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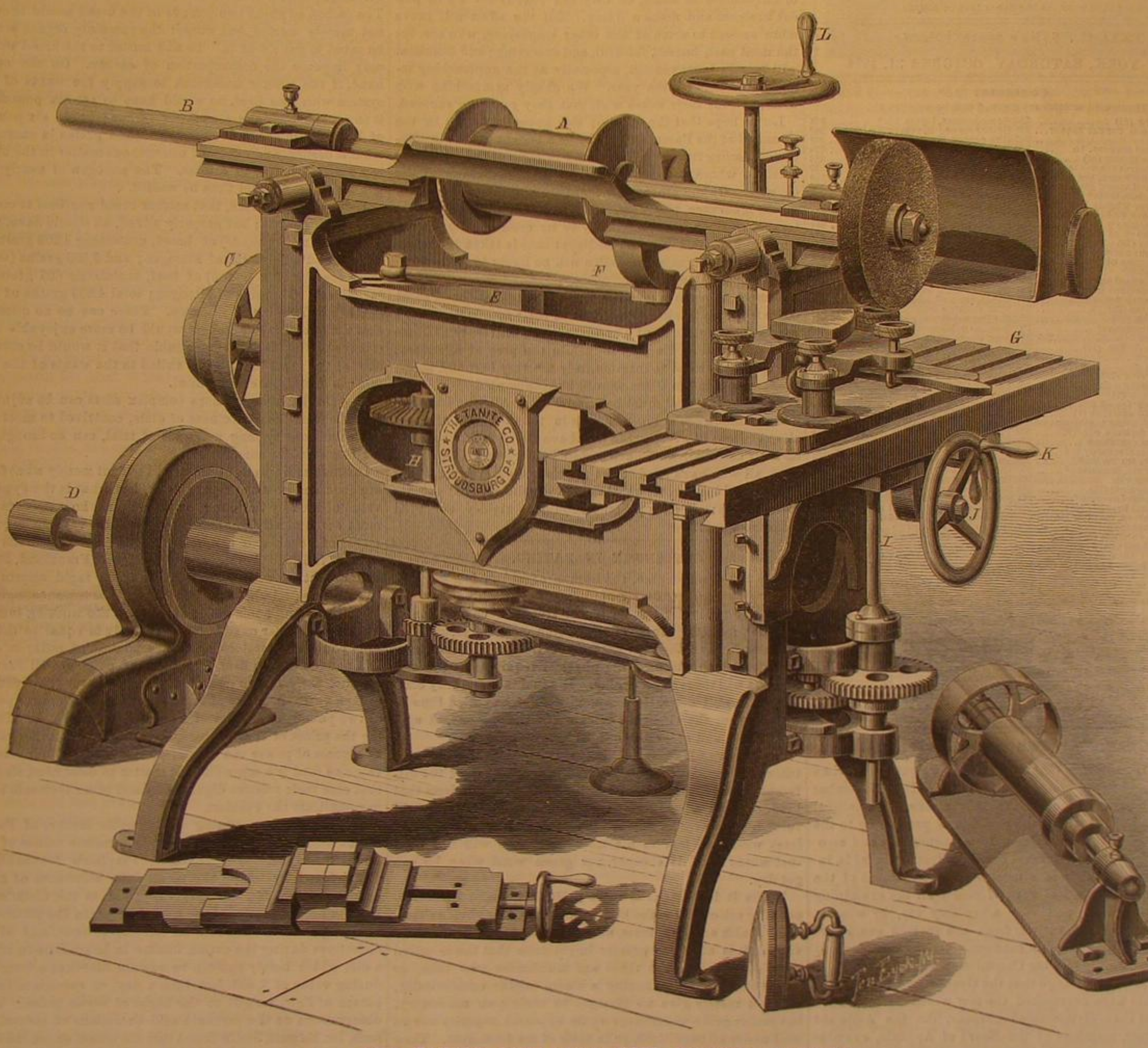

THE TANITE COMPANY'S NEW MILLING MACHINE.

THE TANITE COMPANY'S NEW MILLING MACHINE.

The Tanite Company, of Stroudsburg, Pa., have now on exhibition at the Fair of the American Institute in this city, and at the Franklin Institute, Philadelphia, a new machine, in which an emery wheel is used, for the first time, for surfacing files and sad irons, finishing anvils, nuts, gibs, keys, slide valves, straps, slides, crossheads, and in short, for accomplishing the majority of work now surfaced on the ordinary planer, milling machine, or shaper. It will be remembered that the emery wheel made by the above-named corporation is of the solid type, and a brief review of the advantages claimed for it may appropriately precede the mechanical description of the large and fine engraving, herewith presented, of the machine above referred to.

The solid emery wheel performs the office of a rotary file, the cutting edges of which never grow dull: in other words, it retains its efficiency as a cutting tool until literally worn out. It is hard, and cannot be broken by a fall or blow; it travels uniformly and steadily at a high speed, the latter exceeding, with safety, that of the grindstone, while the emery cuts faster and lasts longer than the sand. Being composed of an artificial mixture, its grit is more even than that of the natural substance; and the waste of material and time lost in making changes is said to be less than is the case with the wooden wheel. Finally, the solid wheels are successfully used for putting the cutting edges on tools of all descriptions, and they may be produced of any shape, fitted for any special work.

The size and clearness of our illustration will enable the forming of an excellent idea of the details of the machine. The driving belt acts upon the pulley, A, secured to shaft, B. The latter at its left hand extremity carries another belt, leading to a counter shaft attached to the floor (represented detached, and lying on the right of the machine), whence a third belt returns to the pulleys, C, and a fourth to the blower shaft, D. Through suitable mechanism, the pulleys, C, actuate the slotted crosshead, E, the revolution of which communicates, by the rod, F, reciprocating motion to the main shaft, B, and thus imparts to the emery wheel, represented on the right hand extremity of said shaft, a transverse movement across the sad iron, which is shown secured in the chuck on the table, G. In addition to performing this labor, the gearing, immediately driven by pulleys, C, also rotates the vertical shaft, H, which in turn transmits power to the cones on its right. These again (through the medium of a belt, other cones, and further suitable interposing mechanism) revolve a vertical rod, I, the lower end of which is fitted with a globe joint. Its upper extremity carries a pinion, which, by means of the handle, at J, may be thrown into action with one or the other of two racks under the table, G, so that the latter, by manipulating the handle as required, may be caused to travel automatically to and fro under the emery wheel, and over such distances as may be necessitated by the dimensions of the work. The hand wheel, at K, allows of similar movement to be imparted to the table by hand, in circumstances where the automatic motion is not desired.

The mode of operation consists in adjusting the work in the chuck to the proper elevation and starting the machine. The surface of the sad iron, for example, is thus carried under the wheel, and at the same time the latter is drawn across it; and this continues until the motion of the table transports the object out of the action of the grinder. The workman then gives the handwheel, shown at L, a part of a turn, thereby moving a fine screw which passes through an arm on the table, thus slightly elevating the latter, so as to give new surface for the tool to take upon. The handle, J, being shifted, the work travels back under the wheel, and so the operation is repeated as often as is desired, or else a new article is substituted after one passage under the emery. To avoid injury to tools and workmen, a small suction blower, with the necessary pipes and an enlarged receptacle in rear of the wheel, is provided, and so arranged as to draw away all dust, while at the same time to be easily removed for setting the work. For keys and similar small articles, a different chuck (see sample in the foreground of the engraving) is needed.

The machine, it is claimed, allows of using the wheel to its full capacity, while protecting the same against uneven wearing, thus rendering the employment of the diamond tool unnecessary. The cut made is much deeper than has hitherto been considered possible to accomplish by the emery grinder. The manufacturers also claim that in those articles in which first quality iron is used, on account of its being more easily worked, the use of their wheel will soon save enough valuable metal to pay for a machine. From a careful examination of the apparatus, these advantages appear to us to be well substantiated.

These machines are manufactured only by the Tanite Company, who may be addressed as above.

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A PANIC AT THE PATENT OFFICE.

General Leggett, the Commissioner of Patents, some time ago announced his resignation, to take effect November 1, 1874; whereupon some of the lady clerks, with natural feminine impulse, made it the occasion of presenting to the General a testimonial of esteem from themselves and associate employees. The General has been instrumental in introducing female labor in almost every department of the Patent Office; the clerical work of nearly all the examining officers is now done, and very acceptably too, by women. The ladies procured donations from the various examiners and assistants, with which a handsome tea set was obtained and presented to the retiring Commissioner.

It is not perhaps strange that the General and his corps of ladies should have overlooked the law which forbids such doings; but that disinterested persons, like the Assistant Commissioner, members of the Board of Appeals, examiners-in chief, and other legal minds connected with the office, should have been so unobservant seems remarkable. The provision of the statute is very stringent, and is as follows:

"Be it enacted, etc.: That no officer or clerk in the United States Government employ shall at any time solicit contributions of other officials or employees in the Government service for a gift or present to those in a superior official position, nor shall any such officials or clerical superiors receive any gift or present offered or presented to them as the contribution of those in the Government employ receiving a less salary than themselves; nor shall any officer or clerk make any donation as a gift or present to any official superior. Any officer or clerk violating any of the provisions of this bill shall be summarily discharged from the Government employ."

We believe it is not pretended that this statute is unconstitutional, or that for any reason it is to be treated as a dead letter. In refusing, summarily, to discharge the Commissioner of Patents and all the subscribers to this tea party, both the Secretary of the Interior and, through him, the President of the United States, are open to the charge of neglecting their plain duty.

A considerable time has elapsed since the knowledge of the above transgression of the law was made known, but the officers of the government have not as yet dismissed one of the offenders.

It is rumored that they are all to be discharged, and then all immediately reappointed. But this would amount practically to a nullification of the statute. The evident intention of the law was to place the seal of public condemnation upon all such transactions, and wholly to remove from the public service those who should be guilty of them.

In no other way can the observance of law be promoted. To dismiss and then reappoint would be to trifle openly with the law, a course which would assuredly meet with public condemnation.

There is but one way for the President to deal with this matter, and that is promptly to discharge all the parties involved from the public service, as the law specifies. To dismiss them in a body would be disadvantageous to the public service, and therefore unwise; but it should be done as rapidly as possible. He should begin with the most prominent offenders first. General Leggett, the Commissioner, should be at once dismissed, and a new commissioner appointed. Mr. Thacher's removal should follow, and so on, down, until the law has been entirely vindicated.

The removal of the Commissioner, the Assistant Commissioner, and some of the examiners would be of little personal inconvenience to them, as they can readily set up in patent business and make a living. But the affair will prove more serious to some of the other employees, who are, for the most part, honest, faithful, and deserving; and dismissal will be very inconvenient, especially at the approaching inclement season of the year. We deeply sympathize with them, and for their sakes wish that they could be excused.

Let us hope that the effect of this general change in the *personnel* of the Patent Office will be a benefit to that institution. Among its officers are many intelligent and valuable persons, whose departure will be a disadvantage to the country. On the other hand there are a number of officials whose ignorance, tardiness, and illiberality towards inventors make their removal greatly to be desired. By an entirely new organization, if intelligent care is taken in the selection of individuals, the Office will be likely to be benefited rather than damaged.

Competent persons who desire employment at the Patent Office may, we think, properly file in their applications. We assume that nothing but a special act of Congress can relieve from dismissal or properly re-instate the present offenders; and if any are to be re-instated, only the very best and ablest of those now in the Office should be reappointed.

The poor material must be eliminated. All who have exhibited indolence or sluggishness in the discharge of duty, all examiners of every grade who have failed to act promptly on their cases, all who have suffered their work to get behind, all who have tried to set up their dictum against the most liberal interpretation of the laws in the grant of patents to inventors: all such persons should be rigidly excluded from the service.

ECONOMY IN EATING.

Like the steam engine, the human organism is a machine for the development and application of power. Like the steam engine, it derives its power from the combustion of organic products. But, unlike the iron mechanism, man has other ends than the performance of work, and there is no one food which will meet his physical requirements, as coal or wood will those of an engine. His fuel is necessarily complex, and, still more, its complexity must be varied time to time to meet the changing demands of the seasons, of age, occupation, and other life conditions.

In choosing his source of mechanical power, the engineer takes into account the relative cost and efficiency of the different sorts of fuel to be had in his locality, and selects that kind, or such a combination of two or more kinds, as will furnish the power he needs at the smallest cost, and with the least wear and tear to his machinery. He will not burn coal where wood is cheaper, nor green wood when he can get dry.

While it is immensely more difficult to make the corresponding selection for the human machine, it is obvious that, since health and happiness, as well as working force, are involved, it is of vastly greater importance that the selection be wisely made. Yet there are multitudes who take, or would take, pride in running a steam engine economically, who not merely give no thought to their own machinery, but rather pride themselves on its apparent capacity to run well under all conditions, or in spite of maltreatment. They "can eat anything"; and so long as their food is savory and they can get their fill, they do not care what its elementary composition may be, or how much unnecessary labor it puts upon their digestive and alimentary organs to dispose of it. Mention economy in eating to them, and they straightway call to mind the pint of beans or pound of oatmeal that ignorant theorists have proclaimed as sufficient for their daily needs, and more or less politely decline to eat by rule. Others, to whom the cost of supplying food for a numerous family is a matter of serious moment, are ignorantly proud of setting as good a table as their neighbors, unconscious that their neighbors have as vague an appreciation of what is "good", under the circumstances, as they themselves have, and that the money they misspend would more than suffice to provide an abundance of food, at once better suited to their needs, more enjoyable, and, in many cases, much more wholesome.

The fact is that the much misused word "economy" is never more severely warped from its true meaning—judicious management—than in its application to domestic matters. To be economical in one's diet is commonly thought to imply the use of cheap food in preference to the costly, to restrict one's self to one dish when appetite would suggest a dozen, to eat vegetables rather than meat: in short, the reduction of the amount, the quality, and the cost of food to the minimum. On the contrary, true economy in eating requires us to select and combine the greatest variety of food so as to furnish the maximum growth or power most enjoyably, with the least waste of substance and the least tax upon the system, in assimilating what is useful and rejecting what is useless. To do this wisely, we need to know not only what the system requires under the varying conditions of life, but also the chemical constitution of different foods, their dynamic power, and how to combine them so as to develop their highest utility with the smallest functional expenditure. For example, a laboring man requires daily, to sustain his bodily temperature under ordinary conditions, to enable the vital processes of respiration, digestion, and the rest to go on well, and to meet the demands of muscular effort, an amount of power equivalent to about 4,000 foot tuns, or enough to raise a man of average weight about eleven miles, vertically. To maintain these conditions, it is found by experiment that a daily diet furnishing about 300 grains of nitrogen and 4,800 grains of carbon is required.

To obtain these 300 grains of nitrogen from bread, the laborer would have to eat rather more than four pounds, containing nearly twice as much carbon as would be needed. The carbon of about two pounds of the bread would thus be not merely wasted, but worse: the excretory organs would be taxed to get rid of it. To add butter to the bread would only increase the disproportion of carbon. On the other hand, if the laborer undertook to supply the wants of his system with lean beef, he would have to eat six pounds of it to get the requisite amount of carbon; but in six pounds of beef the nitrogen is over a thousand grains in excess of what is needed, and excess of nitrogenous matter in the blood is a fruitful source of disease. The nitrogen of nearly five pounds of beef would thus be wasted.

It appears, therefore, that neither bread nor beef is economical eating alone; but properly mixed, we should have, say: 14,000 grains (2 pounds) of bread, containing 4,200 grains of carbon and 140 grains of nitrogen; and 5,500 grains (about three fourths of a pound) of beef, containing 605 grains of carbon and 165 grains of nitrogen; total 4,805 grains of carbon and 305 grains of nitrogen. There can be no question that a diet of bread and beef would be more enjoyable than either singly. It is demonstrable that it would be cheaper and, at the same time, better suited to the wants of the system: in short, more economical.

In a similar manner, more complex diets can be adjusted, and the scientific correctness of diets, contrived to meet special conditions by long processes of trial, can be brought to mathematical demonstration.

In time our works on dietetics will tell not merely what foods are good and how to prepare them, but what is the dynamic value of each by the ounce or pound, and how they may be most economically combined to meet the varying requirements of youth and age, and the different conditions and callings in life. The researches of Payen, Frankland, Pavy, and a host of others have lately made rapid approaches toward this desirable state of things. For instance, a glance at one of Frankland's tables shows that the working force of a pound of butter oxydized in the body is equal to that of nine pounds of potatoes, or twelve pounds of milk, or over five pounds of lean beef. A pound of oatmeal will furnish as much force as two pounds of bread, or over three pounds of lean veal. A pound of lump sugar has the dynamic power of two pounds of ham or eight pounds of cabbage. Knowing the prices of these substances, their comparative values as sources of power can be easily calculated. Their relative value as food is a more difficult matter to determine, since in that case their relative digestibility and other elements enter to complicate the problem.

An extremely interesting and valuable feature of Pavy's recent work is the calculation of the dynamic values of different dietaries. For instance, Playfair's "subsistence diet," found by taking the mean daily allowance of nitrogenous matter, fat, and carbo-hydrates in the dietaries of London needlewomen, of the convalescents in the Edinburgh Infirmary, of the inmates of several prisons, and of the operatives during the cotton famine in Lancashire in 1862—a diet which barely suffices to sustain life—has a force producing value of 2,453 foot tuns a day, or enough to raise a person of light weight to the hight of seven miles. From observations on the carbonic acid excretions of several persons, Dr. Edward Smith found that the power expended daily in maintaining the body's heat is, on the average, enough to raise the body six miles. Professor Haughton calculated the power required to perform the necessary vital functions of respiration, digestion, and the rest, to be, speaking generally, enough to raise the body to the hight of one mile. The seven mile power of the "subsistence diet" would therefore be used up without work or active exercise.

The average diet of adults in full health and with moderate exercise was calculated from the dietaries of the English, French, Prussian, and Austrian soldiery during times of peace. Its dynamic value is 4,021 foot tuns. The average of the dietaries of European and American soldiers during the great wars of recent years gave the diet assigned to active laborers. Its force value is 4,458 foot tuns. The diet of hardworking laborers, determined from the actual amounts of food consumed by railway navvies, hardworked weavers, blacksmiths, and others, is equivalent to 4,849 foot tuns. A similar calculation for the diet of a body of Royal Engineers, actively engaged, gives the high dynamic value of 5,532 foot tuns, or enough each day to lift the eaters over fourteen miles vertically. In food value, this full diet compares with the subsistence diet above mentioned (salts omitted) as follows:

	Subsistence Diet	Royal Engineers' Diet
Nitrogenous matter (dry)	2·33 ozs.	5·08 ozs.
Fat	0·84 "	2·91 "
Carbo-hydrates	11·69 "	22·22 "
Total	14·86 ozs.	Total 30·21 ozs.

With these it may be well to contrast the standard diet of Moleschott, which is generally accepted as a fair representation of a model diet, that is, one containing the requisite combination of alimentary principles for the daily support of an ordinary working man of average hight and weight. It is as follows:

Albuminous matter	4·587 ozs.
Fatty matter	2·964 "
Carbo-hydrate	14·250 "
Salts	1·058 "
Total	22·859 ozs.

Thus about 23 ounces of dry solid matter, one fifth nitrogenous, may be taken as sufficient for the daily needs of an average adult workman. Ordinary food contains about 50 per cent of water, which would swell this amount of dry matter to 46 ounces of solid food. To complete the diet, we must allow from fifty to eighty ounces of water in addition, daily.

Of course, the varying requirements of youth and age, hot weather and cold, indoor and outdoor occupation, individual idiosyncracy, taste, and a thousand other conditions combine to vary the proportion of the several elements needed in any case; nevertheless, all such average determinations are helps toward the developed science of dietetics, which the coming years will see.

DEMONIACAL POSSESSIONS.

The devil dies hard, and the fifteenth century lingers in other quarters than Italy and Spain.

In the middle ages the unfortunate victim of morbid or insane impulses was looked upon as the sport of demons. The history of medicine records the successive steps of progress in knowledge by which this delusion was dispelled, and the true cause of these maladies was found to be organic derangement or vicious education.

A man of kindly disposition suddenly manifests an irresistible desire to kill somebody. He may say that his grandmother's ghost or the spirit of George Washington has ordered him to shed blood; but intelligent people know better. They do not assume, as of old, that some evil spirit has caught his soul abroad and has slipped in and taken possession of the vacant body for diabolical purposes. They say that something is wrong in his physical organization, a tumor on the brain, may be, and treat him accordingly. When he dies, the surgeon's knife will lay bare the cause of the difficulty, which had been slowly developing, perhaps for years before the crisis came. Does any one wonder why, at this late day, we soberly set down what every civilized child is supposed to know? or soberly discuss a theory that died with witchcraft? Simply to spring upon the intelligent reader the surprising fact that belief in witchcraft and the theory of demoniacal possessions is not dead, here, in this land of common schools and newspapers: not among the illiterate, but among newspaper readers: worse, among the editors of newspapers which profess to lead the advance of civilization.

How does this sound for the nineteenth century? We quote from a family paper bearing date October 8, 1874:

"A favorite scoff against religion has been founded on the instances, recorded in the gospels, of persons who were possessed with demons. Perhaps two items of news published recently may throw some light on the demoniacal possessions on which infidels have long exercised their wits." The paper goes on to describe the case of the Pomeroy boy of Boston, and that of a girl in this city who felt a strong desire to burn an infant she was nursing, but fortunately confessed the desire before attempting its execution; then it continues: "These are two of the latest startling items of news. Do they not look as if the devil had more power over human nature than he is ordinarily credited with? In view of them, can we say that demoniacal possessions are impossible?" This is from the *Christian Observer*, and is quoted approvingly by another *Observer*, which puts *New York* as part of its title, but is presumed to be Christian all the same.

We do not know the circumstances of the last mentioned case, nor the history of the girl whose homicidal desire was kept from being carried out. Cases of the kind, however, are not uncommon, and not unaccountable, without the devil's assistance. As regards the Pomeroy boy, there was never a clearer case of moral warping by vicious influences, systematically brought to bear on the child *in utero* as well as in infancy. Had the mother's desire been to breed a monster of bloodthirstiness, her course could not have been more surely adapted to accomplish that end. And the mother's morbid pleasure at the sight of blood was not only inherited but cultivated by the child, who was a butcher by instinct, taking up his father's trade almost as soon as he could walk. Yet we are gravely told that this boy's horrid desire to see how a child would die was due to his momentary possession by the devil!

This is worse than the experience of a medical friend, who, calling the other day to learn the effect of a prescription for a sick child, was greeted by the mother with the triumphant exclamation. "I don't think baby will have convulsions any more!" "Ah!" said the doctor; "why not?" "*I've burned his shirt!*" The lady is the wife of a wealthy merchant and a member of polite society. Very likely she reads the *Observer*: possibly both of the papers of that name.

REPORTS ON SMALL ENGINES.

