in 1790. The span is 235 feet. The members of the arched beam are notched together, as shown in Fig. 1, so as to prevent their slipping upon each other. The ends of the arched beam are held

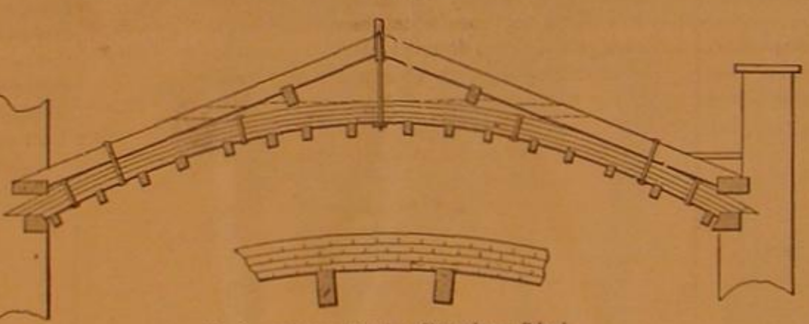
Fig. 1.



Notched Arch-Beam

from spreading by a tie beam, and the arch and tie are connected together by vertical suspension rods and diagonal braces. Emy's arched beam roof, which is represented in Fig. 3, is constructed on a different principle. The ribs in this roof are formed of planks bent round on templates to the proper curve, and kept from separating by iron straps, and also by the radiating struts, which are in pairs, notched out so as to clip the rib between them. The principals, wall posts, and arched ribs form two triangles, firmly braced together, and exert no thrust on the walls; the weight of the roof, being thrown on the walls at the feet of the ribs and not at the pole plate, permits the upper portion of the walls to be comparatively light. This principle has been extensively adopted in wooden bridges in the United States and Europe.

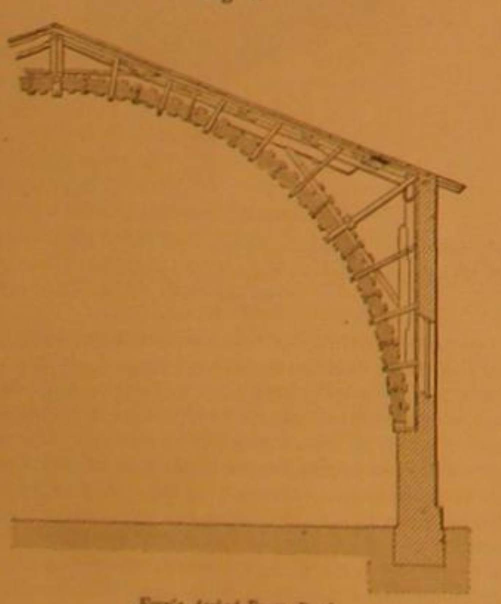
Fig. 2.



Roof over Dining-Room at Charterhouse School.

Another form of arched beam is exemplified in the roof of the dining room of the Charter House School, London, England, shown in Fig. 2. The roof is formed with circular ribs in four thicknesses of inch and a half deal, four inches wide, with saw cuts half an inch in depth on the under sides, and put together with marine glue on a cradle center. The dotted lines show the collars, which are dovetailed one inch into the sides of the principal rafters. The latter, being five

Fig. 3.



Emy's Arched-Beam Roof.

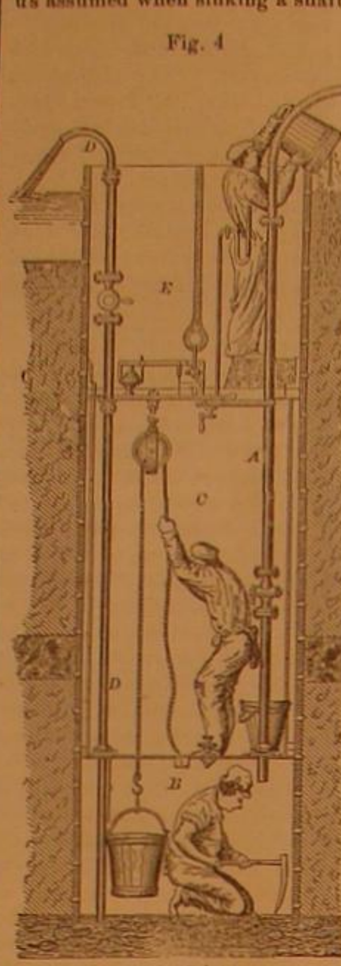
inches wide, project on one side, an inch before the face of the circular ribs, which are only four inches wide. On the collars rest the purlins supporting the rafters. The ceiling 'oists are spiked up to the circular ribs.

Fig. 4 illustrates

TRIGER'S CAISSON,

and shows the comparatively simple form which the apparatus assumed when sinking a shaft.

Fig. 4



Triger Caisson.

Air is forced in through the pipe, A, to the working chamber, B, which has a manhole in the floor above. C is the middle chamber, which has also a manhole in its ceiling. D is a pipe by which sand and water are ejected from the chamber, B, under the pressure of the compressed air in the latter. The said air pressure being such as to exclude the water, the workman descends through the manhole in the floor of the chamber, E, and closes the door behind him. Admitting air in the chamber, B, until the pressure is equal in the two, he opens the door in the floor of the chamber, C, and descends to his work. The buckets are similarly managed, the middle chamber, C, acting as the means of communication, being filled with air at normal pressure, or with compressed air, according as it is in communication with the open air of chamber, E, or the compressed air of chamber, B. The device, which thus acts as an intermediate, is termed an air lock, and is the notable point of invention in the apparatus.

In Fig. 5 is given a section of a

MOVABLE IRON CAISSON

used in building the piers of a bridge at Copenhagen, Denmark. It comprises an upper chamber communicating with the air, an intermediate or air chamber, both equal and cylindrical in section, and a lower working chamber, of larger section than the foregoing and adapted to the shape of the pier: the whole raised or lowered by suspension chains, and

Fig. 5.

Caisson at Copenhagen.

ballasted with iron and water contained in two annular chambers, A and B, surrounding the lower part of the air lock. In working, the apparatus was lowered to the bottom, and an excavation made until a stratum capable of forming a solid foundation was reached; upon this a layer of concrete was laid, and then the structure completed with brickwork and faced with granite. The caisson was gradually raised as this progressed; and when it was finished up to the water line, the caisson, with its suspending stage and tackling, was removed to the site designed for another pier, where a similar operation was performed. Caissons of this kind, having an open bottom and provided with air locks, act upon the principle of the diving bell, the pressure of air in the working chamber and air locks being equal to that of the depth of water in which they are submerged. This renders the use of the air lock necessary. The piers of the bridge across the Mississippi river, at St. Louis, Mo., were constructed by means of an analogous device.

* Published in numbers by J. B. Ford & Co., New York city.

Iron and Steel Rails.

The *Bulletin* of the American Iron and Steel Association reports the following as the rail production of the United States for 1874, in net tons:

New iron and Bessemer steel rails over 40 lbs.	349,978
New iron rails over 40 lbs.	32,480
Rerolled iron rails of all sizes	323,035
Steel and steel-headed rails other than Bessemer	17,181
Steel rails	6,739
Total	729,413

Of this, 259,288 tuns were made in Pennsylvania, including 55,488 tuns unrolled; 125,103 in Illinois, including 51,234 unrolled; 82,561 in Ohio, and the residue distributed among 16 States.

The whole number of rail-rolling mills in the United States, in 1874, was 91, of which 57 make heavy rails mainly, and 34 make only light or street rails. Of the whole 91 mills, 22 made no rails in 1874. The product of the year was therefore rolled by 69 mills, and many of these ran only a part of the time. The capacity of all the rail-rolling mills of the country is at least double the product of 1874, which was 729,413 net tuns. Of the 67 mills which made rails in 1874, 7 made both iron and Bessemer steel rails, 1 made Bessemer steel rails exclusively, 2 made steel-headed rails exclusively, 2 made steel-headed rails and iron rails, and 1 made solid cast steel rails and iron rails.

It will be observed that almost one half of the total rail product of 1874 was composed of old rails re-rolled.

Bleaching Cotton Yarn in the Hanks.

No 1. Bleaching liquor stock tub.—Pound together 20 lbs chloride of lime and 40 gallons water in a tub; allow to settle five hours, when it is ready for use.

No. 2. To bleach white 60 lbs. of cotton yarn.—Boil six bundles yarn with 6 lbs. soda ash for six hours, not less. Stir them and wash in one cold water, and wring. Add to warm water 10 gallons of stock liquor; work yarn half an hour, ten turns; wash from this into a cold water for safety, but this is not absolutely necessary. Sour in a cold water with two quarts vitriol. Wash in a cold water from sour; also in a hot water containing 2 lbs. of soap (white preferred). If necessary to be blued, it should be done in soap water, with a little China blue. Wash in cold water from soap, and dry in stove.

No. 3. To bleach 60 lbs. for dyeing.—Boil as above, only dispense with the soda ash, and take a little less time in working, but it is very necessary to wash well off before dyeing.

No. 4. To set a stock tub of red liquor for dyeing aniline and other colors.—Add to each gallon water 1 gill of red liquor. This tub should be kept for further use, and takes about one quart to each 10 lbs. to keep it up to working order.

No. 5. To dye 60 lbs. light lilac.—Bleach as for dyeing, then steep a quarter of an hour in red liquor stock tub, or give five turns. Wash twice in cold water, and wring out; dissolve 1 oz. logwood extract; add this to a milk-warm water; give ten turns, lift, and add 2 ozs. dissolved alum; give three turns more; wash in cold water; dry in stove.

Finer and brighter colors can be got with aniline and many other shades of color by increasing the logwood, etc.

No. 6. To dye 60 lbs. silver drab.—Bleach as for dyeing, then dissolve 2 ozs. logwood extract; add this to warm water; give ten turns with yarns; lift and add 1 gill of black iron liquor; four turns more. Wash in cold water; dry in stove. This color will look uneven in the logwood liquor, but will come up right when black iron is added.

The Education of the Mechanical Engineer.

We continue our extracts from Professor R. H. Thurston's address, recently delivered to his graduating class at the Stevens Institute:

"Never lose an opportunity. Men rarely succeed in life who are neglectful of opportunities, and, in nearly all cases, those who are successful can count upon their fingers the several occasions which formed the turning points at which, seizing an opportunity that other men might have overlooked or neglected, they chose the path which led to their final success. Many men possess ability, intellectual and physical but yet the number who may achieve high positions is small It is the taking advantage of these rare opportunities, which, unobserved by the careless or the obtuse, are seized upon at the right moment and in the right manner by the watchful and the acute, that usually secures most rapid advancement.

Life is short; great opportunities are rare; therefore, make it a principle never to neglect one, whether small or great; seize it promptly, and make the most of it

"Endeavor to keep 'two strings to your bow.' However much engrossed with the work in hand, however secure apparently your position, however satisfactory your location, keep the fact in mind that life is full of unexpected vicissitudes. Spare an occasional thought to provision against loss of position, failure of business, or compulsory change of location. Do your work so well that you may feel certain that your employer or your client's cannot afford to dispense with your services, and allow none of those about you to excel you. Yet be, at all times, prepared to make a new start, with confidence in yourself and your accumulated resources, should everything fail you. To ensure this, do your work better than can those who may aspire to your position. Have a specialty in which none can compete with you. Be always on the alert to make acquaintances among those whose character, position, and disposition may enable them to assist you when you find yourselves in need of assistance. Always assist your friends and deserving acquaintances heartily and actively. You will thus gain the approval of your own conscience, and will place a strong anchor to windward. The strongest man is weaker than a child if alone in the world without friends, and few men can say that they do not owe much of such success as they may have attained to the aid and countenance of good friends.

"Endeavor to become thoroughly acquainted with the principles and with all the details of the practice of those trades which are auxiliary to the profession of mechanical engineering. Do not feel satisfied until you can tell the pattern maker how to make your pattern, the molder how to mold it, and the founder of what mixture of metals you wish the casting made; until you can tell the blacksmith where to use the best and where to place the cheapest iron, and how to make his scarfs and welds, and how to preserve the fiber of the iron uninjured; until you can instruct an unskillful boiler maker in the selection of his plate and in testing it, in the spacing of rivets and in the welding of a seam or the turning of a flange. Do not rest until you can take every piece of your machine as it comes from the foundery or the blacksmith's or coppersmith's shop, and fit it to its place, giving it the proper finish, in the cheapest, quickest, and most accurate manner. All this will require time, patience, and perseverance, keen observation, a good memory, and a certain amount of actual practice to bring out that natural sleight, that mechanic's 'knack,' that no engineer in successful practice often lacks.

"In doing your work, strive to earn a perfect self-approval. From first to last, work as if your sole object were to acqnire a reputation for good work and to assume a leading place in your profession. You may then feel a perfect confidence that, if you earnestly seek to acquire and if you carefully cherish such a reputation for good work, honest dealing, professional skill, and general intelligence, your reputation will be very sure, in turn, to take care of you and to bring you competence and perhaps wealth.

"Make the most of your resources. The greatest skill is frequently exhibited by the engineer in doing inexpensive work. In some cases the production of elaborate designs and graceful forms, the use of the best materials, and the employment of fine workmanship and the adoption of a beautiful finish, are not only allowable but incumbent upon you, and such construction is at once truly economical and most creditable. In other instances, the highest art is shown in accomplishing a given object at the least expense compatible with safety. Even rude devices, cheap materials, rough workmanship, and entire absence of ornament and finish are evidences, at times, of the ability of the engineer to accommodate himself to circumstances and to accomplish large results with small means. The character of your work in this respect should be determined by the nature of the problem itself, by the means at hand, and by the value of capital. Where capital is plentiful and cheap, and where labor and good materials are plentiful and cheap, it would be inexcusable to design and to construct, in important work, anything but the best work that you are able to produce, using the best material and demanding the best of workmanship. Where capital is difficult to obtain, materials ill supplied, and labor expensive, and where the structure is a temporary one, the really good engineer will pursue quite an opposite course. To build cheap railroads and machinery in Great Britain, where capital is worth but four or five per cent per annum, and labor four or five shillings per day, as we build them in our Western and Southern States, where money costs ten per cent and labor is worth twice as much as abroad, would be extremely unwise. If it were stipulated that all new roads in the United States should be given easy grades, curves of large radius or straight tracks, well ballasted, with cut stone masonry and iron bridges, and furnished with station buildings and permanent structures of stone and brick: if it were prescribed that they should be provided with an ample supply of the best rolling stock, heavy locomotives, cars fitted with all the most recent improvements, and with every convenience known on old and wealthy roads, we should have no new roads, and the country would remain undeveloped. A machine designed for temporary use should be made at the least possible cost at which it will certainly serve its purpose. A machine which is expected to work well until worn out, and then to be replaced by another, should be made of good materials and in the best manner. Where it is anticipated that the machine will be superseded by another of improved design before it can be expected to become useless by wear, it is waste of means to build it with a view to durability simply, and regardless of expense. It is for this reason that the light, cheap, but equally efficient machinery, built by our mechanics for some branches of textile manufactures, and some of our lighter tools, are better, on the whole, than the heavier and more expensive machinery supplied by foreign builders. Improvements follow each other with such rapidity that it becomes necessary sometimes to throw out this finely built machinery before it is half worn out. This difference in first cost is thus simply so much capital thrown away. Here, as in many cases that will arise, a good judgment, a strong, practical common sense, guided by experience and enlightened by acquired knowledge, is your only reliance in determining where lies the golden mean.