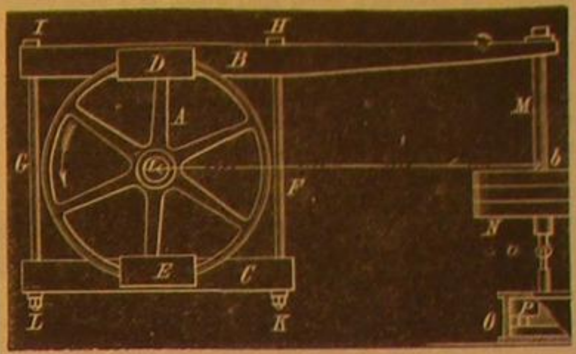
We have been much gratified, of late, by the receipt of letters giving particulars of small engines and boilers. Data of this kind are extremely valuable, showing the results of actual practice, and we hope to receive many more letters of the same kind. These accounts would be more interesting and useful, however, if they contained fuller details of the performance; and we propose to give some account of the manner of making a test. The apparatus needed is quite simple, and can be readily constructed by the young mechanic. The following embrace the principal points that are generally of interest in regard to engines and boilers: Diameter of cylinder, length of stroke, diameters of piston rod, connecting rod, crank pin, valve stem, fly wheel, and shaft; lengths of connecting rod and crank pin, weights of whole engine and of fly wheel, size of ports, stroke of valve, point at which steam is cut off, number of revolutions per minute, clearance at each end of cylinder, pressure of steam in boiler, dimensions and weight of boiler, diameters of steam pipe and safety valve, number of pounds of water evaporated, fuel burned per hour, and power of the engine. Many of these data are obtained at once, by direct measurement or weight. The diameter of the cylinder should be measured when it is at the temperature at which it is ordinarily maintained while running. The point of cut off can generally be ascertained by removing the cover of the valve chest, and observing the point at which the steam valve closes when the engine is moved by hand. This should be done when the parts are heated. The clearance at each end of the cylinder includes not only the space between the piston and cylinder head at the end of the stroke, but also the volume of the ports. A simple and accurate manner of measuring the clearance is to fill the cylinder with water, when the piston is at one end of the stroke, and then measure the water carefully in a cylindrical or rectangular vessel. The difference between the volume of the water and the volume of piston displacement (area of piston multiplied by length of stroke) will be the clearance. In measuring the piston displacement at the front end of the cylinder, the volume of the piston rod (area of section of rod multiplied by length of stroke) must, of course, be deducted.

The number of revolutions of the engine per minute can be determined approximately by observation; but errors are apt to result, especially in the case of small engines moving at a high rate of speed. Small shaft counters can be obtained at a very reasonable price, and measurements made with them are far more likely to be accurate.

Many small boilers are not provided with steam gages, so that the pressure of the steam cannot be observed directly; but all such boilers have, or should have, safety valves, and the pressure of the steam can be determined from them. Secure the valve stem of the safety valve to the lever, with wire or string, and attach a loop to the lever, into which pass the hook of an accurate spring balance, arranging the loop so that it is directly over the center of the valve stem. Then take hold of the upper part of the spring balance, and lift the valve slightly, noting the reading of the balance. Measure the lower diameter of the safety valve, and find its area; divide the reading of the spring balance by the area of the valve, and the result will be the pressure, in pounds per square inch, at which the steam will raise the safety valve. Suppose, for instance, that the diameter of the safety valve is 1 inch; its area will be about $\frac{7854}{10000}$ of an inch. Now, if the tension of the spring balance in raising the valve is 120 pounds, the pressure at which the valve will rise is the quotient arising from dividing 120 by $\frac{7854}{10000}$, or 153 pounds per square inch. It will be easy to make a table for any particular case, giving the pressure corresponding to each pound or fraction of a pound of tension in the balance; and by calculating in advance the reading of the balance for any given pressure, the weight can be adjusted on the lever until that tension is obtained, and the valve can thus be graduated to lift at any required pressure. It may be added that this simple method is applicable to any safety valve, and affords a ready means of testing the accuracy of the graduation; but at present we are treating of this method only with a view to explain how the steam pressure in the boiler may be ascertained at any time. Having determined the pressure at which the safety valve will rise when the boiler is cold, raise the valve by means of the balance, from time to time, when the engine is working, and observe the tension. Find the pressure corresponding to this tension, and subtract it from the pressure at which the valve will be raised by the steam. The difference is the pressure in the boiler at the time. For example, suppose that in the last case the tension of the balance, on raising the valve when the engine was working, was 50 pounds. The pressure corresponding to this will be 50 divided by $\frac{7854}{10000}$, or about 64 pounds, so that the pressure in the boiler at the time would be the difference between 153 and 64, or 89 pounds per square inch. By preparing a table showing the pressure in the boiler due to each pound of tension in the spring balance, the pressure at any time can be read off as soon as the indication of the balance is observed.

The amount of water evaporated per hour and the fuel burned can, of course, be readily determined by measurement, drawing the water from a tank of known dimensions, and observing its state at the commencement and close of a trial, being careful to leave the water in the boiler at the same hight at which it was at the commencement, and maintaining this hight as constant as possible during the experiment. In measuring the fuel consumed, it is best to draw out the fire at the commencement of the trial, rekindling it as soon as possible, and charging all the fuel used from that time, hauling and quenching the fire immediately at the close of the trial, and weighing back all fuel that is unconsumed. In the case of small boilers heated by lamps, a measurement of the oil used between the beginning and end of the trial will generally be sufficient; and if gas is employed as fuel, it will be necessary to attach a meter to the pipe, to determine the quantity consumed in any given time.

To ascertain the power of the engine, the most convenient method is, generally, to attach a friction brake, shown in the accompanying engraving, to the band wheel. Hollow out two pieces of wood, B and C, so that they will fit the circumference of the band wheel, A, and attach light plates of metal, D and E, to the sides, so that the pieces of wood cannot slip off when secured in position. Provide two belts, F, G, countersinking the heads, H and I, into the upper piece



of wood, so that they cannot turn, and put nuts and washers, K and L, on the other ends, so that the two pieces of wood can be clamped on the band wheel as tightly as is necessary. Make the upper piece of wood somewhat longer than the other, and pass a rod, M, through the end. On this rod weights, N, are to be placed, and the lower end of the rod is hooked to the piston rod of a small cylinder, O. The piston, P, fits loosely in this cylinder, which is filled with oil or water; and the piston has small holes in it, so that it can move up and down without much resistance, if moved slowly, but offers considerable resistance to sudden motion. The action of the apparatus will doubtless be apparent to our readers. By tightening the nuts on the bolts, F, G, there will be considerable friction between the band wheel and the pieces of wood. The rod, M, must then be loaded with sufficient weight, so that the engine can just move at its regular rate of speed, and keep the upper piece of wood in a horizontal position. The friction on the band wheel will cause it to become heated, unless some arrangements are made for cooling, either by keeping a stream of water running upon it, or immersing the lower part in a trough in which the water is constantly changed. The small cylinder, O, and piston, P, serve to counteract the effect of sudden shocks, which would otherwise throw the arm of the piece, B, from a horizontal position. Now it will be plain that, as the band wheel revolves (constantly maintaining the arm, with the weight attached, in a horizontal position), the effect is the same as if it were lifting this weight by means of a rope running over a windlass, and the distance through which it would lift the weight in a given time is the same as the weight would move if the whole apparatus were free to revolve. If, for example, the wheel makes 300 revolutions in a minute, the distance from the center of the wheel to the center of the weight is 1 foot, and the weight is 10 pounds; this weight, if free to revolve, would move in each revolution through the circumference of a circle whose radius is 1 foot, and in a minute would move 300 times as far, or about 1,885 feet. The work of the engine in a minute, then, will be that required to lift 10 pounds through a hight of 1,885 feet, or 18,850 foot pounds; and as one horse power is the work represented by 33,000 foot pounds per minute, the engine would be developing a little more than half a horse power.

In making experiments with the friction brake, the apparatus should be placed loosely on the band wheel; and before the weights are attached, a spring balance should be secured to the arm, at the center of the hole for the rod, M, and the reading noted when the arm is in a horizontal position. This reading must be added to the weights that are afterwards attached. The horizontal distance from the center of the wheel to the center of the rod, M, should be carefully measured. Then start the engine, with the throttle valve wide open, and screw up the nuts, K, L, gradually, adding weights at N. It will then only be necessary, when sufficient weights are added, to keep the wheel cool, and occasionally adjust the nuts, K, L, should the brake bind or become too loose from any cause. Should it be difficult or inconvenient to maintain the arm in a horizontal position, note carefully the position it assumes during the test; and for the radius to be used in the calculation, measure the distance, *a b*, from the center of the wheel to the center of the rod, M, in a direction perpendicular to the direction of the rod.

Instead of the weights, N, and cylinder, O, a spring balance may be attached to the end of the rod, M, and secured to some fixed support, its readings during the trial being used in place of the attached weights. In this case, also, the weight of the apparatus must be first determined, and added to the readings of the spring balance. The plan represented in the engraving is, however, the best.

We have thus described, in detail, the methods to be pursued in preparing a report of the performance of small engines and boilers. Although they are far from fulfilling all the requirements of a scientific test, they will give very accurate results if carefully conducted. Should any of our readers make the experiments referred to in this paper, we shall be glad to receive the results, with full particulars.

THE PHYLLOXERA.—R. J. writes to assure us that 1 pint slaked lime, mixed with half a peck horse manure, put round the roots of each vine, will ensure a speedy cure for the disease, protect the plant from frost, and give it a vigorous growth. This remedy, which has been tried and found successful, should be applied in the fall of the year. He offers us half the reward.

IMPROVED DRAFTSMAN'S RULE.

Professor C. W. Maccord, of the Stevens Institute of Technology, has recently published the following in the *American Artisan*:

In making mechanical drawings, it is often required to lay down a series of lines radiating from a single point, as, for instance, in drawing a bevel spur wheel, or a spur wheel whose teeth have radial flanks. This looks like a very simple thing to do with a common straight edge; but the necessity of adjusting the ruler with reference to two points, for every line, renders the task very irksome; and the same is true of drawing a series of lines tangent to a circle, as in the case of the teeth of a ratchet wheel.

These operations are facilitated by the use of the centrolinead, the common form of which consists merely of an arm carrying a needle point, to which the ruler may be clamped at any desired angle, so that the prolongation of its edge shall either pass through the needle point or be tangent to a circle of which the needle is the center. This is very simple and convenient, but it is open to the objections that lines cannot, by its aid, be drawn *through* the center, and that there is danger of defacing the drawing by wearing a hole in the paper; and it evidently gives no assistance in the division of the circle, which must be effected previously by independent means.

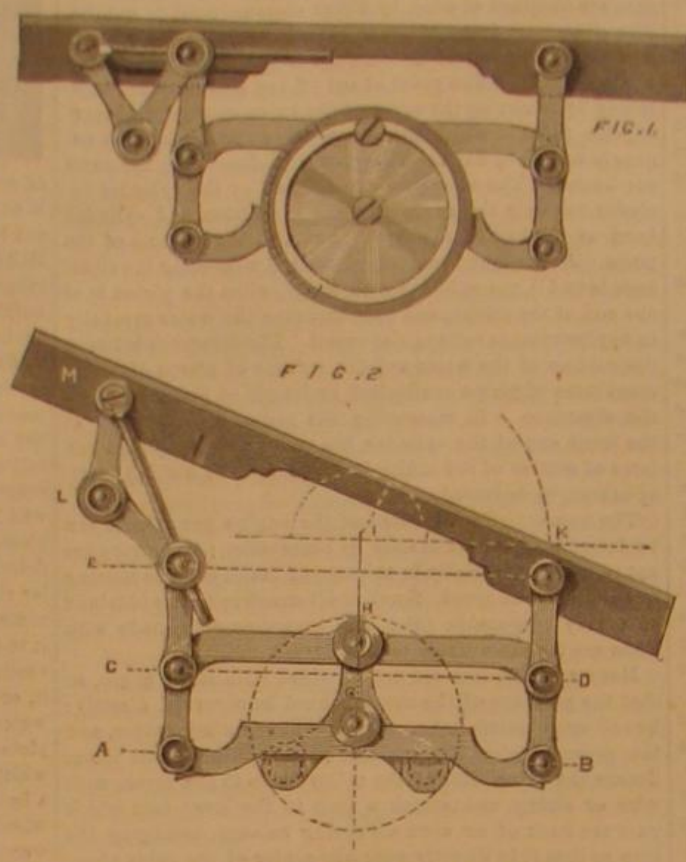
The instrument here shown, which may be called a protracting centrolinead, is designed to obviate the objections above named, and to add to the utility of the apparatus by enabling the user to divide the circle and draw diameters at the same time. This is effected by jointing the ruler, by transverse pieces, to two parallel bars, which, rotating about fixed centers, compel the ruler to move in a similar manner.

Fig. 1 shows the instrument complete, adjusted for drawing radial lines; Fig. 2 shows it as set for drawing tangents, and with the graduated disk removed. From the latter figure it will be seen that since E and F are the extremities of two similar and parallel transverse bars, the line E F will be always parallel to the center lines, A B, C D, of the parallel bars to which ACE, BDF are jointed; also that as these center lines can only turn about the centers, G, H, which are similarly situated with respect to them, the line EF, and consequently any rigid body pivoted to E and F, must rotate about a corresponding center, I. The ruler is pivoted directly to F; and if it be placed, as in Fig. 1, with its edge passing through I, the action as a centrolinead requires no further explanation.

In order to render the instrument capable of adjustment, E is pivoted to the triangle, ELM; this triangle is composed of the two bars, EL, LM, and a radius rod, E M, the latter sliding through a socket pivoted to E; M is pivoted to the ruler; and by means of binding screws at E and L, the triangle may be made rigid at pleasure. This, with the ruler, constitutes a rigid triangle, MEF, every part of which must, therefore, like EF, rotate round the center, I. Consequently, the edge of the ruler may be inclined to EF, or its parallel, I K, at any desired angle within limits; and when this is done, it must, in all positions, be tangent to a circle of which I is the center, as shown in Fig. 2.

The centers, G and H, are fixed in a three armed plate, seen below A B and CD; the under side of this plate is provided with elastic pads, by which adhesion is secured without defacing the paper with holes.

Above the bars, A B, C D, is a disk, held in place by the screws, G and H, which pass through short ferules supporting the disk; the screw, G, is in the center of this disk (which is indicated by the dotted circle in Fig. 2), and the bar, AB, has its upper edge passing through G, thus enabling the user to read with ease the angles measured by the divisions on the chamfered edge of the disk shown in Fig. 1. These divisions extend through only one third of the circumference, since the range of motion in the instrument, shown in Figs. 1 and 2, is limited to 60° in each direction from the position here given. This, however, is sufficient to make it a most convenient addition to the labor-saving devices at the draftsman's command, which, at best, are but few enough; since, besides enabling him to draw tangents at any required intervals, it is at once a centrolinead and a protractor, with the center of the circle always accessible—an important feature not possessed even by the separate instruments heretofore used for the purposes accomplished by the one which we here present for his consideration.



MACCORD'S PROTRACTING CENTROLINEAD.

Pre-Glacial Man in England.

The human remains found in Kent's Hole, in deposits attributed to pre-glacial times, have a rival in antiquity in the human bone discovered in Victoria Cave. The Committee of the British Association for assisting in the exploration of this cave describe minutely the condition under which the bone was found, and express the "inevitable conclusion" that man lived in Yorkshire with *elephas antiquus, rhinoceros tichornus, ursus priscus* and *spelæus*, hyæna, bison, and red deer long before the existence of the great ice sheet in Northern Britain and Ireland.

Local Remedy in Diphtheria.

Dr. James A. Hopkins, of Milton, Del., in *The Physician and Pharmacist*, says: Many have been the remedies used in the local treatment of diphtheria. Some have vaunted *argenti nitras*, in solid form. Others advise the preparations of potassa and its combinations. Carbolic acid has its votaries, as well as muriatic acid and the muriated tincture of iron; externally the oakum poultice has some reputation, and no doubt is of more importance than we are ready to admit. Terebinthine liniment, as well as kerosene oil, stands prominent in the list of external remedies.

But above and before all is the acid tannate of iron. This is a remedy not known to the pharmacopœia, yet it stands second to none among local remedies, and I believe is the only one that bears a shade of semblance to a remedy in this fearful disease, and thus far exceeds any that has become known to the professional world. It may be prepared by the addition of one ounce of the muriated tincture of iron to one of a strong solution of tannin, and applied by means of a brush to the diseased throat, or elsewhere, as the case may be; or, what I believe to be a better way, apply the muriated tincture of iron in full strength to the diseased part with a brush, wait a few moments, then apply the solution of tannin in the same way, thereby forming a union of the two at the point of disease, having at the same time the advantage of chemical action, if there be any. On examination a few hours after, you will see the line of demarcation distinctly drawn by the discoloration of the diseased tissue, showing exactly the extent of the disease, the very thing desired, with a tendency to reparation, which will go on rapidly if the system be properly treated with a nourishing diet and tonic and stimulating remedies.

A SIPHON FOR POISONOUS LIQUIDS AND ACIDS.

In starting the ordinary siphon, by sucking on the longer leg or on a tube attached thereto, it is almost impossible to avoid inhaling the vapors of the liquid, even if the liquid itself does not enter the mouth. A new form of siphon, invented by Professor Weinhold, avoids this difficulty, inasmuch as the suction is produced by blowing, somewhat on the principle of the Sprengel air pump.

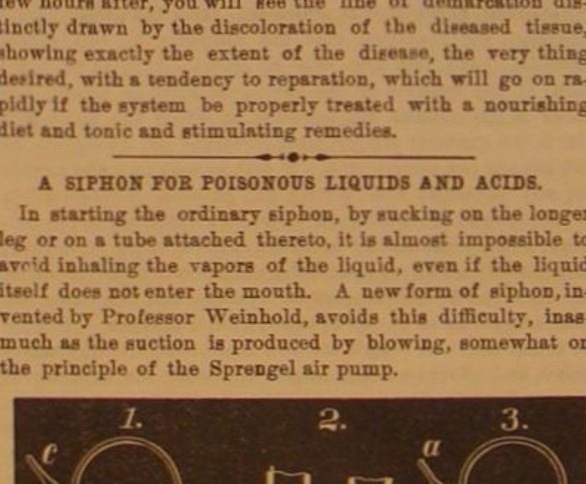


Fig. 1 represents a section of Weinhold's siphon on a reduced scale; Fig. 2 is a full sized drawing of the essential portion of the apparatus. By blowing strongly into *c*, the liquid will flow out of *b*, provided the pressure to be overcome is not more than 12 inches of water, and that the diameter of the siphon is not too great. It is very important that the dimensions be exactly right; the opening at *a* should be 1·5 millimeters (one sixteenth of an inch); the opening at *b*, as well as the diameter of all the tubes, should be 5 millimeters (one fifth of an inch), and the distance from *a* to *b* should be 25 millimeters (one inch).

The so-called French siphon has legs of equal length, turned up at the bottom to prevent its emptying itself when taken out of the liquid. This would probably be more used than it is, were it not so difficult to fill; besides, it gives a spirting or oblique stream. Both disadvantages may be avoided by giving it the form shown in Fig. 3. This siphon is started by closing the opening, *b*, and sucking on *a*, as in the old-fashioned poison siphon. The stream is, of course, delivered downward from *b*. The three pieces of tube at the lower end of the left leg are not arranged in one plane, as shown in the engraving, but in the form of a triangle, ⸫, so as to be as close together as possible. A French siphon must be lifted out of the liquid slowly and carefully, to prevent the liquid running out.

English Enamel for Cast Iron.

A brilliant white and very adhesive enamel is formed on cast iron articles in the following way: After heating them to a red heat in sand, and keeping them thus for half an hour, they are allowed to cool slowly, and are then carefully cleaned with hot dilute sulphuric or hydrochloric acid, rinsed with water and dried. A ground is then laid on by coating them with the following mixture, afterward drying them at a high temperature, and then heating them in separate muffles to vitrification of the coating: 6 parts of flint glass, 3 of borax, 1 of minium, 1 of oxide of zinc, mixed and finely pulverized, and heated for four hours up to a red heat, and finally rendered semi-fluid by increase of temperature; the mass is then quickly quenched in cold water, and one part of it is mixed with two parts of bone meal, and formed into a pap by triturating finely with sufficient water. Upon this ground the two following mixtures, prepared like the first, are then laid in succession, the first of 32 parts of calcined bones, 16 of kaolin, 14 of felspar, 4 of potash stirred up with water, dried, calcined, and suddenly cooled in water, and the powdered mass triturated with water to a fine paste with 16 parts of flint glass, 5½ of calcined bones, and 3 of calcined quartz; after this has been laid on and well dried, a second coating is laid on of 4 parts of felspar, 4 of pure sand, 4 of potash, 6 of borax, 1 of oxide of zinc, 1 of saltpeter, 1 of white arsenic, 1 of the best chalk; these ingredients are mixed, calcined, suddenly cooled in water, and triturated with 5½ parts of calcined bones, and 3 of quartz. The dried article is finally heated in a muffle, in a furnace similar to a porcelain furnace, when both coatings fuse and mix, thus forming the enamel.

More Fulgurites.

We recently published in the SCIENTIFIC AMERICAN the results of certain analyses, by Professor Albert R. Leeds, of a curious mineral which was forwarded to us from Fayetteville, N. C., and proved to be a "lightning tube," or "fulgurite."

A correspondent from Orange, Texas, Mr. W. D. Street, sends us fragments of two more fulgurites. While closely resembling the Fayetteville fulgurites, Professor Leeds states that they have some interesting points of difference. Like the former, one side is highly vitreous, curved into innumerable small, semi-globular forms, stained with bluish black streaks, and presenting, in its glassy and vesicular character, the appearance of complete fusion. The Orange fulgurite differs in being almost white, and very slightly stained with oxide of iron. The rugosities on their exterior or convex sides, where the sand was remote from the source of heat, are somewhat hidden by the greater mass of partly cemented, adherent white sand. The fragments are of two sizes, the thicker pieces, whose interior surfaces are stained black, coming from one lightning tube, and the thinner, unstained pieces coming from a second, located in the sand at a distance of six feet from the former. The tube-like character of these fulgurites has so strongly impressed our correspondent that he is surprised to find nothing visible coming through them. If other correspondents will forward specimens or information concerning these remarkable phenomena, we shall shortly be in a position to know more about them than has been known hitherto.

A New Theory of Electricity.

Professor Edlund, a Swedish physicist, expounds in a recent work a new theory of electricity, the substance of which is as follows: He supposes the existence of a highly subtile and elastic ether, everywhere present both *in vacuo* and in ponderable matter. Two molecules of this ether are mutually repelled along the line of their connection and in inverse ratio to the squares of the distances. In good conductors, the molecules are displaced easily from point to point, it being presumed that they can be moved with little force. If the body be a non-conductor, this mobility is arrested and depends on the molecules of the material body. A molecule is at rest from the moment when it is equally repelled on all sides. If the repulsion be less at one side than at the other, the body will move if it be free in the direction of the resulting forces.

An Ancient Chip.