"Make the interests of your client your own. Let me remind you of the bad policy, of the wrong of which you would be guilty, were you in any case to permit the apparent interests or the wishes of a client to induce you to adopt a plan which your judgment, your knowledge, and your experience condemn. On the other hand, never permit your own interests to dictate a course obviously opposed to the best interests of the client who has entrusted his business to you; and never pursue a line of policy and action of which you know the results will fail to meet his expectations fully in every particular. Present to him every reason, *pro* and *con*; explain the case fully; and if his interests and your own are not identical and cannot be perfectly harmonized, state the matter frankly and courteously, and decline the work. Such a course will always prove to be most correct and most satisfactory in all respects. You will retain the esteem and goodwill of your client, and the small, or even the large, amount of money surrendered will have a full equivalent in the gain of a greater self-respect.

"Be guided always, but never ruled, by precedent. Be always ready to accept what seems, all things considered, best in principle and in practice, without a prejudice arising from its novelty. Study newly discovered laws, and examine every new fact in a fair-minded spirit, and be ready to take full advantage of every evident improvement suggested to you. Respect traditional custom and common practice. They are probably founded upon good reasons and the teachings of experience; but be neither hampered nor blinded by them.

"Be radical in theory, but extremely conservative in practice. I would warn you against too free indulgence in experimental practice. Your client's money should never be risked in even the most promising of new schemes, except with most thorough understanding on his part of the uncertainty involved, and except where you are as fully absolved of all blame, aside from an error of judgment, in case of failure. Even the best of men have been misled by such absurdities as perpetual motion and kindred schemes, ingeniously presented and curiously disguised. The greatest deceptions are those which seem simplest and easiest of investigation. Yet do not hesitate to embark your own means in promising experiment or in the development of inventions if you find yourself well able to do so; never forgetting, however, that the perfecting of a new design and the opening of a market is usually a matter of vastly greater expense than at first estimated.

"Help the inventor whenever an opportunity offers to do so with propriety and to do so effectively. Lend him your most effective aid. Encourage him when his schemes appear to promise well. Never refuse to assist him in detecting fallacies or by exposing the errors into which his enthusiasm may have seduced him. Respect him and honor him as one of a class whose services to you and to the world are beyond estimate or recompense, and who are rarely rewarded for a tithe of their freely expended time, means, and health. You will meet schemers, dreamers, and ignorant pretenders, every day. Do not hesitate to expose them to themselves, and, if necessary, to the world. But, as you demand the respect of your fellow men, and expect credit for good intent and earnest attention to duty, see that you yield the same respect and accord the same credit to every honest inventor. Remember that he is a brother of Savery and Newcomen, of Watt and Evans, the inventors of the steam engine, a colleague of Wheatstone and Morse, who gave us the telegraph, and of Stephenson, who made the railroad a daily convenience; that he is of the same race with Guttenberg, who gave us types, and of Hoe, who, with his wonderful printing press, made possible the modern newspaper and that multiplication of books of 'which there is no end.' He is of the same blood with Arkwright, who gave us the loom, and with Howe who responded to the touching 'Song of the Shirt' by producing the sewing machice. He is one of a noble army of the truest benefactors of the human race. Respect the inventor though his hand may be hard and soiled, his clothing worn, his manners rude, and his language ill chosen. He is one whose name may be remembered long after you and I and all of us, who pride ourselves upon fortune of birth, property, breeding, or education, have passed away and are quite forgotten.

"Do not give up your studies, however pressed by business, but see that you make your foundations deep and solid by future acquirements.

"Take care of your health. Keep this wonderful machine which we call the body—this mechanism which is at once the domicile and the servant, the transporter and the feeder, of the soul and of the mind—in the highest state of efficiency. Study the laws of health, and obey them as conscientiously as the laws of morals or of civil and social duty. A mind diseased is often but the exponent of a body diseased. Restore the body to health, and the mind will often be restored to its activity and its intellectual and even moral strength.

"President Porter, of Yale College, gives you terse and sound advice in regard to your conduct and bearing as men 'Young men,' said he to his pupils, 'you are the architects of your own fortunes. Rely upon your own strength of body and soul. Take, for your star, self-reliance. Inscribe on your banner: 'Luck is a fool; pluck is a hero.' Don't take too much advice; keep at your helm, and steer your own ship, and remember that the great art of commanding is to take a fair share of the work. Think well of yourself Strike out. Assume your own position. Put potatoes in a cart over a rough road, and the small ones go to the bottom Rise above the envious and the jealous. Fire above the mark you intend to hit. Energy, invincible determination, with a right motive, are the levers that move the world. Don't drink; don't chew; don't smoke; don't swear; don't deceive; don't read novels; don't marry until you can support a wife. Be in earnest; be self reliant; be generous; be civil. Read the papers. Advertise your business. Make money, and do good with it. Love your God and your fellow men; love truth and virtue; love your country, and obey its laws."

REDUCTION IN THE COST OF FOREIGN PATENTS.

MESSRS. MUNN & CO. take pleasure in announcing that they have effected arrangements by which the cost of Patents, in all Foreign Countries, for American Inventions is Greatly Reduced, and they are now ready to receive applications for such patents at the annexed rates, which include both Government and Agency fees for all ordinary cases.

Some applications may require a number of drawings, and a specification of unusual length, for which an additional charge will be made. But the annexed very low prices will be adhered to, except in special cases, when the inventor will be notified of any additional cost before any expense is incurred.

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ENGLAND.

The expense of applying for an English patent, which covers England, Scotland, Wales, Ireland, and the Channel Islands, is $75, currency, payable in advance, and an additional fee of $175, payable within 3½ months, to complete the patent. Certain government taxes are required after 3 years. Patents granted to the first person who files in the complete specification and pays the fees, whether he is the original inventor or merely the introducer. For full particulars, send for pamphlet.

FRANCE.

The expense for applying for a French Patent is reduced to $100, currency, payable $75 on making the application, and $25 on arrival of the Patent. A small annual tax is required after the first year. For amount of this tax and particulars about working the patent, see pamphlet. Sent free.

BELGIUM.

The cost of a Belgian Patent, and the conditions, are substantially the same as in France. For full particulars send for pamphlet.

GERMANY AND AUSTRIA.

The expense for applying for Patents in Germany and Austria is $100 each, payable in advance. Send for pamphlet giving details.

MUNN & CO. obtain patents also in NORWAY, SWEDEN, RUSSIA, SPAIN, PORTUGAL, ITALY, all the British Australian Colonies, including VICTORIA, NEW SOUTH WALES, TASMANIA, QUEENSLAND, NEW ZEALAND, and BRITISH INDIA, on the most favorable terms, and at reduced rates from former charges.

GENERAL REMARKS.

No models required in any of the Foreign Countries except Canada; and sometimes in Prussia, the officials require a model when in doubt about the novelty of the invention, but it is seldom that one is demanded, and never till the application is secure.

All persons who desire to take out Foreign Patents are requested to communicate with the undersigned. They may depend that their cases will secure prompt and careful attention. We have had an experience of nearly *Thirty Years* in the business of soliciting American and Foreign Patents; and as it is well known, a very large proportion of all patents obtained by American citizens, both in this country and in foreign lands, are solicited through the Scientific American Patent Agency.

To secure a foreign patent, all that is necessary is to write to the undersigned, transmitting the fees and a copy of specifications and drawings. We can then at once proceed. The personal presence of the applicant is not necessary.

A pamphlet, giving full detailed information regarding each country, sent free. Address, MUNN & CO.,

Office of the SCIENTIFIC AMERICAN, New York.

NEW BOOKS AND PUBLICATIONS.

PROBLEMS IN STONE-CUTTING, for Students of Engineering and Architecture. By S. E. Warren, C.E., Professor in the Massachusetts Normal Art School, etc. Illustrated with Ten Plates. Price $2.50. New York city: John Wiley & Son, 15 Astor Place.

Professor Warren has elaborated the science of stone-cutting into a branch of the higher mathematics, and his volume now before us contains some of the most instructive and interesting problems in the geometry of solids that we have ever seen. The numerous examples are taken from cases which actually occur in erecting buildings, and are therefore of the greatest practical value. The illustrations are very explicit, and the book altogether is an exhaustive treatise on a difficult and important industrial science.

THE AMERICAN STAIR-BUILDER'S GUIDE. By Lucius D. Gould. Illustrated with Thirty-two Plates. Price $4.00, post-paid. New York city: A. J. Bicknell & Co., 27 Warren street.

This is an excellent treatise on the most puzzling question which the ordinary house carpenter encounters; and it is judiciously treated in a clear and elementary manner, presenting no difficulties to the reader of average education. It describes the subject thoroughly, giving instructions for solving all the problems that may arise in practice, and this without departing from the simple and perspicuous plan which characterizes the whole book.

THE MECHANIC'S FRIEND; a Collection of Receipts and Practical Suggestions. Illustrated. By William E. A. Axon. New York city: D. Van Nostrand, 22 Murray and 27 Warren streets.

This book is a compilation from the pages of the *English Mechanic*, and consists chiefly of descriptions of mechanical devices and tools, more or less known to practical workers in the various trades.

ANNUAL REPORT OF THE BOARD OF REGENTS OF THE SMITHSONIAN INSTITUTION, FOR THE YEAR 1874. Washington, D.C.: Government Printing Office.

This annual is too well known to need description here. It is a compendium of scientific progress during the year, and worthily represents the abors of our national scientific institution.

A GRAPHIC METHOD FOR SOLVING CERTAIN ALGEBRAIC PROBLEMS. By George L. Vose, Professor of Civil Engineering in Bowdoin College, etc. Price 50 cents.

WATER AND WATER SUPPLY. By W. H. Corfield, M.A., M.D., Professor of Hygiene at University College, London. Price 50 cents. New York city: D. Van Nostrand, 23 Murray and 27 Warren streets.

These handy and useful volumes are Nos. 16 and 17 of Mr. Van Nostrand's compendious "Science Series."

BROWNE'S PHONOGRAPHIC MONTHLY, a Journal devoted to the Interests of Phonography and Phonographers. $2 a year. New York city: D. D. Scott-Browne, 737 Broadway.

This periodical contains much useful information as to the science of phonography, and some interesting news relating to the profession.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]
From October 2 to October 7, 1875, inclusive.

AIR GUN DART, ETC.—H. M. Quackenbush, Herkimer, N. Y.
BATTERY GUN.—J. P. Taylor, Elizabethton, Tenn.
FIREPROOF SAFE, ETC.—W. A. Shepard, New York city.
GELATIN PRINTING, ETC.—E. Edwards, Boston, Mass.
LUBRICATING OIL, ETC.—C. H. Green, New York city.
NAIL MACHINE.—W. Wickersham, Boston, Mass.
PRESERVING FRUIT, ETC.—A. J. Reynolds, Chicago, Ill.
RAISING WRECKS, ETC.—J. T. Parlour (of Brooklyn, N. Y.), London, Eng.
STOPPING BOTTLES.—E. A. O'Brien, New York city.
VALVE.—T. Shaw, Philadelphia, Pa.

Recent American and Foreign Patents.

NEW WOODWORK AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED CROSSCUT SAW HANDLE.

Lewis Shepard, Mace, Ind., assignor to himself and D. W. Kennedy, of same place.—A stiffening back piece is attached at the end of the saw, it being grooved to fit on the back of the same, and retained by two rods, that are arranged at opposite sides of the saw blade, so as to lock with the hook ends into the recesses of the saw teeth. The main handle is made of curved shape, and fastened to the blade in the usual manner. When the saw is worked by two men, a second curved handle is applied to the opposite end of the saw blade. The stiffening back piece carries on an extension of the foremost rod a second handle, which enables the operator to steady the saw, put his full strength on the same, and work the same in a quick and effective manner.

IMPROVED DRAFT EQUALIZER.

James M. Buckner, Salem, Neb.—This is an improved three-horse evener, consisting of a long lever on the side for the two horses, and a short lever on the side for the one horse, all pivoted to the tongue, and coupled together by connecting the short arm of the short lever to the long arm of the long one in such manner that the one horse has the necessary leverage to counterbalance the two horses. This is a compact arrangement, well adapted for use on harvesters, for which it is more especially designed.

IMPROVED ROOFING COMPOUND.

James A. Craig, Philadelphia, Pa.—This inventor calls attention to the resistance to atmospheric influence peculiar to soapstone, which substance, after reducing it to a granulated form, he mixes with hot pitch, to form a durable and tight roofing compound.

NEW AGRICULTURAL INVENTIONS.

IMPROVED CORN PLANTER.

Albert Hodgson, Humboldt, Kan.—The seed slides are the novel portions of this device. Between said slides are formed two dropping holes, which are adjustable as to size. Near these are projections, which, as either hole passes beneath seed, guides the latter into the aperture, so that the latter are always filled. There is a cut-off in the lower portion of the seed hopper, suitably constructed with reference to the slides.

IMPROVED BUTTER WORKER.

Patrick Rooney, Fairfield, Vt.—This consists of a tray suitably supported on legs. There is a frame, the lower bar of which travels in guide bars, under the central part of the table, and the upper cross pieces of which carry a smaller frame, which enters the tray. With the main frame is connected a spring treadle, so that the former, while being oscillated, may be moved up and down, thus causing the small auxiliary frame to act upon the butter.

IMPROVED FLOUR SACK PACKER.

Charles M. Fuller and Robert M. Parkerson, Batavia, N. Y.—This nvention consists of a tube having movable plates on which the flour rests. When these plates are raised, the flour flows into the sack until arrested by the replacing of the plates when the sack is full. Devices suitably arranged then press and pack down the flour, and the platform on which the filled sack stands is lowered so that a new bag can be set in position. The apparatus is of novel and ingenious construction, and doubtless will prove of much utility to millers.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED EYEGLASS.

James T. L. Anderson, Brooklyn, E. D., N. Y.—The novel feature in these eyeglasses is a movable nose clamp which is pivoted to each frame. Instead of resting against the sides of the nose transversely, it may be turned to fit into the angle between nose and brow, thus accommodating itself to the form of the nose.

IMPROVED AUTOMATIC TELEGRAPH KEYS.

Lucien S. Crandall, New York city.—Two new and ingenious telegraphic improvements of the above description have been devised by Mr. Crandall. The first consists of a series of pivoted spring keys or finger levers, marked with the different letters of the alphabet. These levers come, by cams of varying shapes, in contact with projecting arms of a shaft, that operates, by a spring pawl, a ratchet wheel. The latter closes the circuit by the contact of the teeth with a metal tongue connected to one pole, while the key shaft and ratchets are connected to the other pole. As every cam is shaped in suitable manner by steps and extensions, so that the Morse character of the letter of its key is produced, words may be telegraphed mechanically by simply depressing the required keys. By some practice a very rapid and reliable mode of transmitting messages is produced, as each key, when depressed, produces the exact corresponding Morse character on the sounder, one shaft, ratchet wheel, and tongue serving for all the keys jointly.

The second invention also consists of a series of spring keys or finger levers, representing the letters of the alphabet, which move on being depressed. A series of wheels are divided along their circumference into insulated and non-insulated portions, so as to close or break the circuit by the contact with spring tongues or riders connected to one pole, while the wheels are connected to the other pole of the battery. The insulated and non-insulated portions of each wheel are so proportioned that the Morse character of the letter of its key is produced at each depression of the same, and the subdivision of the circumference and of the ratchet wheel is accurately constructed, so as to repeat the same letter regularly and uniformly by the exact contact of the tongue or rider. Thus the mechanical transmission of words and messages can be accomplished in rapid and reliable manner.