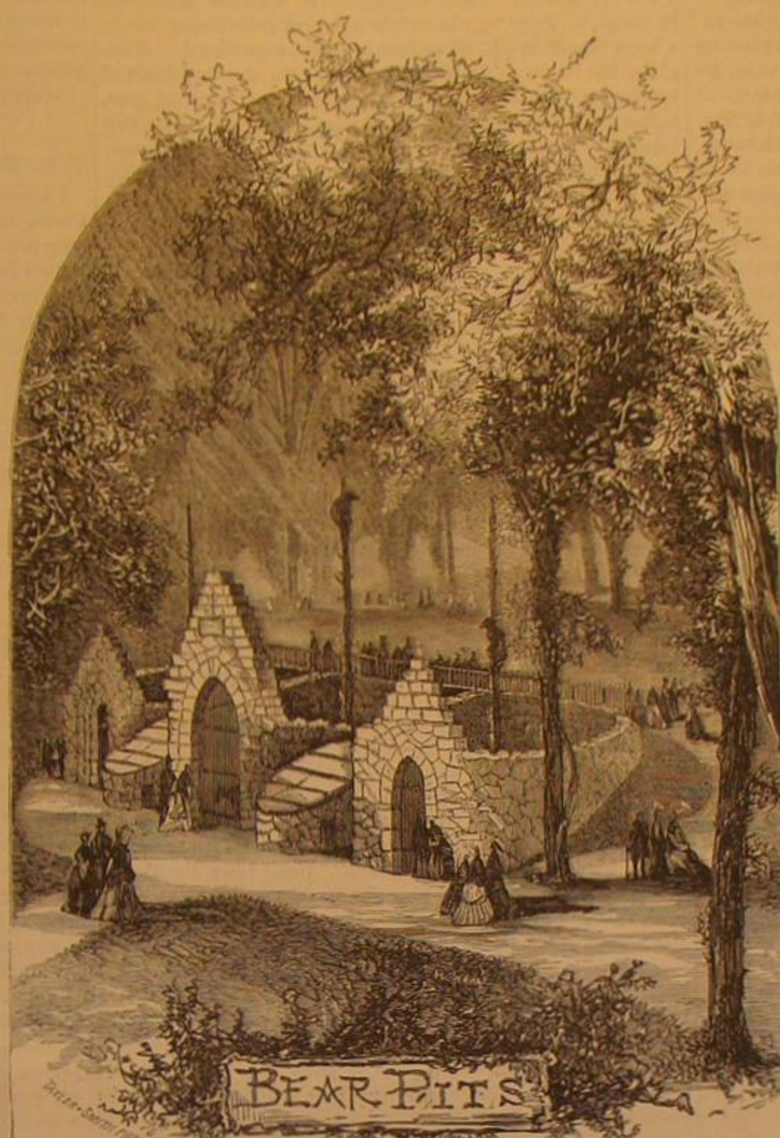
At the recent meeting of the British Association, Professor H. A. Nicholson exhibited and described a silicified chip of wood from the Rocky Mountains. At the Brighton meeting, the same specimen was shown, the opinion then being that its woodlike appearance was due to mineral structure, that it was in fact merely a specimen of the hornblendic mineral known as rockwood. Subsequent examination has shown conclusively that it is a genuine chip of wood, silicified. The age of the chip and the circumstances of its production were thought to present many points of interest, the accepted conclusion being that it is a prehistoric relic, produced by the stroke of a copper ax, such as the mound builders used to hammer out of native copper.

THE FAIRMOUNT PARK BEAR PITS.

The bears cooped up in the dirty and narrow cages, in the temporary quarters provided for the animals in our Central Park, have good cause to envy their brothers of the Philadelphia Zöological Society's collection. The unfortunate brutes in the first mentioned menagerie, are dependent upon public enterprize, and doubtless will die as they have lived, in their confined boxes, unless some unwonted celerity in our city officials results in the establishment of the proposed zöological grounds, at a much earlier date than now seems probable. The Philadelphia bears are, however, the happy property of a society of private individuals, who rapidly pushed forward their undertaking from its beginning, until, in July last, it assumed a nearly completed shape, and the public were admitted to examine a collection of animals, which, in course of time, it is hoped will rival that of the renowned Zöological Gardens of London.

Our illustration, extracted from the pages of the *Fancier's Journal*, published in Philadelphia, represents the bear pits in the grounds of the Philadelphia society; and between such commodious quarters as are here depicted and the ordinary menagerie cage, the difference need hardly be pointed out. The structure is strongly built of pointed stone work, iron, and cement floors; and in the center of each pit is erected a very strong cedar pole, on the summit of which the bears perch as if enjoying the view of the surrounding scenery.

The pit nearest the foreground of our engraving contains a fine grizzly, purchased in Omaha. Pit No. 2 serves as a dwelling for three brown, one black, and one cinnamon bears, all young and not yet full grown. A pair of black bears, male and female, inhabit the third pit. The entire building was planned with much skill by Mr. C. P. Chandler, and serves greatly to add to the comfort of the animals, as well as to maintain them in healthy condition. The beauty of the surroundings, as well as the artistic appearance of the structure itself, is well represented in the picture.



BEAR PITS IN THE PHILADELPHIA ZOOLOGICAL GARDENS.

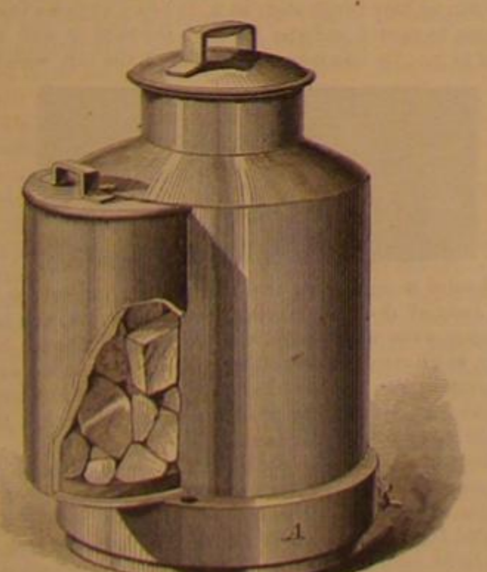
Quick Telegraphing.

Several instances of quick telegraphing have been brought under our notice of late, but the following shows the perfection to which the cable telegraph service has been brought. A message was sent from New York to London, and in thirty minutes, actual time, the answer was received in New York. Another dispatch was sent to London, to which a reply was received in thirty-five minutes, actual time. In neither of these instances was any special effort made to hurry the answers, but the party addressed sent the reply to the London office by the messenger delivering the original message.

To fully appreciate this wonderful achievement, we must consider that the distance from New York to the cable station at Heart's Content, N.F., is about 1,300 miles, that of the cable about 2,000 miles, and of the land lines and cable from Valentia to London about 300 more. Each message, therefore, was transmitted about 3,600 miles, and passed through the hands of eighteen persons, all told; consequently, the message and reply, in each case, passed through the hands of thirty-six persons and traveled over 7,000 miles in thirty to thirty-five minutes.—*The Telegraphic Journal.*

MILK COOLING CAN.

This is an ingenious device for cooling milk during transportation. The car is provided with an ice chamber, which



is suitably covered with non-conducting material, and the bottom of which is slightly inclined so as to keep the ice which is placed therein in contact with the main vessel. Recesses in this bottom conduct the water through a perforation to an annular receptacle, A, formed by soldering a sheet metal strip of suitable shape around the can. One end of this channel is closed so that the water is obliged to pass around the entire circumference to be drawn off by a faucet at a point opposite that of its entrance. In this manner the full cooling capacity of the ice water is utilized without increasing to any large degree the bulk or cost of the cans.

Patented through the Scientific American Patent Agency, June 23, 1874, by Mr. George W. Fluke, of Mount Pleasant, Henry county, Iowa.

Stuttering.

Stuttering frequently disappears for the time in whispering, and in speaking in an unnatural pitch of tone. These facts have been taken advantage of in the treatment of the affection, to inspire confidence in the patient that it is not impossible to conquer his defect; and the inspiration of this confidence is not without its effect in the success of a rational method of treatment.

In most instances the defect will be found, says Dr. J. S. Cohen, in the *Medical and Surgical Reporter*, to be in great part mental, and to consist chiefly in a want of consentaneous action of the involuntary muscles of respiration and the voluntary muscles of vocalization and of articulation. Here lies one of the chief indications of treatment: to secure a voluntary harmony of action between lungs, larynx, and mouth (including palate, tongue, jaw, and lips).

When a stutterer is carefully examined in the utterances of those sounds in the enunciation of which his deficiency exists, it will often be found that some portions of the organs concerned in speech are too active or too inactive proportionnately to the activity of the remaining organs; and this may exist in the chest, the larynx, the palate, the tongue, the jaw, or the lips. One or several of these organs may be in defective action simultaneously.

Irregular respiration is to be overcome by voluntary efforts at rhythmical respiration at the will of the teacher, being regulated by some movement which the patient may see and follow, or some sound which falls upon his ear at stated regular intervals. In similar manner, gymnastic exercises of the tongue, lips, jaw, and larynx are instituted, either with or without the enunciation of sounds, as the case may seem to require, or as may best suit the condition of the patient for the time being. Finally, exercises in reading and in speaking are made to suit the special defect which is being combated. Thus, words and sentences are arranged in which the defective sounds recur with more or less frequency, and at more or less regular intervals; and these are repeated more or less slowly at first, and afterwards with more or less rapidity and in varying rhythm. In this manner the patient is gradually educated to bring the defective movements under voluntary control; and as he progresses in the cure his voluntary movements gradually become individually unconscious, like the fingering of the instrumental musician; and in this way he becomes rid of his defect.

An interesting discovery of a life-sized female bust in pure silver has lately been made at Herculaneum. A discussion has arisen whether the work was originally cast or chiseled, but there is little doubt that the former hypothesis is correct. The head is that of a beautiful young woman; but the features have not been identified with that of any other extant head.

Engineering Two Thousand Years Ago.

Perhaps some of the most remarkable remains of ancient engineering are those which were discovered by excavations made some ten or twelve years since, a short distance from Rome, and near the ruins of the ancient city of Alatri. This city was surrounded by massive walls, and located on a mountain, or elevated point, and ill provided with water. About 150 years before Christ, as we learn from a Roman inscription, an immense aqueduct was built to bring water from a neighboring mountain better supplied with that element. We are furthermore told that this aqueduct was 340 feet high, supported upon arches and provided with strong pipes. The topography of the country, moreover, assures us that the water supply could not have been conducted into the city, even over such high supports, except by pipes—an inverted siphon—the lowest point of which must have been some 340 feet below the point of delivery, or under a pressure of at least ten atmospheres, 150 lbs. per square inch.

The excavations already alluded to show that the aqueduct must have been of large size, as the piers of the arches are not less than 5 feet 9 inches in breadth, while the total length of the siphon must have been between four and five miles. The question naturally arises: How, and of what material, was this syphon built? As iron pipes of large dimensions, if of any dimensions at all, were not known at that era, we can look only to masonry or woodwork for the material of such construction. Possibly a clue has been found to the mode of their construction by a subsequent discovery, near the same locality, of a field, supposed to have been the site of an ancient parade ground near this once walled city of Alatri. A complete system of underground drainage has been revealed at a depth of about 7 feet below the surface of the field, effected by a well constructed system of pipes made of fire clay, each about 18 inches in diameter. It is possible that such a pipe, of larger dimensions, and strengthened on its exterior by a strong and massive bulwark of masonry, may have been the means of conveying the water into the city. But however that end might have been attained, the work was certainly a most wonderful feat of engineering, considering the condition of the mechanic arts of that early day. The excavations and discoveries thus brought to light, and so fully confirming the truth of the ancient inscription, were conducted by order of the present Pope, and under the immediate supervision of the well known Italian scientist, Father Secchi.—*Iron.*

LIGHTS FOR GREENHOUSES.

J. L. N. publishes, in the *English Mechanic*, an account of a novel mode of fitting lights in greenhouses and forcing frames, which facilitates the transmission, removal, and putting together of horticultural buildings. It consists in making the lights in two or more rows for the roof of a greenhouse, each light being capable of being raised, and, if necessary, turned over or removed, by means of a hinge joint, one part of which is fixed to the framing of the roof or the garden frame, and the other to the light, the connection being made by a removable pin. Iron "set-opens" are attached to each light, to keep it open to any required degree, and these being connected by suitable gearing, all the lights in a house can be opened simultaneously.

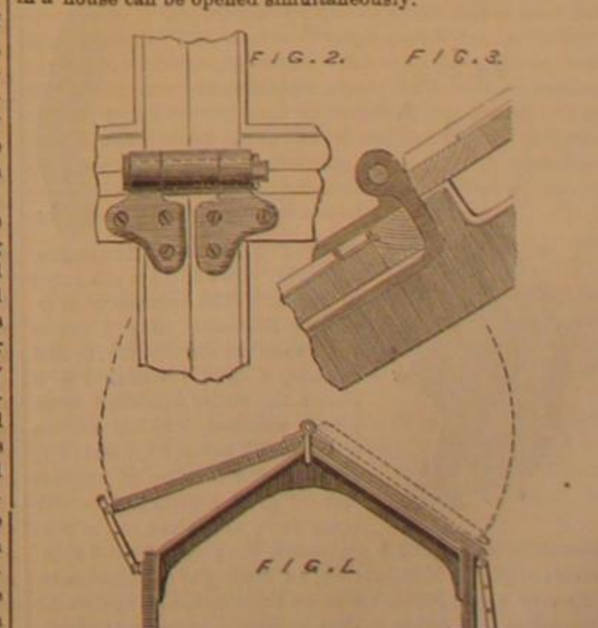


Fig. 1 is a section of a well known and very useful horticultural appliance, showing the light partly open, and also, by the dotted lines, how it may be thrown completely over when required. Figs. 2 and 3 represent top and side views of the hinge, as applied to greenhouse roofs, by which it will be seen that the lights may be thrown over completely, removed altogether, or partially opened, with the minimum expenditure of labor. The lights being interchangeable facilitates the removal of the structures when necessary, and also renders them more easy to repair. The invention, it will be seen, is a very simple thing, but it will, says the author, be found an improvement in the construction of garden frames and other horticultural appliances.

SPIDERS' WEBS AND SPINNERETS.

The exterior parts of the silk-producing organs of spiders are called spinnerets. They are four, six, or eight papillæ, or sometimes, instead of papillæ, flat plates, situate on the under side of the end of the abdomen, in a little depression adapted to their size and shape. As far as I am aware, no British spider has a less number than six. On the ends of each spinneret are little funnel-shaped tubes, *a* and *b*, Fig. 1, from which the silk is emitted, and which I call silk tubes, being ignorant of their proper name. The spinnerets lie in pairs, and are naturally divisible into two sets, an upper and a lower. There are two pairs in the upper set, one above the other, which I therefore name the first and second pairs, the one pair in the lower set being distinguished as the third pair. The spinnerets of the first pair have two joints, and their silk tubes are situated sometimes on the end of the second joint, and sometimes irregularly down its inner side. The second spinnerets have but one joint. They are smaller than the first, and have the silk tubes on and around the ends. The construction of the third pair differs a little from that of the other two. Like the first they have two joints, but the basal joint is always much larger than the terminal, which is very short. Their silk tubes are on a retractile plate at the end of the second or terminal joint, which, when not in use, is drawn inwards until the tips of the silk tubes are nearly level with the end of the spinneret. This plate has a thickened rim, and on the interior margin, where the rim is broadened for the purpose, are a few holes and two silk tubes of unusual size. The exact use of these I have been unable as yet to determine. The spinnerets of a spider are mobile, and their movements are effected by longitudinal muscles.

The first and second spinnerets always produce plain or non adhesive threads; if the spider be of a species that spins viscid threads, these are always emitted by the third pair. There is one family of British spiders which has an extra and very remarkable pair of spinnerets in the lower set, which produce threads of a peculiar character; they are described further on.

Fig. 1. Fig. 3. Fig. 4.

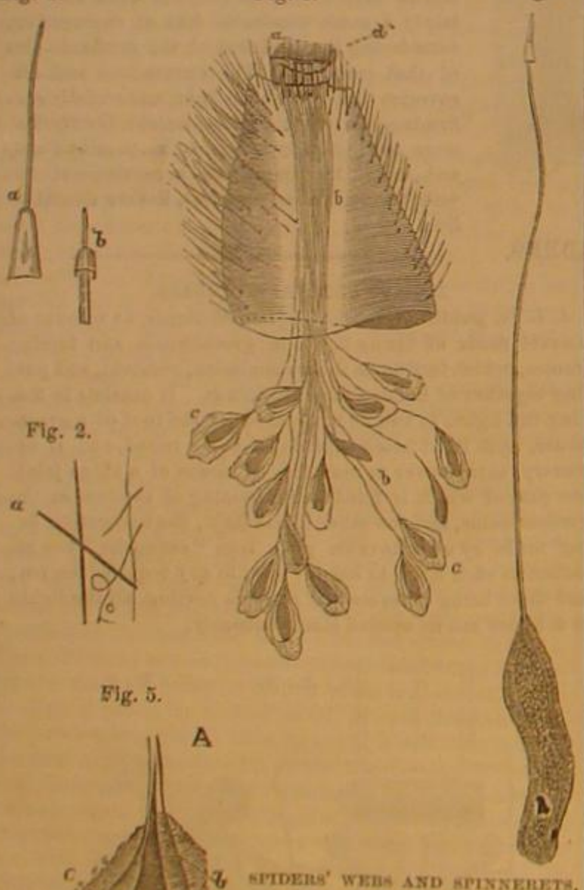


Fig. 2.

Fig. 5.

SPIDERS' WEBS AND SPINNERETS.

In Fig. 1, *a* and *b* are silk tubes of first and third spinnerets of *tegenaria domestica*. Fig. 2 shows the web of the same × 150; *a*, first threads, *c*, third threads. Fig. 3 shows the under spinneret, with glands attached, ×38. *a* are the common silk tubes; *b b*, ducts; *c c*, glands; *d*, silk tube of unusual size. Fig. 4 represents the silk tube, duct, and gland of the first spinnerets, × 38. Fig. 5 represents the gland of third spinnerets; *a*, gland; *b*, bag or case; *c c*, coating of epithelial cells.

As may be supposed, I selected the commonest spiders for observation, and house spiders happened to come handiest. The web of a tegenaria, and I believe of every spider, contains three sorts of threads, not two only, as usually stated. Two of these are plain, and stretched taut from point to point (*a*, Fig. 2), and they differ in nothing but size, being spun by the first and second spinnerets, of which in all spiders the first is larger than the second, although in some instances it has a fewer number of silk tubes. The third thread (also shown on Fig. 2) is exceedingly elastic, and studded with viscid globules, or, if these be absent (as in the web selected for illustration), it is slack, irregular, and sometimes much curled.

The apparatus by means of which a spider forms its silk is a series of glands within the abdomen, near and attached to the spinnerets, and immediately beneath the liver and intestinal canal. The glands of the upper and lower sets of spinnerets differ somewhat in character and shape, as is noted below. Fig. 3 is a drawing of one of the third spinnerets of *tegenaria domestica*, with its glands, of which only a few are shown. These communicate with the silk tubes by ducts, *b*. They vary in size in different individuals, but in a large tegenaria $\frac{1}{100}$ of an inch is an average length. Each gland has its own duct and silk tube. On the first pair of spinnerets there are about 60 silk tubes; on the second pair, although the spinnerets are smaller, about 80. The silk tubes on these two pairs are alike; but they differ in shape from those of the third pair and are much larger (see Fig. 3, *a* and *b*). There are nearly 220 tubes on the third pair, thus making altogether about 360 on the six spinnerets.

The glands, likewise, which are proper to the first and second pairs of spinnerets differ from those belonging to the third. Fig. 4 represents one of them with its duct and silk tube, drawn to the same scale as Fig. 3, for the sake of comparison. It is a simple sac, closed at one end, and terminating at the other in the duct, which carries the secretion to the silk tube. On the surface of the gland is a coating of cells, probably epithelial, which are surrounded by a very delicate membrane. The points of difference in the silk glands of the third spinnerets are these: They are smaller (about one quarter the length), of a different shape, and chiefly, they are enveloped by a bag or case interposing between the actual gland and the epithelium (see A, Fig. 5, *b* and *c*), which bag is wanting in the other glands; while the epithelium is apparently without the membranous covering by which, in them, it is always surrounded. This case, continued as a tube, surrounds the duct for some distance, in all probability as far as the silk tubes, but I have not been able to trace it so far.

It has been argued that the drops of liquid silk coalesce as they emerge from the spinnerets, and so form a simple, homogeneous thread, but various observations have convinced me that such is not the case. The following also tends to contradict this theory, namely: When a garden spider has caught a fly, as every one knows, she very expeditiously binds it in a covering of silk. Until I saw the exact process, I often wondered how she could manage to accomplish this so quickly. She places the tips of her six spinnerets almost in a line, at the same time seeming to erect each separate silk tube, and thus puts forth, not a single thread, but a broad band of many detached threads, which is rapidly wound round the unfortunate fly. The examination of the web of a house spider, under a high magnifying power, will show that many of its main threads are frayed, like a rope worn by use; this could not occur if they were homogeneous.—*H. M. J. Underhill, in Science Gossip.*

Correspondence.

The Scientific Treatment of Criminals.

To the Editor of the Scientific American:

Your remarks on the "Scientific Treatment of Criminals," on page 224 of your current volume, strike me as being, in the main, profound and sensible. You omit, however, to take account of one grave fact, which is a weighty factor in determining society's method of the treatment of criminals.

It is this: Each one of these "ill-regulated machines" is a generator of other and worse regulable machines, and generally the prolificness is in inverse ratio to the regulability. This is a state of facts which the modern theory of dealing with the criminal class takes no account of. We send a badly constructed locomotive to the repair shop, and if it can be tinkered up at all it may have some degree of utility. The case, I imagine, would be very different if each locomotive were the spawner and perpetuator of its own defects to all futurity. The mode of dealing would then be the summary breaking up in the shop for the sake of the old material. This is just what human society has done in all past time with its own failures, and to this process of "moral selection" we unquestionably mainly owe the advance which the race has made in moral evolution. It is only in the most recent times that the retrograde course has been adopted, chiefly for sentimental reasons under false theories. Having reached a plateau of comparative security, society kicks down the ladder by which its moral eminence has been in part attained, and ignores the horrid depths from whence it commenced its ascent toward the light.