IMPROVED BALE TIE.

William H. Walker, Charleston, S. C.—One end of the hoop is first permanently secured in a slot in a plate. Then the other end is brought around the bale and is turned under and over two bent arms of said plate. The hoop can thus be easily detached or fastened, admitting of the device being repeatedly used.

IMPROVED REGISTER.

Frederic J. Hoyt and William H. Hoyt, Batavia, N. Y.—This is a seal for the protection of freight cars on railroads, to prevent them from being tampered with; and it consists of a combination of numbers (or letters), which numbers may be changed without destroying the seal. It also consists in bolts, dog, ratchet wheel and shaft, with the necessary changeable ring disks and apparatus. A movement of the ring takes place at each opening of the car door, which changes the number of the seal. From this it will be seen that a simple means is offered of determining when and where the door was opened, and further, that the seal is not broken or otherwise injured, as is the case with several other devices for a like purpose.

UNITING THE SOLES AND UPPERS OF BOOTS AND SHOES.

George V. Sheffield, New York, assignor to himself and Martin Bennett, Brooklyn, N. Y.—This inventor has devised a new way of uniting the soles and uppers of boots and shoes. A doubled wire is passed through both parts to be joined. Then a thread is passed through the loop of the wire on the under side of the sole, and drawn through the leather by means of said wire. This quadruples the thread in the hole, making a very strong fastening.

IMPROVED CIRCUIT CLOSERS FOR RAILROAD SIGNALS.

Lloyd B. Dennis, Sandusky, Ohio.—This is an improved circuit-breaking device that produces, by the passage of the train, the registering of the position of the same at any desired station, so that the track is within full control, and the danger of railway accidents reduced. A rod which rises beside the track is pressed down by the wheels of the train. This moves a lever, which enters between and separates two pivoted wire-carrying spring clamps. The electric current through the latter is thus interrupted, and the sounders at the stations worked.

IMPROVED COMBINED TRAVELING BAG AND CHAIR.

Celine Laumonier, New York city.—This is a folding chair with which several bags are conveniently combined. When the chair is closed up, a satchel, which is locked by suitable devices, encloses it. The whole forms a simple and convenient means for carrying a chair, well adapted for travelers.

IMPROVED HAIR CRIMPING PIN.

Maria Gardner, New York city.—The number of hair pins which are destroyed by being used for hair-crimping purposes, though probably never computed, must be something enormous, since the majority of ladies who wear their hair in that becoming fashion usually bend and break several each time that the hair is twisted. Mrs. Gardner's invention will doubtless prove economical, therefore, as well as convenient. It is a pin of the usual U shape, having several holes in its arms through which, after the hair is wound around them, a small straight pin is inserted and fastened in place by a key.

IMPROVED SKID FOR OIL BARRELS.

David M. Haight, Oswego, Ill.—The object of this invention is to enable carbon oil, naphtha, benzine, and other oils to be retailed directly from the cask in which they are received without waste from the drip or leakage. The oil-cask skid is provided with a sheet metal lining or pan, and a sheet metal facing upon the concaved and inclined upper edges of its end pieces.

IMPROVED SAFETY POCKET.

Joseph Colton, New Orleans, La.—This pocket is made of stout cloth or leather, into which small chains are mingled in a kind of network. The mouth is protected by semicircular bars, to which the fabric is riveted, said bars being fastened, when required, by a novel catch. The pocket may be conveniently attached to the garment, and probably would baffle the skill of the pickpocket.

IMPROVED POCKET BOOK FASTENER.

Louis Prahar, New York city.—This is a simple and yet secure form of spring latch which may be easily attached to the pocket book. The latter has a ball-shaped end, which enters a socket in the fastening plate.

IMPROVED METHOD OF MAKING MAIL BAGS.

Henry Stephens, Brooklyn, E. D., N. Y.—This is an improved method of attaching a shield to the lower portion of the bag, to protect the stitches of the seam by which the bottom is sewed on from wear. The invention will doubtless add considerably to the lasting qualities of the bags.

IMPROVED DEAD CART.

Thomas F. White, New York city.—In order to cart dead animals through the streets without exposing people to offensive odors, this inventor proposes a box provided with doors at each end, said doors being arranged with packing, so that when they are shut the box is hermetically sealed.

IMPROVED PROCESS OF TREATING OLEAGINOUS SEEDS.

Alfred B. Lawther, Chicago, Ill.—The object of the invention is to improve the process of working flaxseed, linseed, and other oil seeds in such a manner that a greater yield of oil is obtained at a considerable saving of time and power in the running of the crushing, mixing, and pressing machines, while also a cake of superior texture is produced. The process consists mainly in conveying the oil seeds through a vertical supply tube and feeding roller to powerful revolving rollers, at such degree of pressure that each seed is individually acted upon, and the oil cells fully crushed and disintegrated. They are then passed directly, without the use of muller stones, to the mixing machine, to be stirred, moistened, and heated by the admission of small jets of water or steam to the mass, and then transferred to the presses.

NEW HOUSEHOLD ARTICLES.

IMPROVED SMOKED BEEF SHAVER.

Caleb R. Turner, Brooklyn, N. Y.—This invention consists of a slicing knife, swinging forward and backward at the end of a trough holding the beef, so as to make a shear cut. The knife is suspended from a pivot above the trough, on which it can be swung up out of the way of the trough, to be sharpened without being detached. The knife frame carries a cam, which feeds the meat up to the knife. A pawl mechanism is contrived to vary the feed, making thick or thin slices, and a pusher is so engaged with the feed screw that it can be shifted along the screw quickly to adjust it to the meat.

IMPROVED KEY HOLE GUARD FOR LOCKS.

Henry Cochems, Easton, Pa.—This is a door lock that may be securely locked from the inside or outside, so as not to be opened by the introduction of skeleton keys or other instruments. The invention consists, mainly, of a sliding guard block that is thrown into position to close the key holes by a fulcrumed elbow lever, and a sliding and spring-acted knob spindle and plate. The spindle is prevented from releasing the guard block by a safety locking plate set by a small key from the outside. The knob, latch, bolt, and guard block are separately locked by additional safety stops to secure them. Some such device as this is now needed on the doors of hotel rooms, and of state rooms on steamers.

IMPROVED WINDOW SCAFFOLD.

Heinrich Kruger, Jr., New York city.—This is an improved folding window scaffold that may be readily secured outside of the window. It is available for use as a step ladder, and capable of folding up into narrow compass for storage after use. The idea is to give the servant, who cleans the exterior of the panes, a safer and better seat than the window ledge. The principal point of novelty is the insertion in the bracket which secures the supporting pieces in the window.

IMPROVED BASE FOR REVOLVING CHAIRS.

William T. Doremus, New York city.—This inventor has already patented a large number of new and ingenious devices relative to the improved construction of furniture. In the present arrangement, we have still another, which consists of a strong and simple chair base, which can be easily taken apart or put together. The legs radiate about a central pivot or screw socket, to the flanges of which they are connected by suitable ring plates and bolts.

IMPROVED COMBINED KNOB LATCH AND LOCK.

James F. Cooper, Syracuse, Ohio.—In this lock the key bolt is fastened by the latch bolt and tumbler, while the entire withdrawal of the latch bolt is prevented by the said tumbler. The door, or article to which the lock is applied, is thus doubly secured.

NEW MECHANICAL AND ENGINEERING INVENTIONS

IMPROVED HYDRANT.

Christian F. Rapp, Cincinnati, Ohio.—This invention consists of a hydrant connected, by three-way cocks, with the supply pipe and two separate exit pipes, of which one is provided with a pump to to force out the water remaining in the supply and other pipes. In the warm season the pump-connecting pipe may be closed by the governing rod, so that it is thrown out of operation. The hydrant is, by this anti-freezing arrangement, protected against any interruption of its operation, and the frequent digging and repairing of damage. If the predictions of those who foretel a coming winter as severely cold as the winter of last year are verified, there will be a great necessity for inventions of this kind.

IMPROVED DIKING ATTACHMENT FOR DREDGERS.

George Washington Parsons, Salisbury, Md.—This invention consists of an inclined hopper and chute, supported on vibrating cross pieces placed on suitable framework of lighters. Vertically adjustable screw bolts allow the raising or lowering of the chute, while water supply pipes and spurt holes of the hopper produce the flow of the dredged mass, in connection with a proper inclination of the chute. The new features are the devices which allow of the oscillation of the chute on the settling of the lighter when the material is dumped from the dipper, and also the arrangement of water pipes in the hopper.

IMPROVED MACHINE FOR ROUNDING LEATHER.

James Lewis, Prattsville, N. Y.—The object of this invention is to round leather for making traces, round belting, etc. The material is inserted in a proper groove, a frame is turned down upon it and closed and locked. A crank is then operated, carrying the leather through between the rollers, and bringing it to an exact and uniform round, leaving its surface smooth and unrubbed.

IMPROVED ICE-BREAKING VESSEL.

Erich Jacob Weedermann, Copenhagen, Denmark.—This inventor proposes to build steamboats provided at each end with sharp, strong, and powerful prows. The prow is not placed immediately under and in line with the stern post, but at some distance back of the same, leaving a bow portion with sharp inclined keel in front. This produces the same inclined position of the vessel when propelled against the ice as if weighted by a water reservoir, being raised above the same, so that the ice is cut and broken by the weight of the vessel.

IMPROVED MILLSTONE STAFF.

James See, St. Louis, Mo.—This is simply an iron hoop provided with four adjustable surfacing points, arranged to support the traversing level when marking high places on the surface of the burr. The device enables the bed stone and runner to be readily staffed for being dressed.

IMPROVED CRANE.

Jesse M. Caswell and Addison R. Worth, De Soto, Wis.—This is an ingenious and strong form of crane, easily constructed and having all its parts arranged in the same vertical plane, so that when not in use it can be turned against the side of the building near which it may stand, so as to be out of the way.

IMPROVED EXTENSION LADDER.

William T. Core, Norfolk, Va.—In this ladder, the pulleys around which the cords for raising the sections pass are mounted on the rounds, and are kept in position and strengthened by parallel bars, the ends of which are connected with the rounds above and below the said pulley rounds, thus distributing the strain, and preventing the pulley rounds from being broken.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

Notes & Queries

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(1) C. C. says: I am making a boiler of tin, 15 inches long and 5 inches in diameter. What pressure will it stand per inch? A. The safe pressure is about 25 lbs. per square inch.

(2) A. A. H. says: I have a spring of water which I have brought to a barn through ¾ inch lead pipe. I wish to let the trough fill to within 3 inches of the top, and then to carry the water down a fall of 5 feet. Last winter I had trouble with air filling in the pipe running from the trough to the yard. How can I arrange it so as to have no trouble with the air or the frost? A. To prevent the accumulation of air, lay the pipe with a continuous fall, free from abrupt bends; and cover it well to prevent freezing.

(3) J. B. P. says: I have a hand and foot sawing machine in which the power is taken from balance wheel to saw arbor by means of gear. I wish to get more speed, and propose using a 36 inch balance wheel and a 3 inch pulley on saw arbor to be driven by friction. Is it practicable to drive a 3 inch pulley by a 36 inch one? A. It will probably be best to use a V-shaped gearing, of cast iron.

(4) W. E. W. asks: A substance accumulates in my boiler. It mainly floats on the top of the water, causing inconvenience at the gage cocks. The water used is from an artesian well 118 feet deep. But little sediment or scale is formed. After blowing off and cleaning out the boiler, I have lately been using tallow, putting a few pounds into the boiler; and until I did so this substance never was troublesome. Lately it comes over with the steam; and in the vicinity of even small leaks, the iron of the engines, steam pipes, etc., is covered with a white coat of this impalpable powder. What will precipitate it (magnesia?) before it enters the boiler? A. Stop using tallow or any lubricant in the boiler, and let us know the result.

(5) A. F. E. asks: What are vernier callipers? A. We shall shortly publish an illustrated description of these instruments.

(6) J. H. asks: What is the best method of gumming postage stamps? A. Make a clear white solution of gum arabic, and add a little powdered sugar. The sugar prevents the paper from curling up when dry.

(7) M. T. asks: How can I clean a white ostrich feather? A. Put 1 oz. Castile soap in 1 pint water. Wash the feather in this, and rinse in pure water.

(8) L. S. asks: What is the best method of reducing buffalo skins to a uniform thickness? A. This is best done by perching them, that is, scraping them on the flesh side with a semi circular knife.

(9) A. S. asks: How are purple, red, and violet inks made? A. For purple, use a strong decoction of logwood, to which a little alum or chloride of tin has been added. For red, take Brazil wood 1 oz., white vinegar 1 pint; macerate for 4 or 5 days; boil down to one half; add roche alum 4½ ozs., gum arabic 5 ozs.; bottle for use. For violet, proceed as for purple, but make the ink thinner.

(10) J. I. R. and many others ask: How can I make an æolian harp, to be strung with fine violin strings? A. Make a box of very thin cedar, pine, or other soft wood, 5 or 6 inches deep, 7 or 8 inches wide, and of a length just equal to the width of the window in which it is to be placed. Across the top, near each end, glue a strip of wood half an inch high and a quarter of an inch thick, for bridges. Into the ends of the box insert wooden pins, like those of a violin, to wind the strings around; put two pins in each end. Make a round hole in the middle of the top, and string the box with small catgut or first (E) fiddle strings. Fastening one end of each string to a metallic pin in one end of the box, and carrying it over the bridges, wind it around the tuning pin in the opposite end of the box. The ends of the box should be increased in thickness where the wooden pins enter, by a piece of wood glued upon the inside. Tune the strings in unison, and place the box in the window. It is better to have four strings as described, but a harp with a single string produces an exceedingly sweet melody, of tones which vary with the force of the wind.

(11) H. C. S. asks: Are any scales formed on the inside of a boiler above the water line? A. Generally, no.

Will hard rubber, either red or black, soften under a pressure of 200 lbs. to the square inch on the inside of the boiler? A. We think so.

(12) G. T. S. asks: To whom is due the credit of the revolving or repeating fire arm? A. It was first practically introduced by Colonel Samuel Scott, his first patent being dated in 1835. There is, however, in the Tower of London, a matchlock gun, used four centuries ago, having a revolving breech made on a principle somewhat similar to that employed in the Colt's revolver. There is a pistol similarly constructed at Warwick Castle, England.

(13) H. B. asks: Which of the two link motions, Stephenson's or Gooch's, was invented first? A. The two were invented at almost the same time. What is commonly known as the Stephenson link was applied by the inventor, Mr. Howe, in 1843.

(14) C. C. says: My steam gage indicates 5 lbs. when everything is cold. I called the attention of my employer to it, but without success. Is it safe to continue the use of it in its present condition? A. It should be tested immediately.

I have a dog that is pestered with fleas. What will exterminate them? A. Carbolic soap.

(15) A. L. C. asks: Please give me a process for galvanizing small wrought iron rods. A. Clean the iron, cover it with a solution of sal ammoniac and hydrochlorate of zinc, and dip it into molten zinc.

(16) J. F. asks: What have I to learn in order to pass an examination as railroad or steamboat engineer? A. You must be able to answer questions about the construction, management, and repairs of engines and boilers, and must present evidence of your former experience with steam machinery.

(17) S. C. asks: How many tuns of hay are contained in a stack whose circumference is 67 feet and hight 205 feet, a tun measuring 512 cubic feet? A. About 143.