It is highly questionable whether, sentiment aside, the profit to society from the maintenance of costly prisons and reformatories is greater than the old, simple, and inexpensive methods. For cases other than the most incurable and hopeless failures, however, there seems to be no reason for abandoning the reformatory and punitive modes of treatment, simply on account of a better philosophical hypothesis. The presentation, by society, of powerful motives of action has been, next to selection, a most efficient agent in moral evolution. Now, on the mechanical theory, or any other, it is certain that these motives act, namely, fear of punishment, hope of reward, love of approbation. This is a mere matter of observation. Where, then, does human responsibility to society cease? To be alarmed on this score is to imitate the consternation of the old lady, who, when told that red flames 10,000 miles high had been discovered in the sun, exclaimed: "Now we shall all be burned up alive!" The truth is that the machine is just what it always has been, complex beyond calculation, full of numberless antagonistic springs and coördinating devices, adapted to be played upon by the minutest objective and even subjective phenomena, and capable, to a certain small extent, of a choice of motives. In this lies its responsibility. It is clear that some of the motives by which the components of society have in the past been powerfully influenced and molded may become less potent or disappear. Such transformations are continually going on as society progresses; but there can be no fear that, while the machinery remains constituted as it is, that portion of it which is so wonderfully susceptible to the influence of motives, namely, the imagination and the passions, will, as in the past, be also the prolific generator of new motives sufficient to control the action of all for the general good. H. H.

Washington, D. C.

Small Boat Engine.

To the Editor of the Scientific American:

I have taken an interest in the small engine question, and I wish to say that I have a small engine in a boat 17 feet long and 5 feet wide. It is an upright engine; the cylinder is 2 x 3 inches, and drives a propeller 18 inches in diameter. The boiler is a common upright one with 22 tubes. I can run for four hours with one fire; in a whole day's run, it consumes about 4 buckets of coal. The boat's general rate of speed in still water is about 6½ miles per hour.

Barrytown, N. Y. J. ASPINWALL.

[In descriptions of engines, further particulars would be useful—such as dimensions of boiler, pressure of steam, pitch of screw, and revolutions of engine per minute.—EDS.]

Ice Lenses of Unlimited Size.

To the Editor of the Scientific American:

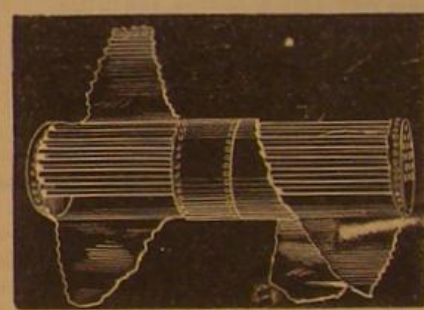
If you had lived in Minnesota and seen our ice, you would not think me foolish in suggesting the possibility of freezing filtered water so as to make a perfectly achromatic lens of unlimited size, to be used in a telescope during the winter months; but as you are used to New York ice, I shall only expect you to think that I am somewhat visionary in this last thought. C. RIDGWAY SNYDER.

Minneapolis, Minn.

Remarkable Boiler Explosion.

To the Editor of the Scientific American:

A fatal boiler explosion occurred in this city at 9 A. M., on October 2, in the factory of the Dubuque Cabinet maker's Association. The engineer and another man were instantly killed, and a third severely scalded. The cause of the explosion cannot be ascertained. The boiler was new (not much over a year in use); it was 15 feet long by 4 feet diameter, with 38 four inch flues. It burst in a queer way, both heads remained on the flues, but the shell of the boiler



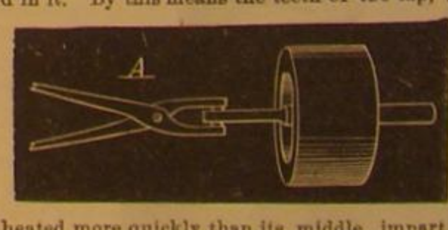
burst along the rivet holes nearly all around both heads, leaving a wreck as shown in the engraving.

Dubuque, Iowa. M. A. KELLER.

Hardening and Tempering Tools.

To the Editor of the Scientific American:

Upon the above subject permit me, in conclusion, to say that, since I withdraw the tube from the fire before inserting the tap, the products of combustion do not interfere with my operation of tempering; and since the tube is shorter than the tap, some part of the latter is at all times exposed to the air, as here illustrated, at A, it being obvious that the tap must be moved endwise through the tube as well as revolved in it. By this means the teeth of the tap, which be



come heated more quickly than its middle, impart the heat to the body of the tap, making its temperature, and hence its temper, even all through, the color of the temper being plainly, at all times, discernible; and perfect access of the air is permitted. The sand bath process I have objected to from the first, for reasons then stated, to which Mr. Hawkins has given his endorsement.

In tempering dies, I do not permit them to lie more than a few seconds on either face, excepting at the end of the operation, when I lay the back edge (the one furthest from the teeth) for several seconds on the hot iron, making the back a little softer than the teeth, and thus strengthening the die. JOSHUA ROSE.

New York city.

To the Editor of the Scientific American:

Enclosed find a tap, or rather the pieces of a broken tap, a quarter inch in diameter, with twenty threads to the inch, with a very deep wire thread (round top and round bottom This tap has tapped over two hundred thousand hot forged nuts. It broke in tapping a nut which was too small in the hole, otherwise it was good for several thousands more. It ran constantly at 480 revolutions per minute for 48 days. This tap I believe to have been well made and properly tempered; and if any of your readers can improve on it, I should be glad to hear from them. It was made from W. Jessop & Sons' best English steel, swaged at as low a heat as possible, the screw end being a sixteenth of an inch larger than the size, in order to true up to size; the shank was forged and swaged as near the finished size as possible, and it was then heated slowly to a cherry red and imbedded in lime until cold; it was then centered and straightened. The shank was filed bright in the lathe, then reversed and the screw end turned straight and parallel for about two diameters, or half an inch from the end of the thread; and from that to the point, the tap is given the amount of taper that will allow a nut of the proper size to go on the tap flush with the end. The lathe is then set to chase a straight parallel thread; the tap, when chased, is passed through a hardened steel gage, and is then ready for the milling machine. It is milled with three deep half round grooves; it is afterwards filed with a little clearance on the top of the thread, then passed through the same steel gage as before (but this time in the reverse way, namely, shank end first), and unwound through the gage. This is done to remove the fine burr made by the milling and filing, which is very necessary; though sometimes the burr is scarcely perceptible, yet it would make a material difference in the size of the nut. The tempering is done thus: Heat the tap slowly to a cherry red, and dip endways and straight into clean cold water; and when perfectly cold, clean off the oxide or thin scale, with soft brick or an emery stick, until bright. The cleaner you make your tap, the higher and brighter will be your color. Then draw the temper to a purple bordering on a blue, by placing the tap shank on a piece of heated iron, and drawing the shank as soft as possible, drawing the temper towards the point. When the shank is soft, roll the tap backwards and forwards over the hot iron, until you have an even temper and color all over the body of the tap; then drop it into oil to cool. The taps are kept sharp by grinding the top of the thread where the nut starts; for the scale in the nuts soon wears a step on the tap and the starting point must be kept sharp or the tap would have to be forced into the nut. This is all the grinding or sharpening given these taps, and, in my judgment, is all they require. I am using taps all of which run at a high rate of speed, and the average amount of work got out of quarter inch taps is ninety thousand nuts. I have sent a quarter inch tap, as a small tap is a more delicate test of quality. Large taps never break if properly made and used, and they last a long time before they wear out; whereas a small tap, if not carefully and properly made, would either snap off or burr up, perhaps with the first nut. I also mentioned machine taps because you can never judge the results or gage the work done by hand taps. One particular point in making a taper tap is to be sure and have the thread parallel, giving the taper only to the outside or top of thread. By so doing each tooth does its share of the work, and the cut is regular.

Pittsburgh, Pa. T. J. B.

The Engines at the American Institute Fair.

To the Editor of the Scientific American:

In your issue of October 17, a correspondent who signs his name "Esor," makes some remarks upon the engines at the Fair which seem to display a hypercritical spirit, and have the further disadvantage of being in one or two instances incorrect in point of fact. For example: He says that "the Wright engine has its eccentric straps a quarter of an inch apart, and are not locked together by the bolts at all, but merely hang on the shaft; they are the only ones in the Fair possessing this defect." When I saw the bolts this morning, there was a head on one end and a nut on the other, and the eccentric straps were held together by them. "Esor" must intend to convey some other impression than that naturally attaching to his expressions. As to the straps being open a quarter of an inch, he is correct; but it is not a defect to have them so, but standard engineering practice, not necessarily faulty because disapproved of by your correspondent. He further says that a small rod on this engine (meaning probably the Wright engine though he has just referred to one or two others previously) "is about ten inches long and connects one end of the rocker arm to the arm of the shaft working the cut off, the movement of each end of the rod being part of the circumference of a circle, the plane of one circle being at right angles to the plane of the other, and said rod having the bore of its brasses at each end trumpet-shaped from the center to each face of the brass, so that the rod has a right-about-face and 'slantindicular' movement, in all directions, merely hanging on its journals, since its faces will be free, and unconfined by flanges, collars, or other guides common to a respectable connecting rod."

In point of fact, and in few words, this rod has a ball and socket joint; how it can be "trumpet-shaped" under such circumstances is more than I, or any one whom I have asked, can discover. It is an old device, not new or claimed to be, by the makers of the engine. As regards the "thump" of the engine, your correspondent, before pointing out such a thing, might have reflected that it is not possible or desirable to go to the expense of putting down as heavy foundations for an engine at a Fair as they would be if intended to be permanent. The slight pound is caused by the springing and settling of the supports, and is in no way attributable to the connecting rod brasses.

Intelligent criticism is always in order and desirable, especially in mechanical matters; but the crudity of your correspondent's remarks can only be accounted for by a want of familiarity with the subject he discusses.

42 Cliff Street, N. Y. EGBERT P. WATSON.

[We were glad to observe, on our last visit to the Fair, that the exhibitors of the engine, acting on the hints of "Esor," had re-adjusted the machine and stopped the pounding. This is practical. But the charges of "hypercritical spirit", "crudity", "ignorance of the subject", etc., raised by the above correspondent, appear to be a waste of adjectives.—EDS.]

The South American Boxer.

To the Editor of the Scientific American:

The boxer of South America is so called by English and American settlers on account of its pugilistic propensities. It is of the grasshopper family, light-made, long limbed, and of a beautiful green color, and is an inhabitant of the south temperate zone. Those which I saw were brought in by *gauchers* (herdsmen) from the camp (country) and given to the *major domo* (foreman) of the *salerado* (salting establishment) at Port Roman, situated on the east side of the Uruguay river, about forty miles above Independencia and in about latitude 34° S. They were brought in to show as curiosities. The major domo, with whom I was well acquainted, placed one of these little fighters on a table and said to me: Tease him, and see what he will do. So I put my forefinger against him and pushed him lightly back; he was then in his natural position, on all fours. He faced around toward me and moved back about an inch. I then touched him lightly again, and he retreated again, as before; and we observed a sort of nervous movement in the hands, or rather the lower extremities of the fore legs, which we will call hands. I followed him up again; but this time, instead of retreating, he raised himself up, his body being nearly perpendicular, and drew his feet up, placing himself like a Turk in sitting posture, at the same time clinching his fists and putting himself on guard as a boxer would do.

I then made a pass at him with my finger, which he turned off as well as Yankee Sullivan could have done; and as long as I continued teasing him in this way, he warded off and gave blows as regularly as any pugilist could do. Soon after I ceased teasing him, he came down on all fours again and walked off leisurely across the table. The major domo told me that he had seen plenty of them, and that they all showed fight when teased, the same as this one had done.

Stratford, Conn. TRUMAN HOTCHKISS.

Vesicatory Potato Bugs.

To the Editor of the Scientific American:

Your correspondent, Mr. I. B. Hodgkin, is correct as to blistering with potato bugs.

In childhood, in the country, I frequently ran bare-legged among potato vines, and nearly always was blistered on my ankles by contact with these same bugs. I am not sure that crushing the insect was necessary; contact sometimes seemed to raise a blister. Generally a sac larger than a buckshot occurred, which (unless attended to) caused an irritating sore.

It was a well known fact; but the bug was rarely used in blistering, in consequence of the acridity of the poison, and consequent difficulty in healing. The Colorado bug, common this season, should rather be called a grub; it will be recognized by most persons who have seen it as similar in form and movement to the blood sucker of the brooks (leech), but different in color and not active. The common impression is that it is in some way poisonous. It is as tough as rubber; a sharp knife will scarcely cut it. Most people hereabout know what it is like to their cost. R. H. A.

Baltimore, Md.

[For the Scientific American.]

SOME NEW GALVANIC BATTERIES.

Several new forms of the galvanic battery have lately been brought to our notice, a short description of which will interest our readers.

I. A copper pot is filled with dilute sulphuric acid, inside of which is placed the ordinary porous cup, filled with a strong solution of sal ammoniac in water, in which is placed the amalgamated zinc. The action of this battery seems to be as follows: The sulphuric acid, entering through the porous vessel, decomposes the chloride of ammonium, setting free the hydrochloric acid, which, in turn, attacks the already oxydized zinc, forming water and chloride of zinc.

II. In a jar, of about six inches diameter by ten inches hight, is placed a carbon plate, within a bag of unoiled leather; the bag is surrounded by peroxide of manganese, closely packed; the jar is then filled with a strong solution of sal ammoniac to which a few drops of hydrochloric acid are added; a plate of amalgamated zinc, of the same dimensions as the carbon plate, is placed in juxtaposition with the carbon. The action in this closely resembles that of the well known Leclanché cell. Constancy of action and large electromotive force are claimed for it.

III. A copper pot or cylinder is taken, inside of which is placed a porous cup filled with a strong solution of sal ammoniac in water and a plate of zinc (amalgamated). The outer vessel is filled with rain water, in which is placed a quantity of lucifer matches surrounding the porous cup. This form of battery is simple yet powerful. The matches seem to furnish a supply of ozone which is really its motive power. L. B.

LABOR is the duty man owes to society; rest is the duty he owes to his person; recreation is the duty he owes to his mind.

Charles M. Keller.

It is with the deepest regret that we announce the death of Charles M. Keller, the eminent patent lawyer, which occurred at his country seat at Milburn, N. J., on Thursday morning, October 14. For a year past Mr. Keller was in delicate health, and it was very evident to his friends that he needed rest from the arduous labors of his profession. Early last spring he was directed by his physician, and implored by his friends, to withdraw for a time from active work, and to devote himself to the restoration of his health. To these entreaties he gave no heed, insisting that his duties to his clients and to his cases were paramount to all others. At last, the feared result came; and about ten days before his death he was assailed by the complication of diseases which ended his life. He died in harness, working and consulting, on the last day before his attack, upon a difficult argument. And almost his last words were an expression of pleasure at the decision of an important case in his favor.

Mr. Keller was born in France, but came to this country with his parents at an early age. His father was employed in the old Patent Office; and at the early age of twelve years, young Keller began his career in the Office. He had a remarkable talent for mechanics, which he developed by assiduous and extensive study. His value was appreciated, and for many years he was an examiner under the organization of the Office prior to the act of 1836. In 1834, he conceived the idea of reconstructing the system of patents, and drew the act which was passed in 1836, and which is the foundation of the Patent Law of today.

A few years afterwards, Mr. Keller determined to leave the Office and to commence the practice of the law. For two years he studied, after office hours, until he deemed himself equipped for his new profession. So wide was his reputation that, before he opened his office, he was besieged with retainers, and with his first case he stepped to a foremost place at the patent bar. Since that day he has been engaged, on one side or the other, of most of the important patentl itigations which have occupied the courts; and his practice was attended with singular success.

Mr. Keller's life was that of a purely professional man. He was fond of social pleasures, and was a charming and genial companion; but his thoughts day and night were on his cases, at which he labored with wonderful assiduity. No one has ever equaled him in his skill and perspicuity in explaining machinery in court, or in describing and claiming it in patents. To this talent he added excellent attainments in the law. His knowledge of equity, of pleading, and of the theory of the law of contracts was thorough and complete; and his method of preparing his cases for argument was so good that some twenty years since, the Supreme Court of South Carolina, in adopting a rule to regulate the form of briefs to be used before that court, printed with their rule a brief of Mr. Keller's as a model.

All friends of the mechanic arts will deplore the great loss they have sustained by his death. He was wise and prudent, learned and modest in consultation, earnest in argument, and always truthful, sincere, and just. His memory will long be cherished as that of one of the Fathers of the Patent Law.

Transformation of Sandstone to Marble.

J. Corvin, an engineer residing at Dresden, Germany, has invented a method of giving the ordinary sandstone, found in abundance in many localities, the exterior appearance of marble. He accomplishes this by impregnating the well dried stone with soluble silica and alumina. The thus prepared sandstone becomes much lighter in color, some kinds being intensely white and translucent, while it is capable of the highest polish, equal to that on the purest marble. He has even succeeded in imitating marbles of every color by adding mineral colors to the liquid used for impregnation. The famous quarries near Pirna, in Saxony, produce a sandstone especially adapted to this process, and Mr. Corvin now makes colored stones from this sandstone, adapted to the most elegant architectural structures. The price is considerably below that of marble; and the new material has the important advantage that it is much more fireproof than marble, which, when exposed to the fire, rapidly burns into quicklime and crumbles to dust.

Distilling Sea Water.

The author of a book lately published in England, entitled "Two Years in Peru," thus describes a simple contrivance recently devised by an English resident of that country for procuring fresh water from sea water through the direct action of the sun's rays:

"The apparatus consists of a box of pine wood, 1 inch thick, and which is about 14 feet long, 2 feet wide, and an average depth of 6 inches. The upper part of this box is closed with ordinary glass, which has an inclination of 1½ inches.

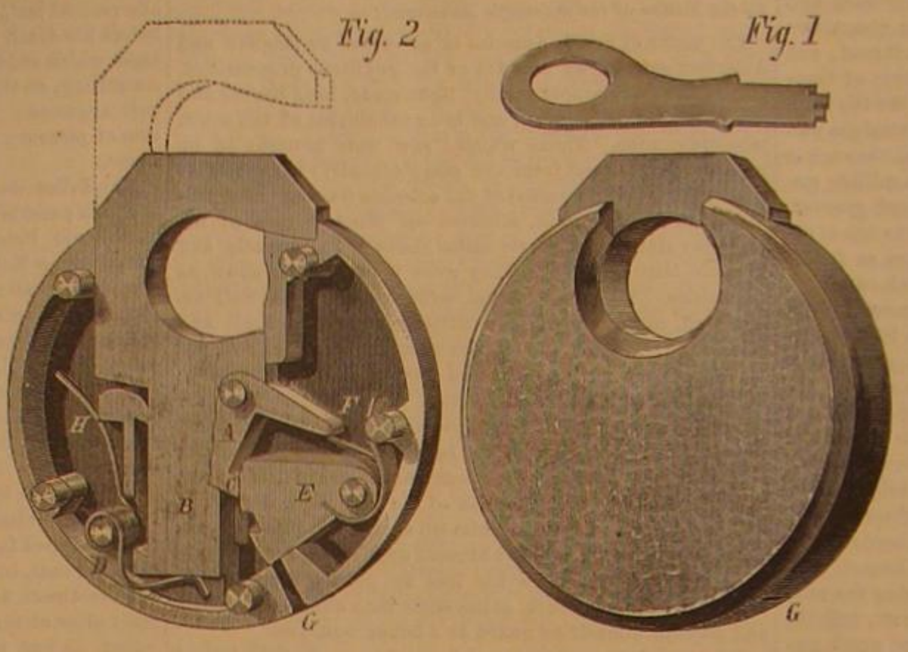
"At the lower edge of the glass, there is a semi-circular channel, destined to receive the fresh water which is condensed on the interior surface of the glass. The salt water is let into the box to about 1 inch in depth. It is then exposed to the rays of the sun, the heat of which is sufficient to raise it to 160° or 180° Fah. A very active evaporation then begins, and it is proved that 10½ square feet of glass will condense daily two gallons of pure water."

The author says he saw the apparatus in successful operation at Callao. There are many places on the coast of Peru, as in various other parts of the world, where fresh water is only to be got by distillation, and in such localities the device cannot fail to be exceedingly useful.

IMPROVED SELF-LOCKING PADLOCK.

The novel form of self-locking padlock represented in the engraving is the invention of Mr. D. K. Miller, of Philadelphia, a well known safe and bank clock manufacturer and a lock expert of some celebrity. In points of workmanship and construction the device possesses the merits of simplicity and convenience; while its durability is enhanced by its being made entirely of brass. The pins at all movable joints are wrought of that metal, so that deterioration from the effects of weather is amply provided against.

Fig. 1 shows the exterior of the lock and its key. In Fig. 2 the outer plate is removed in order to exhibit the mechanism. A is the dog, which is so pivoted as to fit into a recess of the latch, B, when the latter is pushed down. The end of the lower arm of the dog is formed with an angular projection, C, which, engaging against a properly shaped shoulder at the bottom of the recess, holds the latch in the position mentioned, in opposition to the upward tending force of one arm of the spring, D. At E are the tumblers, either six or seven in number, according to the size of lock, all of which are pivoted on a single pin, and each provided with a bent wire spring, as shown. The upper portion, F, of one of these springs, instead of taking, as do the others, against the projecting part in the shell, is brought forward and under the straight arm of the dog, so that its tendency is to force the lower arm of the latter against the tumblers, causing the projection, C, to enter notches in the tumblers when the same are brought into proper position.



MILLER'S IMPROVED SELF-LOCKING PADLOCK.

It will be readily understood that, owing to the angle of the notches in the tumblers, and to the dog being in a solid piece, it is only when all the notches coincide that the projection can enter them; and hence, if each notch were placed in exactly the same position on the edge of the tumblers, then any square bit of metal pushed in through the key aperture, at G, would lift all the tumblers together until the coincident notches met the projection. But this evidently would at once defeat the purpose of the invention, for one of its main features is that no two locks are alike: the key that fits one must be, and is, entirely useless to open another. The important advantage, however, is easily secured by varying the positions of the notches on the tumblers; so that in order to render all the notches coincident, a key having peculiarly formed projections and recesses at its extremity must be employed, which, acting on all the tumblers simultaneously, lifts each the exact distance required.

The key is merely pushed into the proper aperture, freeing the dog as above described, and allowing the latch to be acted upon by the spring, D, and so lifted upward into the position indicated by the dotted lines in Fig. 2. Motion in this direction is then limited by the catch, H, which is held against the side of the latch by the upper arm of the spring, D. The angular projection shown on the left hand lower corner of the latch engages in a corresponding projection in the catch, the lower part of the latch being guided in its ascent by the dog on one side and the straight part of the catch on the other.

We learn that this invention has, after thorough testing, and against a number of competitors, been adopted by the United States Government. The present device was patented in this country July 26, 1870, and October 21, 1873. Similar protection has been obtained in England, France, and Belgium.

For particulars regarding sale of foreign patents and other information, address the manufacturers, the D. K. Miller Lock Company, 712 Cherry street, Philadelphia. The locks are for sale by the hardware trade generally.

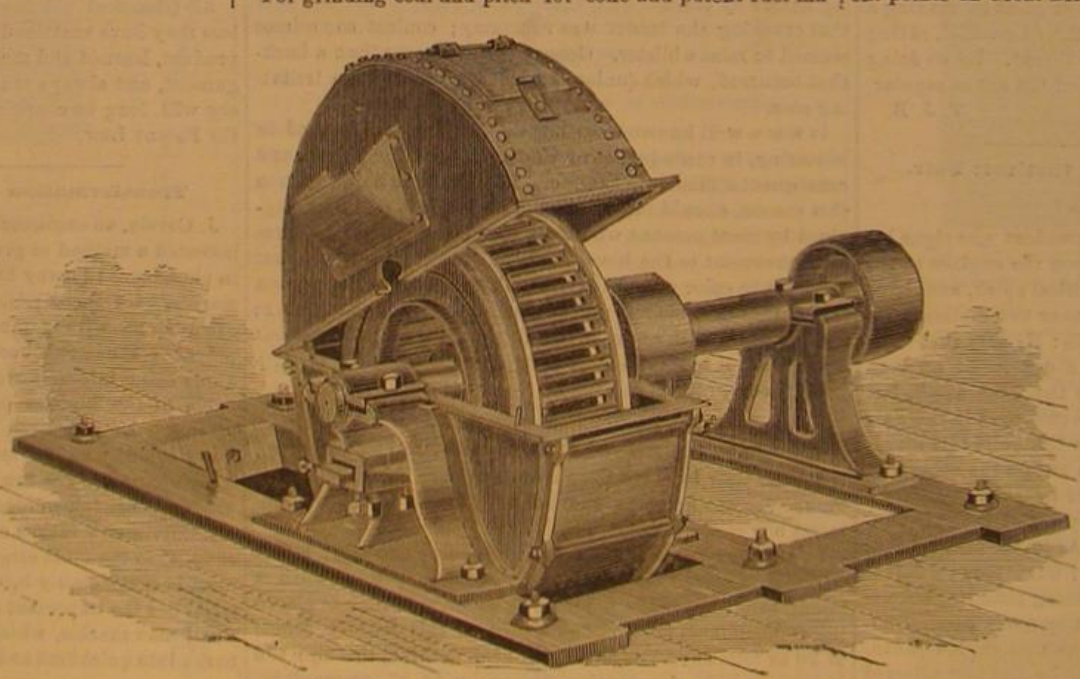
IMPROVED DISINTEGRATOR.

Among the industries based upon the utilization of waste products, that of grinding bones, in order to prepare them for use as fertilizers, is believed to be one of the most profitable. Immense quantities of material are obtainable in the neighborhood of cities, and especially in the cattle raising districts of the Southern and Western States, and this, we are informed, at a cost which, including the expense of transportation to almost any locality in the country, renders the erection of mills and machinery, for its preparation, no small inducement to investors.

The disintegrating mill, which we illustrate in the annexed engraving, is especially adapted to the treatment of bones as above mentioned, and also to the pulverization of a large variety of other substances. Among these may be noted Peruvian guano, alone and mixed with other materials; South Carolina phosphates, also either alone or mixed; and slaughterhouse tankage, bone ash, salt cake, carbonated soda, cracklings, coal, corn and cob, sugar, oyster shells, clay for fire and building brick, animal matter in almost all conditions, mortar, cement, and numerous others. The machine consists of several cylindrical cages, formed of round bars secured to disks and annular rings, one inside the other, and made to revolve in opposite directions, presenting, however, no scrubbing or grinding action. The materials to be disintegrated are received into the inner cage, and, by the rapid revolving of the cages, are projected through the latter by the creation of a powerful centrifugal force. The effect is to disintegrate the substances by a system of free blows from which no friction ensues.

The strength, durability, and capacity of this mill are very great. No skilled labor is required for its running, and the operations of sharpening or dressing are, of course, done away with. As ordinarily constructed the machine, it is claimed, will pulverize the hardest known ores. In bone grinding, where large pieces of wrought iron (that is, larger than ½ or ¾ metal, pieces of which do no harm) are found in nearly every lot of bones, the disks of the mills to be used for the purpose are so reinforced that the entrance of a large fragment of iron can do no more damage than to break a few pins, and these last, owing to peculiar construction, may be quickly and readily replaced.

For grinding coal and pitch for coke and patent fuel making, the apparatus is also well suited. Many of the machines of three feet in diameter, and a few of four feet in similar dimensions, are, we understand, in successful use by brick makers in disintegrating wet, dry, or frozen clay. The stones found in the material are pulverized as thoroughly as the clay itself. Sand may also be mixed with the latter during the operation, or a small stream of water may be run into the mill for dampening the clay. We are informed by the manufacturers that the mill, three feet in diameter, will disintegrate clay sufficient for 3,500 bricks per day, and they report a very large sale of their machines, during the three years which have elapsed since their introduction. Parties ordering mills will be supplied with complete drawings for foundation and for the erection of mill and machinery. If speed of shaft, from which the machine is to be driven, is given, the size of pulleys and other useful particulars will be furnished. Manufactured under the patent of Mr. G. B. Davids, by Messrs. Denmead & Son, North and Monument streets, Baltimore, Md.



DAVIS' DISINTEGRATOR.

ONE of the latest discoveries in the excavations at Rome is a magnificent bust, in perfect condition, of the Empress Plotina, wife of Trajan.

Compressed Air as a Street Car Motor.

Some time ago, in discussing the question of a cheap and effective motive power, for street cars and for use under similar circumstances, where opportunities exist for replacing the stored-up force after its employment for a given time, we intimated the possibility of some mechanism being devised whereby, for the purpose, the power of a strong spring might be advantageously employed. The suggestion, like many others which have appeared in these columns, set one person, at least, thinking; the train of thought led to experimenting, and this, in the end, has culminated in the invention of a novel plan for the adaptation of the natural spring of compressed air to the impulsion of street railway cars.

We have recently inspected a working model of a vehicle provided with the new machinery, and have obtained from the inventor, Mr. Henry Bushnell, of New Haven, Conn., an outline of the proposed plan. The project will, in a measure, call to mind the fireless locomotive, inasmuch as it requires the use of relay stations at which the power expended, in making the intervening journeys, is restored by filling the reservoirs with new supplies of the motor. At these stations the air is compressed into strong receptacles (by means of machinery devised by the above named inventor, through which he is enabled to secure a pressure of over 2,000 pounds per square inch), and is drawn off as required into metal tubes 18 feet long by 8 inches in diameter, four of which are located under the flooring of every car. We are informed that a force, equal to two mechanical horse power, capable of driving the vehicle for three hours, is thus stored. From the tubes the air passes through a regulating device located at one end of the car, by which the pressure, transmitted to drive the engine located at the opposite extremity, may be adjusted as desired. In order to avoid the effects of the extreme cold due to the expansion of the air, the valves and cylinders of the engine are completely jacketed, and a pump is employed to compress air within the jacket to a pressure of some 75 pounds. The model exhibited ran quite rapidly over about 80 feet of track, and we were informed that it would readily ascend a grade of one foot in six. The invention has not yet been tested under actual practical conditions, so that its economical value remains, as yet, undetermined.

The Telegraph between Great Britain and Ireland.

Telegraphic communication with Ireland is maintained by means of four submarine cables, submerged between different points in Great Britain and the Irish coast. These cables contain in all twenty-two separate wires.

One of the largest cables—that between Holyhead and Dublin—has been laid since the post office acquired the control of the telegraphs, and all of them have been under repair during the same period. The rocky nature of the bottom along the Anglesea coast has, it appears, seriously affected the condition of the Holyhead and Dublin line, the newest of all the Irish cables; in many places the outer iron wires which form the chief protection of the core have been completely chafed through from constant friction. Quite a new feature has also developed itself in connection with this fault, namely, the eating away, by a kind of worm, of the gutta percha covering of the core, in much the same way as wood is bored and eaten away by these destructive insects. The post office can hardly be congratulated on the possession of these lines to Ireland, as they have been a constant source of trouble and expense ever since the transfer of the telegraphic system to the government.—*London Times.*

The Passivity of Iron.

M. de Régnon, in order to produce in a certain manner the somewhat capricious phenomena of passivity, uses rods of fencing foil or iron wire, the surface of which is protected for a certain length by a glass tube or a layer of mastic. The free extremity, to a length of 0·9 inch, is plunged entirely in the acid. The conclusions recently reached by the above means show that most of the causes which produce passivity in iron may be reduced to a voltaic force carrying the oxygen to the iron and polarizing it on the surface of the metal. Most of the causes which destroy the passivity of iron may be reduced either to a voltaic force of the contrary direction, or to a current, due to the polarization of the oxygen and by which it is exhausted: or, lastly, to an absorption of the polarized gas by a body that has avidity for oxygen.

These phenomena of passivity are believed to be more general than is now supposed. The acid employed in the experiments was nitric, marking 35° B·

THE ENGLISH CHANNEL STEAMERS.

We have already alluded to the oscillating saloon steamer, and some time ago we gave an illustration of her peculiar saloon, designed by Mr. Henry Bessemer to overcome the seasickness so prevalent in crossing the English Channel. She is now nearly ready for service, and is 350 feet long by 610 broad. She is fitted with two sets of paddle wheels, 106 feet apart, and is double ended. The saloon, suspended on pivots and controlled by hydraulic gear, is 70 feet long by 35 feet wide. Twenty miles an hour is expected of her but it is doubtful if she attains it. We hope to publish a view of the entire ship in a few weeks.

Mr. Bessemer's experimental vessel will, however, be tested by competition with a formidable rival, the Castalia, built on the largest scale and at great expense for the same traffic. This is a twin ship, propelled by paddle wheels placed between the connecting girders; and she is especially designed to sail without pitching or rolling in any sea, however rough. The engraving, reproduced from the London *Graphic*, gives the reader a clear idea of her appearance on the water and the extent of her accommodations. She is 296 feer long and 60 feet wide over all, each hull having a width of 17 feet; she is also double-ended, to avoid the necessity of turning in entering or leaving a harbor. Her cabins and saloons are handsomely appointed; and she was much commended as a successful sea boat in her preliminary voyage from the Thames, where she was built, to Dover, her intended point of departure for the continent. Thirteen knots an hour is to be her speed, according to the expectation of her designer (Captain Dicey) and the builders and engineers. By the latest advices she was waiting at Dover for a heavy sea to thoroughly test her capabilities. We shall shortly know the result of her further trial, and hear, we hope, of her success.

Launch of the Bessemer.

The Bessemer saloon steamer was recently launched from the yard of Earle's Shipbuilding and Engineering Company, Hull. According to the London *Times*, she has very much the appearance of a breastwork turret ship. She is shaped alike at bow and stern, and for 48 feet from each end she has a freeboard of about 3 feet only. Her total length at the water line is 350 feet, and the raised central portion, rising 8 feet above the low bow and stern, is 254 feet long, and extends the whole width of the vessel, 60 feet over all. The swinging saloon, 70 feet long, is in the center, and the engines and boilers which drive the two pair of paddlewheels are stowed in the hold at either end of the raised portion of the vessel.

The whole of the machinery is on board, and the after pair of engines is completely fitted. The nominal horse power is 750, working up to 4,600, sufficient, it is estimated, to drive the vessel 18 or 20 miles an hour. The two pairs of paddlewheels are placed 106 feet apart, and each wheel is 27 feet, 10 inches in diameter, and fitted with 12 feathering floats. The saloon is entered from two staircases leading to a landing, connected with the saloon by a flexible flooring. The saloon itself is upheld on its axis by four steel supports, one at each end, and two close together in the middle. The aftermost of the two central supports is hollow, and serves as a part of the powerful hydraulic machinery which will regulate the motions of the saloon. Without entering into a long technical explanation, it is enough to say that Mr. Bessemer has constructed some machinery which will cause the valves, the opening and shutting of which will adjust the saloon, to work automatically. The interior of the swinging saloon measures 70 feet long, 35 feet wide, and 20 feet high.

As to the question of the double set of paddlewheels and their effect upon the speed as compared with a single pair of wheels, Mr. Reed's view is as follows: When a ship is being propelled at a uniform speed by the exertion of a given constant power of engine, all that the engine does is to prevent the speed from decreasing, as it would do if the propelling power were removed. Were that power removed, the ship would not suddenly stop, but be gradually and slowly brought to rest by the resistances opposed by the water to her progress through it. In point of fact, therefore, in the case of a paddlewheel steamer at full speed, the ship herself carries the wheels rapidly past the surrounding water; and before the wheels can begin to propel at all, the engine must cause them to revolve with a corresponding velocity. If, for example, we take the case of a steamer going at a uniform speed of 14 knots an hour, with 36 revolutions of her engines, we may assume that 30 of those revolutions were required for enabling the wheels to overtake the ship, and that the remaining six only are useful for propulsion. These six revolutions no doubt impart a sternward velocity or race to the water of corresponding amount; and if another wheel has now to be brought into action in order to apply increased power, and has to be set to work in this race, it is obvious that it will require to be turned 36 times before it will begin to propel, and the few revolutions necessary for propulsion must be added to this number. The difference between the two wheels will therefore simply be that the sternward wheel will require to revolve a few revolutions more than the other before it begins to propel, but after that the two will be upon equal terms, excepting as regards any losses from friction, etc., due to the extra speed of revolution. This is Mr. Reed's view, and, if he be correct, the speed realized by the Bessemer will probably prove at least equal to that of the fastest paddle steamers in the world; although, at the same time, the designer considers the very light draft and great beam of the ship, and the extra weights which have been found necessary in connection with the saloon and its machine beyond what he was called upon to design for, will in some degree detract from the speed which has been predicted by the admirers of the vessel.

THE EARLY HISTORY OF WHEELED VEHICLES AND RAILWAYS.

NUMBER 2.

"Men of genius have a hard time, I perceive; and must expect contradictions next to unendurable---the plurality of blockheads being so extreme!"—CARLYLE

The struggle, however, between the friends and enemies of improvement was by no means over. One hundred and fifty years after John Crasset wrote his "reasons," a new motive power, which was to produce an unprecedented revolution in human affairs, to enable immense navies to advance in the face of wind and tide, and vast armies to traverse under lofty mountains and across deep rivers at a pace which far outstrips the fleetest race horse, made its appearance, and the conflict was again renewed with increased vigor. In truth, the opposition made to the railroad in its early years stands peculiarly alone. On the one side was a little band of merchants and manufacturers headed by George Stephenson the self-educated "Killingworth brakesman." On the other hand were the rich monopolies whose interests were about to be affected by the railway: the coach companies now about to be ruined, the canal companies about to avenge on the railroad the opposition they had experienced in time past; the nobility, the preservers of game, the celebrated engineers and famous doctors, the landed gentry, the small farmers, the public press "backed by the opinion of the nation," every profession from the clergy to the engineer, every trade, every rank of society from the peer to the Northumbrian miner, was bitterly hostile to the steam railway. Against this array of public-spirited obstructives ready to choke the new invention at its birth on the ground of the public good, it struggled hard to gain a footing, scarcely daring to lift itself into notice for fear of ridicule. The civil engineers to a man rejected the idea of a "locomotive railway." The idea of traveling at a rate of speed double that of a stage coach was too preposterous for any engineer to risk his reputation by supporting it. Such a thing, they said, "did not fall within their general experience." Mr. Nicholas Wood, C. E., of London, in 1825, speaking of the powers of the locomotive, remarks: "It is not my wish to promulgate to the world that the ridiculous expectations, or rather professions, of the enthusiastic speculator will be realized, and that we shall see engines traveling at the rate of twelve, sixteen, eighteen, or twenty miles an hour. Nothing could do more harm towards their general adoption and improvement than the promulgation of such nonsense." "What," says a writer in the *Quarterly Review* for March 1825, "can be more palpably absurd and ridi-

CAPTAIN DICEY'S TWIN STEAMER CASTALIA.

culous than the prospect held out, of locomotives travelling twice as fast as stage coaches! We will back old Father Thames against the Woolwich railway for any sum." No engine, it was claimed, could be made to move when attached to a heavy load. "The wheels will but slip round on the rails"; besides, even admitting that the engine would move, "no railroad could be so constructed as to bear the weight of forty tuns running at the rate of twelve miles an hour; because the more rapidly a body moves the greater the momentum generated, and no railroad could stand this increase of momentum." Moreover, it was vehemently asserted that the engine running at twelve miles an hour could never be made to "run round curves"; either the curved rail would bend straight, or the machine leap the track.

When engineers, high in their profession, whose experience had been large and whose opinions on such matters was held to be of great moment, advanced such ruinous views, with nothing to refute them but the evidence of a self-educated mechanic of Northumberland, it is not surprising that men of other professions began to find objections based on their own professional learning. Sanitary objections were now urged against railways; and many wise doctors (never to be outdone at such a time) strongly inveighed against tunnels. Sir Anthony Carlisle insisted that "tunnels would expose healthy people to colds, catarrhs, and consumption", and others believed the noise would be injurious to hearing. But worst of all was the "destruction of atmospheric air", as Dr. Lardner termed it. This learned gentleman made elaborate calculations to prove that the provision of ventilating shafts would be altogether insufficient to prevent the dangers arising from the combustion of coke, producing carbonic acid gas, which was fatal to life. There was not, however, the same unanimity among the doctors as among the engineers. Indeed, the proverbial disagreement of the doctors was, in this case, productive of much good. Solemn documents in the form of certificates, signed by many of the most distinguished physicians of the day, attesting the perfect wholesomeness of tunnels, were prepared and published. There were not wanting some, however, who, in default of reasons of their own, carried the statements made by others to the last extreme, and asserted that the air along the routes of the railroads would become unhealthy, that birds would drop dead as they flew over the locomotive in consequence of the CO_2 discharged: and that the noise would cause cows to cease giving milk and women to miscarry!

Nor did the clergy and country gentlemen fail in this extreme. So violent was the antagonism of many patient and long-suffering men "of the cloth" to even a survey being made on their grounds, that the expedient was resorted to of performing this piece of work while the clerical gentlemen were in their pulpits.

By far the most persistent opposition, however, was undoubtedly that met with among those classes whose pleasures or interests were directly interfered with, or whose prejudices had been aroused through ignorance and false representations. For the opposition resulting from this latter cause, the press must to a great extent be held responsible. Thus in 1825, when the Liverpool and Manchester Company were preparing to introduce their bill to Parliament, the Leeds, Liverpool, and Birmingham canal companies appealed to the public to oppose the measure, and a Birmingham paper invited all to resist it to the last; and subscriptions were taken up to render this opposition more effectual. The farmer was told that his cows would be prevented from grazing and his hens from laying; that his sheep would no longer fatten, his horses would start and shy when at the plough, his houses and barns would be burned to ashes by the fire thrown from the engine chimney, and the air polluted by dense clouds of smoke; his hay and oats, usually so saleable, would rot in his fields and granary, his agricultural communications be destroyed, his lands thrown out of cultivation, and himself reduced to beggary. There would no longer be any use for his horses, and the breed, nay the very species, would soon become extinct! The poor rates would be largely increased in consequence of the number of laborers thrown out of employment. Every calling was to be utterly ruined. Hundreds of excellent inns would fall into decay; and in a short time, not a solitary house of this description would be found within the four kingdoms; posting towns would become depopulated, turnpike roads deserted, and the institution of the English stage coach destroyed for ever. The noble sport of the chase, the love of which was born in every true Englishman, must be ended for all time in order that a few merchants and cotton spinners might build railroads, and send their engines screaming through the heart of the fox covers and game preserves. It was another deplorable illustration of the leveling tendency of the age. It put an end to that gradation of rank in traveling which was one of the few things left to distinguish a nobleman from a Manchester bagman. There was, however, one consolation left; none but fools would trust their persons to the conduct of explosive machines like the locomotive, and the canals would beat them after all.

It may well be believed that such a doleful picture of evils as this was not without its effect on those most interested. In the large towns, meetings were held denouncing the railway system as a delusion, similar to the many other absurd projects of that madly speculative period, when balloon companies proposed to work passenger traffic through the air at forty miles an hour, and road companies projected carriages to run on turnpikes at twelve miles an hour, with relays of bottled gas for horses. In the country, however, where not one man in five hundred knew anything about the railroad, other than that he had been told it would assuredly pass through the heart of his cabbage patch and his bean field, the fury of the opposition lead to blows. When Mr. Stephenson was making the preliminary surveys for the projected Liverpool and Manchester railroad, many of the nobility stoutly refused him permission to enter their lands. At Knowsley, Mr. Stephenson was driven back by the keeper and threatened with rough handling if found there again; Lord Derby's farmers turned out all their men to watch the surveyors; guns were discharged over the property of then Duke of Bridgwater, and men armed with pitchforks, were stationed at the gates; while at St. Helen's, as a chainman was clambering over a gate, a laborer ran at him with a pitchfork and thrust the prongs through his clothes into his back; others of his party coming to his assistance, the laborers, who had now gathered in force, poured in a volley of stones and finally completely demolished the harmless theodolite. Finally, in order to protect both his surveyors and his instrument, Mr. Stephenson was forced to make his surveys at night with the aid of dark lanterns, and to employ a "noted bruiser" to carry the theodolite.

Forty-nine years have passed since George Stephenson finished his first railroad, and all doubts of the merits of this great invention were set at rest forever. Fifty years ago it was the dream of a mechanic; today it is a great, almost the greatest, achievement of human ingenuity and human skill, the great civilizing agent of the nineteenth century, increasing the means of public intercourse, removing national and provincial antipathies and binding together all the branches of the world family.

Never did so marvelous an invention pass through more vicissitudes, or struggle up through more bitter opposition to a more glorious triumph never was courage tried by more reverses and disappointments that was George Stephenson's; yet that background of disaster only sets in brighter relief the spirit that bore up under all, the faith that never gave way, and the patience that never was weary.

Premium for Fireproof Construction.

The Merchants', Farmers', and Mechanics' Savings Bank, of Chicago, Ill., offers a premium of $1,000 for the best plan for two fireproof buildings, subject to conditions, among which are the following:

"One building shall be a dwelling house of not less than 18 feet front, with 5 rooms, and shall contain not less than 5,500 cubic feet; of which a complete building as per plans must be erected, at expense of the bank, by the successful competitor; also a building of not less than four rooms for dwelling, with store on ground floor, of a cubic capacity of not less than 30,000 cubic feet, subject to the same requirements as the foregoing. The successful competitor will be required to erect, at prices specified in his plans, one or fifty buildings, at the option of the bank, anywhere within the corporate limits of Chicago. The model erected by the successful competitor shall undergo a thorough test as to its fireproof qualities, and also as to the action of water upon the material when heated. All damages resulting from such test will be at the expense of the successful competitor.

The main purpose of this offer is to secure an approximately fireproof cottage; but other things being equal, pre ference will be given to the best arranged building in the matter of symmetry, convenience, ventilation, heating, and drainage, and which, as the purpose is mainly for the benefit of employees, falls in price not above $1,000 when ready for occupancy."

The competition will be open till January 1, 1875. We are curious to know if the bank really expects to have all the specified conditions filled, for one thousand dollars. Guess not, gentlemen.

A Question for American Steel Manufacturers.