(18) J. H. C. asks: On what principle does the air railroad brake work? A. Under each car there is a cylinder with piston. The latter is connected with the levers of the brakes. Pipes lead from the cylinder to an air chamber on the locomotive. The chamber is charged with air at a high pressure by means of a small steam air pump on the locomotive. To operate the brakes, the engineer opens a cock by which the compressed air is allowed to act on the brake pistons under the cars, thus instantly working all the brakes at once.

(19) E. asks: Is there any particle of a car wheel in a moving train perfectly still? It is said by some that that atom of matter directly under the center of the wheel, touching the rail, is perfectly still for an infinitely short space of time; that if such was not the case, the wheel would slide on the rail. It is said to have been discussed at a meeting of railroad engineers and decided affirmatively; but I cannot believe it without the SCIENTIFIC AMERICAN decides that such is the case, and even then I am afraid that I cannot understand it. A. The answer to this question depends upon what is meant by "perfectly still." The facts of the case are as follows: If the car wheel is revolving at a uniform rate, every point in the circumference is moving at the same rate of speed in a circle; but each point in the circumference is moving away from a fixed station, say a post by the side of the track, at a different rate of speed; and any point in the circumference, when it touches the rail, is at rest momentarily, with respect to the fixed station.

(20) J. B. asks: Will an overshot water wheel, 20 feet in diameter and 3 feet wide, run a 50 inch circular saw, with proper gearing? A. Yes, if there is plenty of water.

(21) B. F. F. asks: What quantity of water will be forced through a pipe 1 inch in diameter, under a pressure of 62 lbs. per inch? A. Mr. R. H. Buel gives the following formulas, which give average results: L=length of pipe in feet. D=diameter of pipe in feet. A=area of pipe in square feet. V=velocity of water, in feet per second. H=head of water, in feet, to give the required velocity. h=theoretical head required for same velocity. F=head, in feet, required to overcome friction. P=pressure per square inch equivalent to a given head. Q=number of cubic feet of water delivered by pipe per second. $H=\frac{0\cdot00025\times L\times V^2}{D}$ $h=\frac{V^2}{64\cdot4}$. $F=H-h$. $P=H\times0\cdot433$. $H=P\times2\cdot308$. $V=\frac{Q}{A}$.

(22) C. M. B. asks: How can I cement a hair bracelet into a gold clasp? A. Melt together equal parts of clear resin and pure gum rubber. Apply hot.

(23) M. F. asks: What are gold pens pointed with? A. Gold pens are now almost universally tipped with the native ore of the metals iridium and osmium. Diamonds and rubies were formerly employed for this purpose.

(24) Q. Q. Q. asks: What preparation, when written with on blue paper, produces a white mark by discharging the color from the paper? A. Use a dilute solution of oxalic acid in water.

(25) W. B. H. says: You speak of water conducted through galvanized iron pipe tending to dangerous results. I have a reservoir holding 50 gallons, made of galvanized iron. The water comes in lead pipe into the bottom of the reservoir, and discharges through lead pipe near the top, leaving the reservoir to stand nearly full of soft water. Is this water injurious? If so, what paint or other substance can I apply to the inner surface, that will prevent the poisonous effect of the zinc, without injury to the water? A. The question as to whether the water is rendered unwholesome by its passage through the pipes and reservoir depends upon the character of the water itself. Waters containing a small quantity of certain mineral substances in solution are not affected by these metals, while, on the contrary, but a small quantity of other mineral salts may have a very deleterious action upon the quality of the water when in contact with the same metals. You should have a chemical examination made of your water.

(26) W. H. H. M. and others, who ask as to the qualities of certain waters: We are not able to give you decisive answers without first having given the waters a chemical examination.

(27) G. W. W. says: Please tell me how to prepare lime for the oxyhydrogen light. A. Select a piece of good, thoroughly and newly burnt lime, as free from sand as possible; and by means of a saw and knife, cut out a piece about 2 inches long and ¾ inch in diameter. Trim this down to the form of a cylinder, and it is ready for use. These limes, when not in use, should be kept in small, dry, airtight bottles.

(28) C. H. asks: What substance is used on the cushions of hard rubber plate frictional electric machines? It is a powder very much like coarse gold bronze. A. Take zinc and grain tin, each 1 oz.; melt in an iron ladle, and add mercury (hot) 8 ozs.; stir with an iron rod, pour into a well chalked wooden box, and agitate until cold; or stir till cold, and then powder. Keep in a well corked glass bottle.

(29) K. L. asks: 1. What is the best and most convenient article for covering steam pipes, running to radiators for heating public or private buildings? A. Felt bound in canvas. 2. When laid in a box under ground, what is the best filling? A. Plaster of Paris. 3. Would you paint the pipes with coal tar before covering or filling? A. Give them a coat of red lead paint. 4. Is coal tar a conductor of heat? A. Yes.

(30) J. C. B. asks: At what season of the year is it best to trim trees and bushes, and why? A. Timber trees are usually felled in the winter, when the trunks and bark are free from sap. Fruit trees are trimmed in the spring, that the vigor of the tree may be expended in the fruit instead of on the growth of the tree.

(31) M. W. asks: How is the metal calcium obtained? A. By igniting the iodide of calcium with an equivalent quantity of sodium in an iron crucible, having its lid screwed down.

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

E. D. E.—Both specimens consist, chemically speaking, of silex and silicates of lime, alumina, and iron, with some carbonate of lime and iron. They are valuable only for polishing purposes.—D. H.—Your box, which came to hand some time before your letter, contained (if we remember rightly) particles of decomposed mica.—J. F. B.—It is iron pyrites imbedded in talcose schist. No further results are given by analysis.—B. F. B.—No. 1 contains a very minute percentage of silver. It is galena. No. 2, no silver detected.—C. H.—One is a piece of water-worn coral. The other is part of a tibia of some animal.—E. C. M.—We will require the root of the unknown plant, with the leaves, stem, and blossom, before we can classify it.—D. W. S.—It is sulphuret of iron.—D. K.—No. 1 does not contain nickel. No. 2 does not contain silver.—F. A. W.—It has a very slight trace of tin.—H. N. L.—It is not gold.—D. M. S.—They are very nice specimens of sulphuret of lead or galena.—R. H. C.—It is mica in quartz.—A box of specimens forwarded by S. D. M. contained many pieces of bituminous coal, marked with the curious disks referred to in the SCIENTIFIC AMERICAN of June 12. In opposition to the explanation there given, S. D. M. says: "While the material forming the coal was in a semi-fluid state, the bitumen in part composing it contained an oil of some kind not chemically mixed with it, which, when the enormous pressure took place on the stratum forming the coal, attempted to escape, and, finding space to spread, did so in the very slight openings left by the cool crystals. These, becoming dry as it were, formed those pellicles or films, which in turn protected the spots from being oxidized by the atmosphere or water with which the then forming coal was surrounded." The author of this theory has of course considered the probability of the existence of so peculiar an oil, and of its forming when squeezed into cracks. He has also considered the fact that these structural peculiarities exist in many different varieties of coal, anthracite included. Mineral impurities are apt to accumulate along planes of cleavage or structure. We have no experimental data to prove the justness of the theory heretofore given in this particular instance. The specimens of specular and pot ore are fine. The kaolin is much colored by yellow hydrated oxide of iron. The pinkish gray stone is an inferior variety of asbestos.

COMMUNICATIONS RECEIVED.

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

On a Cheap Telescope. By W. K.
On the Origin of Man. By H. M. S.
On a Magic Square. By A.
On Exterminating Grasshoppers. By J. P.
On Veneered Diamonds. By J. W. M.
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On a New Explosive Agent. By M. O. N.
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On Coal. By S. F. V. F.
On the Persecution of Galileo. By C. J. W.
On Preventing Colds. By G. F.
On Weather Predictions. By M. O'R.

Also inquiries and answers from the following:
H.—W. A. K.—A. H. R.—O. W. M.—R. B. R.—H. P.—A. W. P.—G. R. B.—A. A. R.—W. T. S.—H. C. P.—W. F. H.—R. E. P.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells giant powder, vulcan powder, etc.? Who sells acetometers? Who sells draining machines? Who sells bicycles? Who makes wire fencing? Who sells fittings for model boats? Whose is the best process for drying timber? Who makes chains of malleable cast iron? Who sells small steam engines? Who sells twine-making machinery? Who sells the best boiler and steam pipe covering?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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Plow, gang, D. Kendig ... 168,646
Plow, sulky, S. F. Woodworth ... 168,595
Power, transmitting, J. W. Woodruff ... 168,701
Press and former, brick, A. J. Haws ... 168,743
Press, cotton, B. F. Platt ... 168,668
Press for baling cotton, etc., C. B. Churchill ... 168,557
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Pump, plunger, Hartley and Marshall ... 168,640
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Regulator, pressure, J. Taylor ... 168,807
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Roof, iron, M. A. Shepard ... 168,587
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Saws, dressing circular, W. Potter ... 168,580
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Screw thread cutters, making, T. T. Nash ... 168,577
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Sewing machine, L. Lyon ... 168,757
Sewing machine bobbins, filling, G. Gowing ... 168,634
Sewing machine gatherer, A. Everess (r) ... 6,690
Sewing machine hemmer, W. L. Kotzum ... 168,753
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Sewing machine treadle, W. B. Higgins ... 168,565
Shade fixture, Brooks & Morell ... 168,713
Shoemaker's knife, A. C. Wetherbee ... 168,818
Shutter bower and fastener, Fellows & Finnegan ... 168,563
Spindle bolster, W. Jenckes ... 168,641
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Square, slotted framing, J. H. McInnes ... 168,656
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Stone, artificial, P. B. Doty ... 168,559
Stone, artificial, Lemon & Metcalf ... 168,651
Stove attachment, cooking, T. R. Timby ... 168,809
Stove door knob, M. W. Gardner ... 168,736
Stove leg, W. Tanner ... 168,586
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Street sweeper, O. W. Kellogg ... 168,569
Sugar, splitting hard, Dinkel & Elmenhorst ... 168,728
Temple teeth, setting, N. Chapman ... 168,719
Tobacco-cutting machine, A. A. Hagen ... 168,636
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Trap, animal, W. A. Shigley ... 168,792
Trunk fastening, R. Hilton ... 168,566
Trunk fastening, J. F. Simpson ... 168,677
Tubes, sealing ends of iron, D. C. Stillson ... 168,588
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Tyre tightener, W. H. Swarthout ... 168,806
Umbrella, cane, W. E. Engelhardt ... 168,628
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Vehicles, elevator for, R. R. Robert ... 168,784
Vehicles, running gear for, C. M. Murch ... 168,768
Violin, H. W. White ... 168,820
Violin, guitar, etc., J. Oehrlein ... 168,665
Wagon, dumping, J. Bond ... 168,555
Wagon jack, B. W. Stanton ... 168,798
Wagon wheel scraper, N. Sage ... 168,675
Washer cutter, E. Brulé ... 168,607
Washing machine, G. W. Gilbert ... 168,735
Watch, E. J. Pacaud ... 168,774
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Watch compensation balance, A. H. Potter ... 168,581
Watch escapement, A. H. Potter ... 168,582
Water closet, W. S. Carr ... 168,613
Water wheel, J. L. Helmer ... 168,641
Wells, apparatus for walling, Beach & Marshall ... 168,707
Wind wheel, horizontal, F. Burt ... 168,608
Windmill, J. M. May ... 168,574
Wire sign and banner, Upham, Garrett, & Tully ... 168,687
Wood splitter, W. Latus ... 168,649
Wringer, H. A. Buck ... 168,716
Wringer, T. J. Dickerson ... 168,727

DESIGNS PATENTED.

8,706.—LANTERN.—C. Herter, New York city.
8,707.—NEWELL LIGHT.—C. Herter, New York city.
8,708.—BOTTLES.—G. Jaques, Boston, Mass.
8,709.—COFFIN HANDLE TIPS.—G. Rogers, West Meriden, Conn.
8,710.—BUTT HINGES.—E. J. Steele, Westville, Conn.
8,711.—LATCH HANDLES.—E. J. Steele, Westville, Conn.
8,712.—DRAWER PULLS.—E. J. Steele, Westville, Conn.
8,713.—FOUNTAIN.—W. Tweeddale, Brooklyn, N. Y.
8,714.—TYPES.—J. M. Connor, Greenville, N. J.
8,715.—SHIRT BOSOM.—C. H. Horsfall, New York city.
8,716.—INKSTANDS.—C. M. Jenckes, New York city.
8,717.—MONUMENTS.—W. T. Price, Circleville, Ohio.

SCHEDULE OF PATENT FEES.

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On application for Design (14 years)	$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,

October 5 to 20, 1875.

5,258.—J. Shirreff, Chatham, N. B. Freezing and refrigerating machine. Oct. 5, 1875.
5,259.—J. S. Rogers, Gloucester, Mass., U. S. Process of manufacturing gelatin. Oct. 5, 1875.
5,260.—D. Hawkesworth, Digby, N. S. Spark arrester. Oct. 5, 1875.
5,261.—D. Steele, Hamilton City, Ont. Apparatus for extinguishing fires. Oct. 5, 1875.
5,262.—P. Wood, Uxbridge, Ont. Shaft coupling for cutters. Oct. 5, 1875.
5,263.—I. Hahn, Pittsburgh, Pa., U. S. Hydraulic crane. Oct. 5, 1875.
5,264.—A. Betties, Warrensburgh, Miss., U. S. Heating stone. Oct. 5, 1875.
5,265.—T. Kane, Hamilton City, Ont. Coal ash sifter. Oct. 11, 1875.
5,266.—T. X. Bellefeuille *et al.*, Trois Rivières, P. Q. Horse power. Oct. 11, 1875.
5,267.—E. Pitch *et al.*, New Liverpool, P. Q. Paper match box machines. Oct. 11, 1875.
5,268.—C. Z. Mattison *et al.*, St. Louis, Mo., U. S. Spinning machine. Oct. 11, 1875.
5,269.—E. Balkema *et al.*, La Fayette, Ind., U. S. Wagon axle. Oct. 11, 1875.
5,270.—G. Mescom, Beverley, Mass., U. S. Catamenial sack. Oct. 11, 1875.
5,271.—A. E. Barthel, Detroit, Mich., U. S., *et al.* Machine for making peat. Oct. 11, 1875.
5,272.—C. L. Fisher, Spring, Pa., U. S. Side spring vehicle. Oct. 20, 1875.
5,273.—A. Worster, Groveton, N. H., U. S. Locking latch. Oct. 20, 1875.
5,274.—W. F. Neal, Liberty, Me., U. S. Horse hay rake. Oct. 20, 1875.
5,275.—A. Cornell, Bosanquet, Ont. Quilting frame. Oct. 20, 1875.
5,276.—G. B. Thurber, Upton Station, P. Q. Oscillating steam engine. Oct. 20, 1875.
5,277.—T. Harriman, Thorold, Ont. Tumbling rod and joint covering. Oct. 20, 1875.

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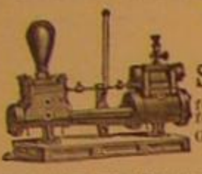

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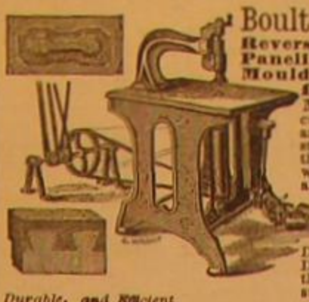

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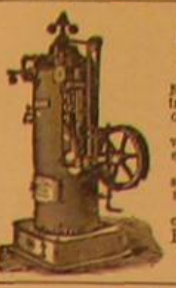

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