The ordnance bureaux of both the war and navy departments have just ordered from Mr. B. B. Hotchkiss, the inventor of the well known rifle projectiles and of the revolving cannon not long since illustrated in these columns, two of his new breech-loading metallic cartridge steel field guns, with equipments complete, the same to be exported from Europe. The trials of these weapons, we understand, are to be held in April next. Mr. Hotchkiss informs us that he cannot obtain steel blocks, large enough for the manufacture of his guns, from any foundery in this country, and that therefore he is compelled to have resort to foreign productions. It strikes us that the necessity existing, of making arms for service of the nation outside our own borders, is a condition of affairs to which American steel manufacturers may profitably devote their serious consideration.

Recent Walking Feats.

A walk of thirty-two miles, in seven and a half hours, from New York city to Bronxville, N. Y., and return, was lately performed by James A. Crozier. The wager was $250, and eight hours time was allowed.

E. P. Weston lately completed in this city his third attempt to walk 500 miles in six days. On the second day, after about 200 miles had been walked, one foot was attacked with erysipelas, and he had to rest for a day for treatment. At the end of the six days he had walked 346 miles.

The New York *Christian Intelligencer* says: Among all our exchanges, none is valued more highly than the Scientific American. We never open its pages without finding something useful, instructive, or entertaining to reward us for so doing. It is a most valuable educator to youth; while to those who have a practical advanced knowledge of matters relating to art, science, mechanics, chemistry, and manufactures, it is an invaluable aid, keeping them thoroughly posted on whatsoever is doing, or has been accomplished, in those important branches.

Invisible Ink.

If we write with a very dilute solution of chloride of copper, which has scarcely more color than pure water, the characters are invisible; but if gently heated, they become distinctly yellow, and are easily read. Let the paper cool, and they vanish; and they may be made to appear and disappear an indefinite number of times. If heated too strongly, the compound is decomposed, and the writing becomes permanently brown from the deposition of the copper. The chloride of copper may be conveniently made by mixing solutions of ammonic chloride (sal ammoniac) and of cupric sulphate (blue vitriol).

The change of color in this and kindred cases is due to the removal of the water of crystalization by the heat. In chemical combination with the water, the salt is transparent; without the water, it is opaque. The salt, being very deliquescent, rapidly absorbs moisture from the air when cool.—*Boston Journal of Chemistry.*

DECISIONS OF THE COURTS.

Supreme Court of the United States.

THE GREAT CORN PLANTER PATENTS.—GEORGE W. BROWN, APPELLANT, *vs.* RUFUS B. GUILD, EXECUTORS, ETC.; AND GEORGE W. BROWN, APPELLANT, *vs.* JAMES SELBY *et al.*

[Appeal from the Circuit Court of the United States for the Northern District of Illinois.—October Term, 1873.]

Bradley, Judge:

These cases arise upon separate bills in equity filed in the court below by the appellant against George J. Bergen and Frederick P. Sisson, in the one case, and James Selby and others in the other case, charging them, respectively, with infringement of certain letters patent granted to the complainant for improvements in corn-planting machines, being reissues of previous patents, and praying for an account of profits, for injunctions, and for general relief. The defendant in the first named case filed an answer, and two amended answers, setting up, in general, that the complainant was not the original and first inventor of the improvements patented to him, but that the same were previously known and used by various other persons named in the answers; and that the reissued patents of complainant were fraudulently obtained; and they denied that they infringed the complainant's patents. The pleadings in the other case were substantially the same. Much testimony having been taken, the causes were heard together before the Circuit Court, and the complainant's bills were severally dismissed. These appeals are from those decrees. * The principal question in these causes is, whether the appellant was the original and first inventor of the improvements claimed by and patented to him, or whether he was anticipated therein by other persons named in the answers of the defendants.

As set forth in the bill, the first patent obtained by the complainant for one portion of his alleged invention and improvement was granted to him on the 2d day of August, but antedated the 2d day of February, 1853. This patent was surrendered on the 16th day of February, 1858, and a new patent was issued in lieu thereof, upon a corrected specification. This reissued patent was also surrendered on the 11th day of September, 1860, and in lieu thereof five new patents were issued upon five several corrected specifications, which new patents were numbered, respectively, reissues 1,036, 1,037, 1,038, 1,039, 1,040, each one being for a distinct and separate part of the original invention alleged to have been made by the complainant.

On the 8th day of May, 1855, a patent was granted to the complainant for certain improvements on his corn planter, which patent was, on the 10th day of November, 1857, surrendered, and a new patent was issued in lieu thereof on a corrected specification. This last patent was also surrendered on the 11th day of December, 1860, and five new patents were issued in lieu thereof on five amended specifications, each being for a distinct and separate part of the improvements intended to be secured by the patent of 1855. The last-mentioned patents were respectively numbered reissues 1,091, 1,092, 1,093, 1,094, and 1,095. Copies of all the reissued patents of both series were annexed to the bill. Upon the taking of proofs in the cause copies of the two original patents, and of the first reissues thereof, as well as the reissued patents on which the bill was founded, were put in evidence, together with full detailed drawings and models of the complainant's original and improved machines.

The defendants, in their answer, and the several amendments thereof, referred to many machines, patents, and applications for patents which, as they alleged, embodied all the improvements of the complainant's machine, and antedated the same.

The Supreme Court reverses the decrees of the Circuit Court and declares that the Brown patents are valid and the defendants infringers. The following points were held by the Court:

If an alleged prior invention was only an experiment, never perfected, but abandoned, it cannot prejudice a patent for a similar improvement obtained by a subsequent inventor.

An application for a patent which stands rejected will not, in such a case, avoid the subsequent patent.

The question of fraud in obtaining a reissue must be regarded as settled by the Commissioner of Patents in granting it.

An inventor cannot claim such parts of a machine as another had previously devised, and which worked well after the machine was perfected, although this was not until after the other had perfected his.

But he may claim them in a new combination of them with devices of his own which result in a useful machine.

If a patent describes the invention as embodied in a cheap and rude form, this will not relieve those who construct the machine with more expensive fixtures from the charge of infringement, however useful they may be.

The summary of the patentee's claim, usually annexed to the specification, admits that all that is not included is old, and it is a sufficient compliance with the law requiring the new to be distinguished from the old.

A claim for "mounting the attendant upon a seed-planting machine in in such a position that he can see the marks made on the ground and operate the dropping of the seed accordingly" is void as a claim for a result irrespective of the means of accomplishing it. But if qualified by the words "substantially as herein set forth," and the means are described in the specification, it is no longer open to the objection.

A patent is void which claims substantially the same thing which is claimed by the same party in a prior patent.

A peg or stop, to prevent the rear part of a machine from tipping so far as to dump the driver on the ground, is too frivolous a device to be regarded as an invention, and a patent for it is void.

NEW BOOKS AND PUBLICATIONS.

The Transit of Venus. By George Forbes, B. A., Professor of Natural Philosophy in the Andersonian University, Glasgow. With Numerous Illustrations. New York: Macmillan & Co., 21 Astor Place.

This work gives a most lucid explanation of the expected observations of the transit, pregnant as it is with results of the highest importance to physical science. The particulars of the various parties of observation and the engravings of the instruments, many of which latter are especially designed for this occasion, are replete with interest, and will repay the student, as well as the general reader, for a careful perusal.

A Fourth Catalogue of Double Stars, giving Forty-Seven Double Stars Newly Discovered by S. W. Burnham.

In December, 1873, Mr. Burnham published his third catalogue of the double stars, and shortly afterwards followed up with the present publication, first given to the public in the June issue of the Royal Astronomical Society's "Notices." Mr. Burnham's observations were, in all but one instance, made with a 6 inch Clark reflector, the exception being *tau Orionis*, a star so distant that the 18½ inch refractor of the Dearborn Observatory was necessary to reveal its duplicity.

The American Educational Annual, a Cyclopædia or Reference Book for all Matters Pertaining to Education. Volume I., 1875. New York: J. W. Schermerhorn, 14 Bond street.

A valuable book of statistics, carefully compiled and well arranged.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From September 18 to September 28, 1874, inclusive.

Anvil Bed.—A. Hitchcock, New York city.
Electric Alarm.—A. S. Howe, Utica, N. Y.
Heating Feed Water, etc.—R. Berryman (of Hartford, Conn.), Newcastle-on-Tyne, England.
Horseshoe.—R. F. Cooke, New York city.
Knitting Machine.—J. Bradley, Lowell, Mass.
Making Asphaltum Mastic.—R. Skinner, San Francisco, Cal.
Making Gas.—F. H. Eichbaum, Detroit, Mich.
Ordnance, etc.—R. R. Moffatt (of Brooklyn, N.Y.), Liverpool, England.
Reverberatory Furnace.—E. Helligendorfer, Eureka, Nev.
Telegraph.—M. Gally, Rochester, N.Y.
Tilting Coal Wagons, etc.—J. W. Upsan, Tallmadge, Ohio.
Weaving Fringe Headings.—J. T. O'Brien *et al.*, Brooklyn, N.Y.

Recent American and Foreign Patents.

Improved Tobacco Press.

James M. Gaston, New Albany, Ind.—This invention consists of the molds and follower for pressing tobacco into plugs, arranged between upper and lower rollways, slightly converging, and provided with means for forcing the mold and follower along, and wedging them powerfully together between said rollways. There are cross partitions between the ends of the molds, contrived to recede before the ribs of the follower and thus allow said ribs to extend the whole length of the group of molds whereby the necessity of fitting the ribs accurately to the molds, which would otherwise exist, is obviated; and moreover it allows of shifting the molds for making plugs of different lengths, and employing the same ribs with molds of any length. A contrivance of the end partitions is added for removing them and the mold bottoms and sides, for changing them to any required length. The inventor has furnished us the figures in deta of the capacity of his machine for making plug tobacco, of various sizes' in one day. We have not room for his statements; but if they are accurate (which we do not doubt), his invention is very important to the tobacco manufacturers. We shall probably publish engravings of the press, with detailed descriptions, in a few weeks.

Improved Fire Arm.

James B. Thomas, Montgomery, O.—This invention consists in attaching to fire arms of any size or kind a measuring instrument by which the exact distance of an object may be quickly and accurately obtained, the army officer or the sportsman being thus enabled to make the precise allowance for the rise or fall of projectile that characterizes his fire arm at varying distances. The surveyor or backwoodsman can also thus conveniently carry on his shoulder his means of defence and a perfect instrument for measuring regularly shaped sections of land.

Improved Car Pusher.

Edward Little, Alva S. Bailey, and Frederic L. Clarke, Paxton, Ill., assignors to Edward Little and Alva S. Bailey.—This is an improvement on the car pusher for which a patent has been granted to Alva S. Bailey, under date of June 3, 1873, so that the car sill may be held firmly, without possibility of detachment, during the forward motion of the car, while the clutch part gripes firmly the rail and slides readily along the same with the motion of the car. The invention consists, first, in providing the upper end of the slide beam with a pivoted sill clamp, which is readily adjusted to every thickness of car sills; and, secondly, in an improved spring rai clutch applied to the lower end of the main beam.

Improved Fertilizer Distributer and Seed Planter.

Mark Cooper, Greenville C. H., S. C.—This is an improved machine so constructed as to open a deep furrow, grind and distribute a fertilizer in said furrow, and cover it with soil. It also opens a shallower furrow above the fertilizer, distributes the seed in the furrow, and again covers it with soil.

Improved Miter Box.

Edwin Knock, Vermont, Ill.—This invention relates to boxes for guiding the saw in sawing miters and other angles in doing woodwork of various kinds. An adjustable plate is moved toward or from a main plate by suitable mechanism, according to the width of the piece to be sawn, and may be adjusted to saw at any angle from a right angle to almost any other desired.

Improved Iron Ship Builder's and Boiler Maker's Gage.

James McPhail, Ellis, Kan.—Two guide rods have a gage head sliding on them, fastened by means of a plate and hinged clamp. A slotted hole gage is held on the rods, having a fixed hole and a slide plate also with a hole. The holes may with it be adjusted to any desired distance from each other. The boiler plate is secured against the previously adjusted guide, so as to bring the lap edge in position to have the location of holes determined by the hole gage. The movable plate is moved to or from the gage hole, and the whole instrument is then moved along the lap edge until the hole in said plate comes where the gage hole had been, and thus the places for hole after hole are indicated at uniform intervals.

Improved Pile Cutter.

Isaac E. White, Brooklyn, N. Y.—In this invention, the saw frame is made independently adjustable in a shifting frame, so as to permit the adjustment of the saw shaft or of the frame, or of both.

Improved Track Clearer.

Thomas C. Churchman, Sacramento, Cal.—A scraper raises the snow from directly over the rails and delivers it to a vertical rotary cylinder, whereon are fixed strong spiral flanges, which, being turned from the center of the machine outward, beat the snow off at the sides, and at the same time screw it upward, so as to pack it into the sides of the cut when the snow is as deep as the hight of the cylinders, or throw it to the top when not so high. The cylinders are hollow, perforated in the shell, and have a steam pipe entering the interior chamber through the top journal, for delivering steam to heat them. Below the scraper is a perforated pipe receiving steam from the boiler through conducting pipes, to heat the scraper for softening the snow.

Improved Fare Box.

Cassius M. Cooledge, Rochester, N. Y.—This box is designed to be carried by the collector to the passengers, who are to deposit the exact fare therein. Glass in the side and top enables the collector to see that the passenger deposits the proper amount. The money is placed upon a wing through an opening and slides to a lower compartment, being allowed to do so by the conductor turning a handle and so moving the partition. By the same operation a bell is caused to ring.

Improved Potato Digger.

Paul Dennis, Schuylerville, N. Y., assignor to himself and David Craw, same place.—The plow is placed in a diagonal position, and its ends are inclined so as to be parallel with the length of the machine. The rear end of the plow is provided with a guard, to prevent the potatoes and soil from passing off at the same end, and the forward end also has a guard for the same purpose. The lower side of the plow is made nearly flat, and in its rear part is a longitudinal T groove, in which works a bar, to which are attached fingers. The throw of this shaker bar is to be adjusted as the condition of the soil may require. A lever, operated by the driver from his seat, operates a shaft to which is attached two cams, which, when the free end of the lever is moved to the rearward, press down upon the axle, and thus raise the frame and its attachments, throwing the machine out of gear. To the shaft is also attached a hook, which, when the free end of the lever is moved forward to allow the frame and its attachments to move downward to throw the machine into gear, will pass around and beneath the axle, and lock the frame in place.

Improved Adjustable Pitch Board.

Joseph Noll, Poughkeepsie, N. Y.—This pitch board is made of metal, with sliding and slatted sides. It is arranged in such a manner that the pitch and width of tread may be adjusted along the slatted sides of a rectangular corner piece, and set rigidly, by suitable clamping screws and connecting pieces, to be readily used on either side.

Improved Lawn Mower.

Alvah P. Osborn, Seneca Falls, N. Y., assignor to Eugene A. Rumsey, same place.—The stationary cutter or cutter bar is provided with curved and projecting guards that prevent the grass from getting beyond the ends of the knives before it is cut. In order conveniently to adjust the cutter with respect to the rotary knives, it is pivoted to the head, and fastened at the upper end of the guard by a screw bolt and nut.

Improved Car Coupling.

George D. Burton, New Ipswich, N. H.—There is a socketed buffer and a solid headed one for entering the socket. The former is bell-mouthed, so that the latter will enter readily for self-coupling; and it has vertical shoulders just inside of the mouth for locking the solid buffer after entering the socket by means of notched pawls which are pivoted to side recesses just behind the head. The forward ends enter freely, and have springs to push them out as soon as the notches pass the shoulders. To unfasten the pawls, they are connected by a cord with a shaft extending up to the platform or to the top of the car, and arranged to turn for winding the cords on and off.

Improved Revolving Harrow.

Henry N. Dalton, Pacheco, Cal.—Mechanism is provided which causes the rollers to revolve uniformly; and as the harrow is drawn forward, one roller will be revolved by the revolution of the other roller, so that they will stir the soil evenly. Levers enable the harrow to be adjusted to work at any desired depth in the ground, or to be raised away from the ground for convenience in passing from place to place.

Improved Mechanism for Propelling and Steering Boats.

Andrew J. Emmons, New York city.—This invention consists of a vertically adjustable cylindrical compartment at the stern of the boat, which is rotated by a lever or tiller, and provided with a steam cylinder for rotating the screw shaft, supported in bearings connected to the compartment. The lever may be geared in any suitable manner, and the boat jointly propelled and steered by means of the screw. For entering locks or for other purposes the compartment may be turned under a full right angle from its exact position, and thereby the screw carried to one side, being protected against injury in this position.

Improved Current Wheel.

Michael McCarty, Pueblo, Col. Ter.—This invention consists of a current wheel arranged at the outside of a float which is arranged in a slip in the river bank, or between two piers at right angles to the current, so that it can be floated out to extend the wheel into the current, and back to withdraw it therefrom, for stopping and starting the wheel, and regulating it to the force of the current. A full description and illustration will be found on page 223 of the current volume of this journal.

Improved Aerial Propeller Wheel.

Lewis A. Boswell, Talladega, Ala.—This is an aerial propeller wheel in which the fans are mounted horizontally on a hub of a vertical axis, so as to revolve on their own axes independently of each other. An arm moves against a stationary cam and turns the vanes edgewise to the wind at the time of beginning the return movement, so as to offer little or no resistance while going backward, and a spring and chain are combined with each vane arm in such manner as to turn the vane back so as to take the wind when the vane begins the forward movement, at the moment the arm escapes from the cam.

Improved Machine for Welding Together Sections of Tubing.

James Sadler, New York city.—This machine is for welding boiler tubes when they are to be repaired by attaching pieces of tubes to their ends. It consists of two short cylinders on the ends of two rotating shafts. The tube is welded between the said rotating cylinders. The upper cylinder is made adjustable and governed by a pressure lever and spring attached to an adjustable bracket.

Improved Seed and Fertilizer Sower.

James Codville, Woodstock, Can.—The invention consists of a hopper conveying the seed to the sliding seed-dropping bar, to which motion is imparted by the supporting wheels, intermitting pinion, and crank rod, jointly with pivoted weighted elbow pipes. Said sliding seed bar has feed cups for regulating the quantity of seed, and feeding it to the swinging elbow pipes thereon for distributing the seed or fertilizers broadcast over the ground.

Improved Car Coupling.

Howard Daniels, Morley, Mich.—This invention consists of a rest for the lower end of the coupling pin in advance of its hole in the drawhead, a little shoulder in front of the hole, and a spring rest on the front of the car above the drawhead. The whole is so arranged that the pin, being set on the rest for the foot and leaning against the spring rest, will be thrown into the hole to fall and secure the coupling link self-actingly as soon as the buffer is pushed back against the spring under the car by contact with the car to be coupled.

Improved Lubricator.

Joseph W. Reed and Martin V. Osborn, Kalamazoo, Mich.—This invention relates to providing air openings in connection with a discharge pipe and regulating cock or plug; and also to a non-heat-conducting substance interposed between the case or cylinder and its lining. When the plug has been turned for lubricating, the oil descends into the cylinder by its own gravity as the plug is turned to open the ports and bring the air passages to register with each other to admit air to the cavity.

Improved Heating Stove.

Anna Wheeler, Brownville, Neb.—There are two hot air chambers on opposite sides of the fire chamber, from which the hot air is led away for heating different rooms. The air enters these chambers from heaters or flues located on the sides, and, to some extent, over the fire, so as to make very direct application, and through pipes, partly at the sides and partly under the fire. The chambers are divided horizontally by a partition, and the air from the lower portions, which are more exposed to the heat than the upper portions, is allowed to pass directly into other chambers through openings. There are two sets of pipes, each receiving the air from one heater, and conducting it down and through the fire chamber to the hot air chamber of the opposite side. The partitions separating the chambers have a hole with a damper, to be opened or closed at will, to pass the hot air from one to the other, as may be required in different cases; and the escape passages have dampers to regulate the escape of heated air, whereby it can be directed into conducting pipes.

Improved Water Wheel.

Abisha B. Reniff, Bingham's Mills, N.Y.—In this turbine wheel, the water is admitted through a horizontal annular stationary chute rim to a horizontal annular bucket rim of the wheel. The buckets are arranged radially to the axis of the wheel between two circular plates which converge from the top downward a third, or a little more, of the width, and then continue parallel to each other to the bottom, either with or without converging side plates to the chutes. The buckets incline forward about one third of their length, and backward the rest of their length in straight lines.

Improved Toy Dart.

Edwin B. Morgan, Paterson, N. J.—This is a dart to be thrown by a spring connected to the handle by an elastic cord, which serves both for the said spring for throwing the dart and for a recoil spring to return it to the operator, and thus to save running for the dart each time it is thrown. The object is to provide an entertaining toy for children.

Improved Car Axle and Bearing.

John Bailie, Milwaukee, Wis.—This invention has for its object to improve the construction of the axles and bearings of cars, locomotives, and other vehicles in such a way as to prevent lateral motion in said vehicles and the consequent end friction and wear of said axles and bearings. The invention consists in the combination of two parts, one an axle arm having a peripheral concavity formed longitudinally upon the arc of a circle, and the other a bearing block, the under side or wearing surface of which is longitudinally convex correspondingly.

Improved Portable Screen.

Henry L. Leach, New York city.—This invention consists of a box frame placed on wheels, which is provided with an inclined adjustable screen, and with hinged and detachable doors at the rear end for getting at the dust, and emptying the same, as required. An illustrated description of this device will shortly appear in our editorial columns.

Improved Pruning Hook.

Edward E. Stedman, Ravenna, Ohio.—The blades are made of a single piece of steel, which is bent in the center at right angles for the space of one inch, to allow it to be attached to the end of the handle. The two cutting edges face each other, thus allowing the pruning hook to be worked up or down, or by pushing or pulling. The blades are parallel to the staff or handle, but in different planes, and have a curved edge. This arrangement adapts the implement for use in such a manner as to often prevent slipping at the commencement of a downward cut.

Improved Letter Box.

William D. Dann, Phœnix, assignor to Wells M. Peck, same place.—This invention consists of the application of a signal bell to a drop letter box, together with contrivances by which the cover of the orifice through which the letters are dropped into the box will be made to cause the bell to strike when the cover is moved to open the orifice for dropping the letters in, and thus give notice of the arrival of the mail.

Improved Device for Turning Locomotive Crank Pins.

Andrew J. Schindler, Hornellsville, N. Y.—This is a tool carrier, called a quartering tool, mounted on a boring bar, which is arranged in such relation to the center of a lathe for turning and boring locomotive wheels that, when the wheel is centered in the lathe, the quartering tool will, by being revolved and fed along by the boring bar, turn off the crank pin exactly parallel with the axis of the wheel. This is done whether the wheel itself be true or not.

Improved Combined Desk, Seat, and Table.

David Francis, Birkenhead, England.—In constructing this article of furniture to serve several uses, the standards are made of wrought iron welded and riveted together. A bar of extra strength is inserted in the upright portion of the back, to give greater strength, and to form a knuckle, to which a movable top is hinged. The movable top is furnished with plates formed in L iron, with ratchet and tongue, the latter riveted on. Plates are secured to the top by four strong iron screws, and to the standards by a bolt running through the said knuckle, a longitudinal slot being provided at the end of the tongue. The bolt has a head at one end and is secure at the other by means of a split pin, with ends turned round the bolt. By means of the longitudinal slot at the end of the tongue, the top can be moved to any angle, and secured in position by means of the teeth and ratchet. The seat is secured to each standard by flat round-headed bolts and nuts. To make the desk and seat more rigid, and freer from rocking, stays are fixed to the under side of the seat, and secured to the standard by bolt and nut, and to the seat by bolt and nut and strong iron screws.

Improved Ticket Clasp.

Hermann Lücke and Philipp Brümmer, Worcester, Mass.—The clamp is formed by bending and doubling over an extension of the main plate. A spring, which curves over the clamp, latches in the hook, which secures the device to the clothing, and protrudes through the clamp. A point is cut from the clamp, which extends through an orifice in the plate to puncture the ticket, and prevents it from being withdrawn. There is also a spring hook, at the lower end of the main plate, upon which baggage checks and similar articles may be safely confined. A pencil holder is besides added, it being a lateral extension of the plate, bent in a circle to form an eye and hold the pencil by friction. A thread cutter is provided, formed of a piece of metal, separate from the plate, but attached thereto by means of solder, having a curved slot therein. In the slot is fixed a steel blade. The thread to be cut is forced down into the acute angle of the opening, and is severed by its contact with the edge of the blade.

Improved Reciprocating Winnower.

Henry Keller, Sauk Center, Minn.—This invention relates to improvements in the reciprocating winnower or fanning mill patented by the same inventor under date of June 24, 1873, by which the grain may be separated as to fineness and delivered directly to suitable measures, and also the whole mill stiffened and braced in a more perfect manner. The present device consists mainly in the arrangement of spouts supported in the frame below the fan box for delivering the winnowed grain in connection with the lower separating screens supported in the shoe, and provided with spout-connecting guide straps. The grain is thus continuously and steadily separated from the chaff, assorted as to fineness, and fed to the receiving measures.

Improved Ditching Machine.

Jordan W. McAllister, Woodson, Ill.—The ditching wheel is made with three or more flanges upon its face. The central flange is attached to the center of the outer ends of the spokes. The tyres are then put on, and afterward the side flanges. This construction leaves the face of the whee entirely smooth, so that the plows or scrapers will encounter no obstructions in removing the soil from said wheel. In bearings in the front vertical bar of the frame, works the rear end of the draft shaft, the forward part of which passes between four vertical angle iron posts of an upright frame. To the latter is bolted a horizontal plate, which is slotted to correspond with the space between the posts of the frame, so that the shaft may not be obstructed in its up and down movement. The forward part of the plate passes through a slot in the bolster, and has four pairs of friction wheels pivoted to it, which rest against the front and rear sides of the said bolster. The plate and vertical frame may be moved laterally, to keep the ditching wheel in line with the ditch, should the bolster, axle, and wheel deviate from said line. The ditching wheel may be raised from the ground for passing out of and into the ditch, for turning, and for passing from place to place. Suitable mechanism, governed by a lever, enables the ditching wheel and its frame to be inclined to one or the other side to keep them vertical should the surface of the ground, and consequently the bolster plate and frame, be inclined.

Improved Skate.

Reginald H. Earle, St. John's, Newfoundland.—In this device there are slotted pieces penned to the foot plate, which are pushed apart or drawn together to grasp the boot by a suitably pivoted lever acting upon a longitudinal plate through inclined slots, in which projections on the flanged grasping arms pass. The fastening apparatus on the heel is operated by moving a screw in the shank of the skate; and the entire mechanism is such that the skate may be easily adjusted or removed without requiring the use of an extra key or wrench.

Improved Oval Lathe for Finishing Hats.

Carlos W. Glover, Danbury, Conn., assignor to the Tweedy Manufacturing Company, same place.—There is a hollow arbor, the journals of which revolve in uprights, and which carries a fly wheel. The ends of a crosshead work in bearings formed in the fly wheel, and to it is attached a spindle, which passes longitudinally through the hollow arbor, and is made smaller than the cavity of said arbor, and tapering, so that it may have an oscillating movement therein. The end of the spindle has a screw thread cut upon it to receive the hat block. The screw thread also carries a crank arm, the crank pin of which enters a hole in a ring, which fits into, and works in, a ring groove in a plate. With this arrangement, when the crank is in a vertical position above the spindle, as it moves through the first quadrant, the spindle moves downward, bringing the center of the spindle into line with the center of the hollow arbor. As the crank moves through the second quadrant, the spindle moves upward, and again moves downward through the third quadrant, and upward through the fourth quadrant having thus two upward and two downward movements during each revolution. The effect of this is to keep the upper side of the work always in the same horizontal plane.

Improved Brake for Steering Wheels.

John P. Geisler, Dubuque, Iowa.—A swinging bar is so arranged as to be pressed by a lever, through the medium of a triangular block, against the rim of the wheel. When the pilot presses with his foot on a treadle, the long end of the lever will be raised and the brake will be applied. The amount of pressure which he thus applies determines whether the whee is to be suddenly stopped or simply retarded. The back motion of the lever is produced by a spring. When the brake is applied, the opposite side of the rim of the wheel bears against the end of a timber, which prevents the straining of the wheel and adds to the friction and power of the brake. The parts of this brake are duplicated to allow the pilot to stand either to the right or left in operating the wheel.

Improved Life Raft.

Bernard Almonte, Great Barrington, Mass.—This raft is composed of four, more or less, sections, hinged to each other and to a central keel, and made of planks. Each section is provided with a keel, and on each side of each keel is an air chamber of waterproof material. These sections, being thus hinged together and to the keel, fold up when not in use. Latches hold the sections on the same plane, so that they form a broad platform when on the water. When launching the raft, one of the sides is let loose from the davit hook, allowing it to unfold and hang by the side of the vessel, where the latches are adjusted so that, when it is launched, it is ready for use.

Improved Harrow.

Martin McNitt, Mound Station, Ill.—In this invention, the teeth of the rear bar of the series are adapted to assume an angle or position different from the teeth of the other bars. The result is that the teeth of the rear bar may be set at different angles, and hence be brought into action even when the others are out of action altogether.

Business and Personal.

The Charge for Insertion under this head is $1 a Line.

S.I.Cotton Seed to sell, box 28, Lake City, Fla.

The City Council of Green Castle, Ind., wish to receive proposals for putting down an artesian well. Bore to be 8 inches, and from 6 to 1800 feet deep, through Limestone Rock. Would also like to correspond with parties putting up water works. Address Alvah Brockway, Committee, Green Castle, Indiana.

Situation Wanted—Steady, middle-aged, Practical Mechanic, Bobbin Spool and Tool Maker, Machine and Hand Wood Turner. Familiar with business, D. E. Book Keeping, and the Control of Labor. T. Henry Van Riper, 76 Marshall St., Paterson, N. J.

Oilers for Machinery and Shafting—are reliable—$1 per doz. [Sample sent for 15 cts. S. F. Burgess, West Morris, Conn.

The Varnishes and Japans of the London M'f'g Co. compare favorably in price with, and are unexcelled in purity, durability, and color by, any first class houses in Europe or America. Hyatt & Co., office 246 Grand St., New York; Factory, Newark, N. J.

Patent for Sale—The best Burglarproof Door Lock in the world. F. Gyss, 196 Greene St., N. Y.

A small sum will buy a Newly Patented Monopoly. Address Jamer & Jacobs, 84 John St., N.Y.

For Sale—Excellent Chucking Lathe, 50 in. swing. Price $275. Forsaith & Co., Manchester, N.H.

Bartlett's Boulevard, Street, and Park Lamps excel all. Park size, $3; Street, $5; Boulevard, $6.50. Reflectors, $1 to $3 each; old style square Lanterns, from $3.50 upward, according to quality. General Depot, 569 Broadway, corner Prince St., New York.

Chester's Boiler Scaling Solution and Compound. Send for circular. Office 237 Broadway, N. Y.

New Stiles' No. 4 Geared Press, Cheap.—J. S. Newell & Co., 53 Haverhill St., Boston, Mass.

To Manufacturers and Amateurs—Solutions for covering all kinds of metals with different metal, either by Electro Plating or chemical process, always on hand, with reliable direction for use. Address Alb. Lovie, 222 N. 4th St., Philadelphia, Pa.

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Answers to Correspondents

C. H. does not send his name and address.—J. G. can bend sleigh runners by following the directions on p. 43, vol. 30.—C. K. will find recipes for waterproof glue on p. 379, vol. 30; for polishing iron and steel on p. 133, vol. 31.—H.C. K. will find a description of ice-making machinery on p. 243, vol. 30. Pure butter needs no artificial coloring.—F. C. M. will find instructions concerning induction coils on pp. 215, 218, 363, 378, 379, vol. 30.

(1) T. S. K. asks: What will be the proper size of a boiler for a cylinder $1\frac{1}{2}$x3 inches, and what will be the size of the flues for such a boiler? Of what plate should it be made, and what amount of horse power will it give? A. You do not give sufficient data.

Will calcined plaster be fit for cores for small castings? A. Yes.

Will white metal wear as well, for a small engine, as brass? A. Yes.

(2) J. C. S. asks: Given the diameter of a circle, how can I find the length of a chord that will cut off one third of the area? A. The chord is about 0·961 of the diameter.

(3) H. W. asks: 1. Of what size and how set should a boiler be to run an engine of 1 inch bore by $2\frac{1}{2}$ inches stroke at 200 revolutions per minute at 15 lbs. on the square inch? A. Vertical boiler 12 inches in diameter, 3 feet long, with 6 tubes, $1\frac{1}{2}$ inches in diameter. Set it upright, with fire underneath, and casing around. 2. How thick should it be to hold 45 lbs. steam? A. One eighth of an inch. 3. Of what size should the safety valve be? What should be the distance between the notches, each notch denoting 5 lbs.? A. One quarter inch diameter. Distance between notches depends upon the weight.

How much steam will one gallon of water produce if confined in the same space? A. One gallon.

(4) G. E. asks: I wish to construct a small steam engine to run on a lathe of 7 inches swing. How large a cylinder will be necessary? What should be the area of ports? What should be the diameter and weight of fly wheel? What proportion should the connecting rod have to the length of stroke? A. Make the engine to develope about ¼ horse power. Ports 1-20 area of piston. Fly wheel, 6 miles diameter; weight, 15 lbs. Connecting rod, from $2\frac{1}{2}$ to 3 times length of stroke.

Is there any work published for amateurs or others on the construction of small engines? A. There is no such book; but you will find many valuable hints and suggestions in back numbers of the Scientific American.

(5) B. R. asks: 1. What is meant by lap and lead of a steam engine, and what is the proper method of setting a slide valve? A. Consult Auchincloss on "Link and Valve Motions." 2. What power would a high pressure engine of 16 inches cylinder by 30 inches stroke, at a pressure of 60 lbs., running at 40 strokes per minute have, and what power would the same engine have with a condenser? A. You can answer this by multiplying the mean effective pressure of steam on piston by distance in feet that the piston moves in a minute, and dividing by 33,000.

What is a good work on bird stuffing? A. Brown's "Taxidermist's Manual."

(6) C. M. C. says: I am operating an engine with a cylinder $8\frac{1}{2}$ inches by 14 inches stroke; the bed frame sits fair on top of boiler. There are two 6 feet driving wheels; the crank shaft is $5\frac{1}{2}$ inches in diameter; the bearings of the crank shaft are 8 inches in length. The wristpin is 3 inches in diameter and 3 inches long. Key up the connecting rod as I may, the engine has a thump that can be heard 200 yards off at all speeds up to about 160 revolutions; above that speed the thump appears to cease; but as soon as the speed slacks, it commences again. If I tighten up the connecting rod brasses, they heat and cut in spite of all the oil that we can put on them; if I leave them slack, they cut without heat. The main journals will also heat if a little tight, and cut if slack. I have tried every plan that I have ever heard of. I have run it tightened up and slack. I have lengthened my main rod and shortened it. I have put in liners until the strap key would hardly enter. I have tightened my cylinder rings, and I have run them loose, and all to no effect. What shall I use for it? A. It appears from your account that the valves are not set properly. Possibly the piston may be loose. An indicator diagram would be very apt to show the cause of the trouble.

(7) J. W. E. asks: 1. If I have a number of blocks of ice, about 3 feet square and 1 foot thick, frozen all round 1 or 2 inches in thickness, there still being 8 or 10 inches of water in the center, and I store these cakes all together in an ice house, will they freeze solid? If so, will they keep as well as if they were frozen solid before being stored? A. They will not freeze solid. 2. Is there any book published on ice, or the proper construction of ice houses? A. We do not know of any. See answer No. 29, p. 251, vol. 31.

(8) H. C. asks: Please give me a formula for preparing cotton, to be not so explosive as gun cotton, yet to burn rapidly and leave no perceptible ash? A. Sulphuric acid of specific gravity 1·70, 6 ozs.; dried nitrate of potassa $3\frac{1}{2}$ ozs.; water 1 oz. Mix the acid and water in a porcelain vessel, and add the pulverized niter, gradually stirring with a glass rod until the lumps disappear and the mixture becomes transparent. Place a thermometer in the mixture, and when it indicates between 140° and 100° Fah., the cotton should be immersed. Take 60 grains clean cotton, separate it into 10 or 12 bolls, and immerse the bolls separately; and leave the whole in the mixture for 10 minutes. The temperature should fall to 140°. Float the cup on boiling water, and maintain it between 140° and 150°. At the expiration of 10 minutes, lift the cotton with glass rods, and squeeze out the acid quickly; and dash the mass into a large vessel of clean, cold water, separating the mass so as to wash it thoroughly and quickly; complete the washing by immersion for several hours in running water, then spread it out to dry spontaneously.

(9) G. H. R. asks: What is the method of obtaining the latitude of any place by the use of the box or pocket sextant? Is there any work which explains the use of the sextant? A. You will find the information you desire in Loomis' "Astronomy."

(10) B. A. C. asks: How is lead pipe made? A. It is forced over a die by hydraulic pressure.

(11) H. M. asks: I am about building a cheap rain water cistern. 1. Is it practicable to dig my cistern to the required dimensions, and then to cement directly on the walls without the use of bricks, giving it two or more coats? If it can be done, would it make a substantial job? A. It is not safe to attempt the construction of a cistern on the plan you propose; but if your soil is hard enough to stand to the line when your excavation is made, you can line it with a 4 inch wall of brick laid up in cement and plastered with the same on the face. If this is laid hard up to the bank, it will make a tight cistern. 2. I wish to raise the water with a pump; can I construct a pump by rabbeting the sides together, using square buckets? A. If you inquire the price of pumps, you will find it more economical to buy one than to make it and risk the chance of failure.

(12) H. D. S. says: I am building a small engine, 1x2 inches. What sized boiler should I use, to run it, driving a sewing machine? Would copper or iron be best? A. Make one 12 inches in diameter, 2 feet high, with 6 flues, $1\frac{1}{2}$ inches in diameter. Either copper or iron ⅛ of an inch thick will answer, the former being more durable of the two.

(13) G. A. B. asks: Suppose a rope is stretched moderately tight between two trees, and a weight of 140 lbs. is suspended from the center, what is the strain in pounds on the rope on each side of the weight? Is it 70 or 140? A. If t = tension of rope, w = weight, a = angle between parts of rope on each side of the weight, then $t = \frac{w}{2\cos. a}$. From this equation you will see that the tension of the rope is equal to the weight when the angle is 120°.

(14) D. H. E. asks: Will a stream 3 inches square in cross section under 8 feet or 6 feet head, afford power to run a 80 saw gin? A. No.

(15) M. A. asks: If a wheel rolls down an incline with nothing but inertia to resist its descent, where is its axis, theoretically? A. The axis is a line passing through the center of inertia of the wheel, which generally nearly coincides with the geometrical center.

(16) F. O. S.—In general, machinery can be driven with less power by belting than by gear wheels.

(17) H. W. G. asks: 1. What does the best flint and crown glass cost per lb., such as is used in the best achromatic object glasses? A. Chance's flint glass, such as is used in making small object glasses for telescopes, costs $2.50, and crown glass of the same quality $3, per pound. Camera glass, which is less expensive, is used for cheaper achromatic lenses and photographer's tubes. 2. To calculate the earth's distance from the sun by the transit of Venus, does not Venus' distance from the sun (or what is more likely, from the earth) have to be known before the problem can be solved? A. The relative distances of the planets from the sun being computed from their times of revolution by Kepler's third law, the earth's distance is to Venus' distance as 1,000 is to 723. The ratio of Venus' distances from the earth and sun is as 277 : 723, and Venus' parallax measured on the sun's disk is in miles 2·61 times the distance in latitude between two observers on the earth. The linear value of a second of arc at the sun being about 460 miles, the solar parallax, or angle which the earth's radius subtends at the sun, will be about 9 seconds of arc, and his distance 91,500,000 miles.

(18) J. H. S. asks: How can I obtain a certificate as an engineer? A. You must apply to the local supervising inspector in your district. 2. To whom should complaint be made of a steamer, run, on an inland lake, by a common machinist who never ran an engine of any kind before, and is not a competent man in any way? A. To the inspector.

(19) M. M. asks: What is the best way to regild parts of a mirror frame? A. See p. 96, vol. 30.

How is it that when the moon is visible the aurora is not? Has the moon anything to do with the appearance of the aurora, or is it merely a coincidence? A. The light of an aurora is usually so faint that it is not visible except on dark nights.

Are atoms all of one and the same size? A. No.

(20) D. B.—The cost of an analysis would be larger than such a recipe would be worth.

(21) T. C. asks: In a small spring of water, near where the water emerges from the ground, I found a crab similar to the salt water crab, but of a darker color. Can you tell me how it came in such a place? A. A. Your description is too indefinite. It might have been a fresh water shrimp.

(22) H. W.—Filtering water through brick is commonly done, and is a most efficient method.

(23) H. I. H. asks: What is the rule for finding the number of square inches in any circle? A. Square the radius in inches and multiply by 3·1416.

(24) C. S. B. says: I have discovered a new rule for the solution of a certain kind of equation which I think preferable to the one usually given in the text books. It is applicable to all equations which can be reduced to the following form: $(x^2+ax)^2 \times b(x^2+ax) = c$. The rule usually given in books is this: Reduce by inspection the given equation to the above form; then consider the compound term as a single quantity, find its value by completing the square and extracting the square root of both sides of the equation, from which the value of x is easily found. My rule is this: Extract the square root of the left hand member of the equation as far as possible, which will show you a numerical quantity that must be added to the left hand member of the equation to complete the square, add thi quantity to both sides of the equation, extract the square root of both sides, and you have an equation from which the value of x is easily found. The advantage of this rule above the one usually given is that it is sometimes very difficult to reduce the given equation to the above form, whereas that necessity is obviated by the last rule. A. We do not know that we understand your method thoroughly. We append two examples which are readily solved by the ordinary method. If you will send us solutions in accordance with your rule, we shall be better able to compare it with the old method. 1. $\frac{4x^2}{7} + \frac{2x}{7} + 10 = 19 - \frac{3x^2}{7} + \frac{58x}{7}$

2. $a^2+b^2-2bx+x^2 = \frac{m^2x^2}{n^2}$

(25) J. G. W. asks: Where can I get any information that will aid me in foretelling the weather by the aid of a barometer? There are times when the mercury is well up in the tube, and yet considerable rain falls without much falling of the barometer. At other times when the barometer is falling, there is no rain. A. Read T. A. Jenkins' pamphlet on the barometer, thermometer, hygrometer, etc.

(26) M. A. asks: 1. Why is it that the contact breaker in an electro-magnetic machine stops and makes the current jump, very nearly stop, and then jump again? Is it because the platinum is not good? A. The spring and face of the hammer should be perfectly clean, as should also all connections. The trouble may lie in your battery and not in the coil. We do not understand your other question. Copper, not iron, wire is used in the coil.

(27) S. K. S. asks: How large a tube would be required for the barometer referred to on p. 331, vol. 30? A. From 3 to 4 feet long.

I made a storm glass according to the rule given on p. 234, vol. 29, but could not tell anything by it, the liquid remaining cloudy all the time. On the lowering of the temperature, it would form crystals like snow flakes. A. Your trouble is probably due to impure chemicals. These glasses are not considered as absolute indicators. Some claim that they are affected by electrical disturbances.

What is meant by the power of spy glasses, 10, 15, 25, etc.? In the last instance, does it mean that an object 25 miles off can be seen as plainly as it would if it were only one mile distant with the naked eye? A. Yes but this is not absolutely true, as the intervening atmosphere, with its varying density and humidity, is never taken into account.

(28) I. T. O. says: I tried to make marine glue after the recipe you give in your book; I first put the rubber in one bottle and the shellac in another and then poured, as I thought, enough ether on each to dissolve it; I put them on a warm stove, removing the corks to let the gas escape. Both bottles took fire and burst. A. Fill your bottles with ether, stopper tightly, and keep in a cool spot for forty-eight hours. The bottles, because of their extremely volatile and inflammable contents, should be kept cool, and at a safe distance from fire of every kind. We are sorry for your accident.

(29) O. S. C. asks: 1. How can a permanent gold color be given to metallic lead? A. By alloying it with a certain percentage of copper. 2. How can the specific gravity of metallic lead be increased? A. The specific gravity of pure lead is unalterable, but an alloy of lead with either gold or platinum may be made, the specific gravity of which will be greater than that of lead alone.

(30) H. D. M. asks: 1. How can I apply paraffin to heavy canvas to make it waterproof? A. Saturate with solution of paraffin in naphtha. 2. How shall I make it of a dark color? A. The paraffin is first melted and then digested for a short time with coarsely powdered or bruised anacardium nuts, the fruit of the *anacardium orientale*. This nut contains a black vegetable fat, which combines intimately with the paraffin.

(31) L. L. G. asks: Why does a piece of lead pipe become filled with holes when it runs through certain soils? A. There are many mineral salts which, when dissolved in water or when brought into contact in a moist condition with lead, corrode it. Which salts are present in the water or in the ground through which your pipe runs could only be determined by analysis.

(32) H. F. asks: What is the specific gravity of ordinary vulcanite, vulcanized for 2 hours under a temperature of 320°? A. We will determine the specific gravity of such a piece of vulcanite; but we have none at present in our possession.

(33) C. G. H. asks: 1. If a man built an engine, boiler, and boat, and put them together, would he be considered fit for an engineer, to run said boat? A. This is a question that could only be answered by the inspecter. 2. What does a boat's certificate cost? What does an engineer's certificate cost? A. Licence for boat costs $25. Licences for captain, pilot, and engineer, first class, $10 each, second class $5.

(34) D. O. asks: In what part of Europe did the first locomotive engine run? A. In France, in 1769.

(35) L. P. asks: What proportion should the cooling surface of a condenser bear to the heating surface of a boiler? A. From one half to two thirds. Use thin tubes.

I send you a specimen of boiler scale. Of what is it composed? A. The scale seems to be formed from water containing salts of lime. It is probable that the use of tannate of soda would be advisable.

(36) M. M. asks: How should a square piston or abutment of a rotary engine be packed, and what kind of material is best for the packing? A. This is a matter that has engaged the attention of inventors for many years, and is, as yet, undecided.

(37) G. L. M. asks: Is there a simple solution of this problem: The area of a segment and the radius of a circle being given, to find the chord? A. We do not know of any rule.

(38) J. C. says: 1. I wish to make a flat bottomed sail boat, about 15 or 16 feet long, with center board. How wide and how deep should I make it to be nicely proportioned and safe? A. She should be 6 feet wide and 2 feet deep. 2. How can I bend the boards for the sides, having no steam box? A. You can either do it by making saw cuts, or by working it out in the proper shape in short lengths and joining together. 3. About what sized sail could she carry for speed and safety? A. About 8 feet high on the mast, with boom 11 feet long. You can add a topsail, if you find that the boat will stand it.

How is gold lettering done? A. Attach the gold leaf to the leather by pressure, then take the required letters (which must be of brass and heated), press them singly and heavily on the gold leaf, having first smeared the face of each letter on a greasy rag.

(39) J. B. asks: What quantity of water would be required to supply an engine of the following dimensions: 2 cylinders each 16x18 inches, working with 75 lbs. per square inch, at 100 revolutions per minute? A. You do not send sufficient data. You should state the point of cut-off.

(40) B. W. D. asks: Are there any self-regulating mills in use, so that, when the wind gives a high speed to the fans, they can be changed to present less flat surface to the wind, and consequently diminish the motion, and *vice versa*? A. Yes.

(41) J. C. asks: If the wind has a velocity of 1 mile an hour, it will exert a pressure on 1 square foot of surface equal to 0·005 lbs. On a surface 5 feet square, will the pressure be more than 25 times as great? A. Multiply the pressure per square foot by the number of square feet in the surface.

Where can I find a description of the Mammoth Cave, Kentucky? A. See p. 321, vol. 25.

(42) J. R. W. asks: When was ammonia gas first applied as a motive power? A. We could not give you the date of the first patents, without a search; 1869 was, we believe, the date of the earliest patent for an ammoniacal engine that attracted much attention.

What is the principal difficulty in using compressed air as a motive power? A. Its cost. Tests with this motor have not been very extended.

(43) H. F. M. asks: What sized engine will be required to propel a boat 70 feet long by 6 feet beam at the end and 12 in the center, against a current of 2 or 3 miles per hour at low water, and 4 or 5 miles at high water, the boat drawing 6 inches of water with considerable rake at bow and stern? The boat is to go empty up and come down loaded. A. An engine with a cylinder 12x12 inches.

(44) J. C. K. asks: What should be the diameter of an upright iron shaft 3 feet long, 2 feet 6 inches between bearings, with 4 levers each 10 feet long with a horse hitched to the outer end of each? The shaft should be of such size as to resist torsion. A. Allowing that each horse will exert a force of 200 lbs., the diameter of the shaft, to resist wrenching, should be about 2½ inches.

(45) W. S. F. asks: How can I make a good and cheap boot blacking? A. Take ivory black 2 ozs., sweet oil ½ tablespoonful, and brown sugar 1½ ozs. Mix them well, and then gradually add ½ pint of small beer.

What colored liquid preparation (red preferred) can I place in small quantities in a bottle of alcohol and have it always remain on the surface and not become mixed with or dissolved in the alcohol? A. We know of none.

If a bag made of white rubber were filled with oil, what effect would the oil have on the bag? Would it soak through the rubber or rot it, in time? A. This depends upon the kind of oil used. For instance, sweet oil would have very little effect upon the rubber, while petroleum would dissolve or destroy it in a very short time.

(46) B. C. W. says: 1. I have a hydraulic press necessarily exposed to frost, sometimes as low as −5° Fah. What liquid can I use which will not congeal at this temperature, alcohol and kerosene being objectionable? Will glycerin diluted with water do? If so, in what proportion? A. The solution you speak of is much used where it is necessary for the liquid employed to stand a low degree of temperature. An aqueous solution of glycerin of specific gravity 1·024, containing about 10 per cent of glycerin, freezes at 30° Fah. With 60 per cent of glycerin, of specific gravity 1·127, the freezing point of the solution is below −31° Fah.

(47) S. W. asks: 1. During what period, after the death of Julius Cæsar, did the Romans (owing to a misunderstanding of the theory of the Julian year) intercalate a day every third instead of every fourth year? A. For 36 years. 2. In what year was the intercalary day changed from its position between the 24th and 25th of February to the end of that month? A. We cannot give you the date; but it was probably in the time of Pope Gregory XIII. Perhaps some of our readers can furnish the information.

Which do you consider the best work (not too costly) on astronomy, containing the mathematical formulæ and tables for calculating the planetary motions, and tables of the lunar perturbations? A. We do not think there is any single book that covers this ground. We can recommend Norton's and Bartlett's works on astronomy.

(48) M. C. asks: What will remove fruit stains from linen, etc.? A. Try hot soap and water; if not successful, try lemon juice; if again unsuccessful, try oxalic acid.

(49) J. H. F. asks: Would an achromatic object glass 1½ inches in diameter, and of 30 inches focus, answer the same purpose for a telescope as the meniscus described by B. on p. 7, vol. 30? A. It would be much better. Cheap achromatics are made of camera glass, and the lenses ground several at once upon the tool.

(50) J. S. A. says: Some clergymen take their regular full meals on Sunday and attend to their duties the same as other clergymen who eat very little food, and that of a light kind, till the Sabbath is over, when they take a full and substantial meal. Which is best for health? A. This is best solved by experiment. As a general rule, men of well marked bilious temperaments require more food than those of the nervous temperament. The best rule, however, is to eat at regular hours.

Some telegraph posts produce a sound which is much like that of a steamboat's whistle in the distance. The sound can be heard when the weather is perfectly still and at a distance of from five to ten yards. These posts are cedar and stand in a sandy soil. Their wires are connected with the post by glass insulators. What produces the sound? A. The wire forms a mammoth æolian harp; and when drawn unusually tight, an almost imperceptible breeze will cause it to give off this low murmur.

(51) H.J.J. says: I am running 5 fifty horse power tubular boilers. Our water is hard; and for three months in the year (the time I use the hard water) I find that scale accumulates to the thickness of 1-16 of an inch. I am pumping all of the feed water from a large hot water tank, containing one half water from the well; when the exhaust water from the trap does not heat it to 100°, I use a little direct steam. Yet the scale continues to form. Would you recommend the use of sal soda in the hot water tank to soften the water before pumping the same to the boilers? If so, in what proportion to every 100 gallons of water evaporated? A. We think that the soda, even if effective would be a very expensive remedy. Some other form of heater might be better, or perhaps you could trap more of the condensed steam. We advise you to consult an expert.

(52) O. M. says: Olmsted's "Astronomy" says that the next transit of Venus will occur on December 8, 1874, while all late accounts say it will occur on December 9. Possibly both are correct, according to the side of the 180° of longitude from Greenwich from which it is viewed. Is this the case? A. Yes. The astronomical day commences at noon, and is half a day behind the civil day. The transit of Venus commences astronomically at Bombay on December 8 at 18h. 42m., Irkutsk, on December 8 at 20h. 40m., Pekin, December 8 at 21h. 29m., Yokohama, December 8 at 23h. 0m., Melbourne, December 8 at 23h. 28m., Auckland (New Zealand) December 9 at 1h. 24m., Honolulu, December 8, at 8h. 4m., and is not half over at sunset. At the Cape of Good Hope, Alexandria, and Kazan the transit commences before sunrise. See Comer's "Navigation Simplified."

(53) S. H. asks: 1. What is the power of a field glass of 2½ inches diameter of about 8 inches focus? How far could I recognize a person with it? A. Perhaps ten times as far as with unassisted vision. Short focus field glasses cannot equal telescopes in power. 2. What is the rule for computing the power of a glass? A. Divide focal length of objective by focal length of ocular.

(54) C. P. says: I read that, as alcohol can be converted into steam with much less fuel than water could, it would be economical to use it, provided a method of saving it by condensation could be devised. Is it safe to use it in a boiler used for heating purposes only, where all the vapor is condensed in the radiators and pipes and returned to the boiler? Should you deem it safe to use naphtha instead of water in the boiler, and would the steam, gas, or vapor made by heating it cause an explosion, if there were no actual contact of flame or fire? A. Both of the liquids mentioned would be dangerous if used with ordinary apparatus. The great difficulty in using volatile liquids is the prevention of leakage.

(55) J. W. B. asks: Is there any process by which fine grit of flint or quartz can be removed from fine earth or chalk deposits? A. By agitation in proper vessels with water and decanting off the liquid, holding only the finest particles in suspension from the heavier particles remaining at the bottom.

(56) C. B. asks: Please give me a recipe for printer's roller composition. A. Melt glue in water, and add molasses to keep it soft. Let cool, and you will see if it be of the right consistence. More molasses will be needed if it be too stiff. More glue is necessary in warm locations, as the composition readily softens as the temperature rises. Some makers use glycerin in combination with the molasses.

(57) S. C. asks: 1. Which is the best work on the medical use of electro-magnetism? A. "Galvanism, Animal and Voltaic Electricity," by Sir W. S. Harris, is both cheap and comprehensive. 2. Is there any difference in the currents of a medical battery and of a magneto-electric machine? A. In the former the current is stronger and more even.

(58) H. asks: Can the following problem be solved? If so, what are its roots? $x+y=xy$. $x^3-y^3=xy$. A. It cannot be solved by any of the ordinary rules of algebra, since there is only one independent equation for two unknown quantities. Moreover, from casual inspection, we are inclined to think that the independent equation is untrue.

(59) O. K. asks: How can I prevent rust on polished steel tools? A. Melt 1 oz. paraffin in 1½ ozs. petroleum, and apply with a linen rag.

(60) E. D. E. asks: What is the process for crystallizing flowers, grasses, etc.? A. One process is to thoroughly dry the flowers and grasses, and then allow them to soak in a strong solution of alum.

What are the ingredients and proportions of the compound used for marking the name or brand on unbleached cottons? A. Iodide of potassium 1 oz., iodine 6 drams, water 4 ozs., dissolve. Make a solution of 2 ozs. ferrocyanide of potassium in water. Add the iodine solution to the second. A blue precipitate will fall, which, after filtering, may be dissolved in water, forming a blue ink.

Will a pure gold stud blacken a shirt bosom? A. Yes.

(61) M. C. asks: By what part of their bodies were the Siamese twins connected? A. The connecting link was an extension of the sternum of each; it was 4 inches long and 2 inches broad.

(62) J. C. K. says: According to Dr. Ure, amber is a solid mineral, disseminated in sand, clay, and lignite formations. In another place I find it under the head of resins, and described as procured from the vegetable kingdom. It has been elsewhere described as procured by diving, the divers tearing it from a reef. Is there more than one kind of amber? A. Amber occurs often in beds of wood coal, but is chiefly found after storms on the coasts of the Baltic, between Konigsberg and Memel. It consists of a mixture of several resinous bodies, which have not been accurately examined. There is but one variety.

(63) J. B. asks: How can I make a lac or paint to turn German silver black, and stand handling without losing gloss or color after drying? A. There is one simple method by which artists may be enabled to obtain all the different tints they require. Infuse 4 ozs. of gum guttæ in 32 ozs. essence of turpentine; and 4 ozs. dragon's blood and 1 oz. annatto, each in a separate dose of essence. These infusions may be easily made in the sun. After 15 days' exposure, pour a certain quantity of these liquors into a flask; and by varying the doses, different shades of color will be obtained. Black Japan varnish, we think, would answer your purpose very well, and may be made as follows: Boiled oil 1 gallon, umber 3 ozs., asphaltum 3 ozs., oil of turpentine as much as will reduce it to the required consistence.

A barrel of cider vinegar nearly 3 years old was found to have turned black, the cause of which is attributed to the barrel having been burnt too much when new. What will make the vinegar clear? A. If the supposition is correct, the vinegar may be cleared by filtering.

(64) W. B. says: I find that my tea kettle becomes caked up with scale very often; in six weeks it will become one quarter inch thick, if left undisturbed. Is the water (from a well) likely to produce gravel, if drank without being boiled? A. There is no danger from this source. 2. How can I soften it for washing purposes, as it has been so dry here that we have run out of rain water? A. Boiling the water will render it softer, by expelling the carbonic acid and depositing the carbonate and a portion of the sulphate of lime held in solution.

(65) A. M. T. says: 1. How can I make an electrical machine with a glass plate 1 foot in diameter and ⅛ inch thick? A. Suspend your glass plate between two wooden supports, by an axis passing through its center, which is to be turned by means of a glass handle. The plate should revolve between two sets of cushions or rubbers, of leather or silk, one set above the axis and the other below, which can be pressed by means of screws as tightly against the glass as may be desired. The plate also passes between two brass rods, shaped like horseshoes and provided with a series of points on the sides opposite the glass; the rods are fixed to larger metallic cylinders which are called the prime conductors. Each rubber must be connected by a chain with the ground. 2. Will it do to make it of insulated wood coated with tinfoil? A. Yes. 3. Would a Leyden jar placed to the prime conductor be of any value? A. Yes. 4. Which is the simplest way to make one? A. It consists simply of a wide-mouthed bottle, lined inside and out to within about three to four inches of the top with tinfoil. A stopper of dried wood closes the mouth, through which passes a brass rod surmounted by a brass ball. A fine wire connects the inside coating of the jar with the end of the brass rod. 5. What is the rubber composed of, and how can I amalgamate it? A. The cushions may be made of silk stuffed with horsehair. Use common bisulphuret of tin amalgam on them. 6. How can I fix the axis firmly to the plate? A. The axis may be of light wood; the hole in the center of the glass plate should be square. 6. In Carré's electrical machine, described on p. 402 of vol. 28, how is the condenser made and applied to the machine? A. You will find that condenser described on p. 363, vol. 30. A Leyden jar would perhaps answer your purpose. 8. Cannot shocks be taken from the prime conductor without it? A. Yes. 9. What is the distance of the brass knob from the prime conductor in Carré's machine? A. The distance is not mentioned. 10. How are the ebonite disks made? A. Ebonite is rubber heated with half its weight of sulphur.

(66) Q. A. S. says: Imagine an engine made like an ordinary steam engine, but with an opening in the valve larger, and the ports larger, so that the air could go in freely, to be driven by atmospheric pressure. The exhaust is connected by a slide valve arrangement with two drums or chambers, which are heated to produce a vacuum. The idea is, that the vacuum produces a suction which draws the air out of the cylinder from in front of the piston head, alternately and instantaneously, so that the atmospheric pressure of 15 lbs. to the square inch can drive the piston head back and forth, as steam does. How much actual pressure would there be on the piston head to drive it, provided a vacuum existed in front of the piston head? I know that a perfect vacuum only exists theoretically; but suppose that the drums are made so large and heated in such a manner as to suck the air out from in front of the piston head rapidly, and strongly, would this suction add to the atmospheric pressure and give the engine more power, or would there remain in the cylinder in front of the piston head a certain quantity of air, which would offset the atmospheric pressure on the back of the piston head to the extent of 4 or 5 lbs. pressure, and leave an actual working atmospheric pressure of only 10 lbs. to the square inch? A. Air expands about 1-491 of its volume for 1° Fah. that it is heated, and its pressure is inversely as its volume. Knowing, then, the temperature of the air in the drums, you can easily calculate the pressure, which will be the back pressure in the piston. There is, properly speaking, no such principle as suction. If the pressure on the side of the piston is less than that of the atmosphere, the unbalanced pressure of the atmosphere will tend to move the piston.

(67) E. A. W. asks: How many cubic feet are there in a perch of stone? The stonemasons say 16½. A. Webster gives the same figures; but a "rod, pole, or perch" is 5½ linear measure, which makes 30¼ superficial measure, which does not agree with 16½ feet solid in any respect.

(68) J. G. P. asks: How can I make a good bronze on polished steel or iron, such as hardware trimmings and the like? A. To 1 pint methylated finish, add 4 ozs. gum shellac and ½ oz. gum benzoin: put the bottle in a warm place, shaking it occasionally. When dissolved and settled, decant the clear liquid and keep it for fine work. Strain the residue through a fine cloth. Take ¼ lb. powdered bronze green, varying to suit the taste with lampblack, red ocher, or yellow ocher. Take as much varnish and bronze powder as required, and lay it on the article, which must be thoroughly clean and slightly warm. Add another coat if necessary. Touch up with gold powder according to taste, and varnish over all.

(69) P.T.B. asks: How can I produce a verde bronze on brass? A. Dissolve 2 ozs. nitrate of iron and 2 ozs. hyposulphite of soda in 1 pint water. Immerse the articles till they are of the required tint, as almost any shade from brown to red can be obtained; then wash well with water, dry, and brush. One part perchloride of iron and 2 parts water mixed together, and the brass immersed in the liquid, gives a pale or deep olive green, according to the time of immersion. If nitric acid is saturated with copper, and the brass dipped in the liquid and then heated, the article assumes a dark green color.

(70) G. W. H. asks: Can you describe the sights used in the late rifle contest at Creedmoor, between the Irish and American teams? A. The back sights were disks with small holes in them, moved vertically on parallel bars by means of a screw. The bars were graduated and furnished with a vernier, and were attached to the stock of the rifle. The foresights were shaded by an almost circular cover. 2. Can you explain the plan of scoring? A. The scoring was according to the Wimbledon system, namely, 4 for a bullseye 3 for a center, and 2 for an outer.

(71) T. C. says, in answer to W. F. M. (No. 18, p. 250, vol. 31) in regard to using a ¾ inch pipe a short distance from the spring and then adding a ½ inch pipe: If you place a 1 inch pipe leading from the spring for about 2 rods, and then add the ¾, and then the ½ for the remainder of the distance, you will have a larger and more steady flow of water.

(72) M. P. B. says, in answer to F. A. McG.'s query: Why does a belt run to the highest point? A belt, in passing over a pulley, inclines to the outline of that pulley. This outline on a taper pulley crosses the line of the belt obliquely, which throws the first point of contact higher on the pulley than it is at the central point. As the first contact soon becomes the central point, the belt runs up.

(73) M. P. S. says, in answer to J. B. G. who asks how to make music by rubbing the fingers on the top edges of goblets: I have in my possession a musical instrument of rare purity and sweetness of tone, called an harmonicon, which was made by my father very many years ago. The sounds are produced by thin flint glass hemispheres, supported by glass stems, and varying in diameter from 2½ to 7 inches, each one giving an absolutely perfect and unchanging tone. The instrument has a compass of three full octaves, with the semitones, and is enclosed in a mahogany case, making a handsome piece of parlor furniture. Any composition, not too rapid in movement, can be played by a skillful performer. The tones far surpass in delicacy and sweetness any known instrument, uniting the softness of the æolian harp to the power of the violin. The pitch of each glass is determined in the blowing, and can be but slightly varied by cutting the glass lower at the edge. Water deadens the sound, and robs it of all its exquisite *timbre*. Many thousands of glasses had to be made before the perfect instrument was produced. It may be interesting to mention that, by means of these glasses, my father was enabled to divide a semitone into sixteen clearly defined intervals, the difference between any two successive glasses being so slight as to be almost undistinguishable.

(74) J. C. P. says: To make a carpenter's bench, take three pieces of 2x5 inches stuff, 3 feet long for supports for top. Take two 12 inch boards, 12 feet long and 1 inch thick, for sides; nail the side boards firmly on to the ends of the 2x5 cross pieces and put on a top of suitable material, and you have a bench without legs. Then take four pieces of 2x5 inches stuff of the desired hight for the legs, and frame a piece 1x3 inches across each pair of legs, 6 inches from the bottom of the leg, putting the legs at the proper distance apart for width of bench. Cut a fork or slit in the top end of each leg, so as to straddle the cross piece at the ends; put a 3½ x ⅜ inch bolt through each leg and the side board, and you have a good solid bench, that can be taken down in five minutes by simply removing the four bolts. It can also be taken through any door or window, or down or up stairs, or to any place required, thus saving a great deal of worry incident to trying to move the old style of bench. Besides, it is more easily made than any other form in use.

(75) G. M. says, in reply to A. O. W.'s query: Is there anything to make spelter flow more easily on copper? To do this, and on thin brass also, I file or rasp block tin into the spelter and borax (a small quantity), using my judgment for the mixture.

(76) A. S. says, in reply to N. S.' query: How can I put solder up in small bars, the size of knitting needles, without molds? Make a narrow trough of sheet iron about two inches in length, and punch a row of holes about 1-16 inch in diameter, ⅜ inch apart in the bottom. Affix a handle. Pour the solder from the ladle (quite hot) through the trough, at the same time moving the ladle and trough together rapidly over a plate of iron. He will find after practice that he can make the bars in this way very rapidly.

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

F. C. R.—No. 1 is a quartzite, containing hematite. No. 2 is principally iron pyrites and hematite.—J. B.—Your minerals and fossils were not received.—R. W. Z.—No. 1 is decayed shale, with red ocher. No. 3 is composed principally of red oxide of iron. No. 5 is a carbonate of iron. No. 4 is specular iron ore No. 5 is menaccanite. No. 6 is iron pyrites. No. 7 is hematite. No. 8 is aragonite. No. 9 is shale containing red oxide of iron, with seams of carbonate of copper. No. 10 is marcasite.—W. M. D.—No 1 is magnetic oxide of iron. No. 2 is titaniferous iron ore.—H. W.—It is iron pyrites in quartzite.—T. T. R.—No. 3 is a quartzite, depending upon a layer of dark sandstone, containing scales of iron pyrites. No. 4 is iron pyrites distributed in gray quartz rock. No. 5 is a schistose rock containing iron pyrites, quartz, and hornblende.

D. E. R. says that a man recently bought a whisky barrel, to haul water in; and after bringing it home, a child got hold of some matches, and tried to ignite them by scraping on the barrel head. He succeeded in igniting one, and in exploding the barrel with a report which was heard four miles off. How came an explosive gas in a whisky barrel?—C. A. G. asks: How can I take oil stains out of brown stone or freestone?—J. C. M. asks: Can you give me a recipe for razor strop paste that will not cause the strop to be come glazed in cold weather?—E. M. asks: 1. How do plumbers burn two pieces of lead pipe together, with a bolt and without the use of solder? 2. How do plumbers make a nearly square bend on the end of a large pipe?—E. B. G. says: Nearly every black bass I have caught since last spring has been full of worms in the gills, and all through the flesh; they appear like small white specks curled up in the flesh, but, when taken out, are alive. Fifteen years ago I caught a three pound bass full of worms about half an inch in length. Some old fishermen tell me that they are always so. Can any one give me information on this?—I. asks: Will goldfish breed in an aquarium?—A. P. asks: How can I deodorize rubber?—S. T. W. asks: Where can I find tables of the variation of the needle at the State capitals for the last fifty or one hundred years?—J. K. asks: Can you tell me of a good varnish to put on tracing cloth or paper that will allow of its being washed or cleaned after using in a machine shop.—B.C.W. asks: Is rubber ever used instead of leather as a packing for hydraulic presses?

COMMUNICATIONS RECEIVED.

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

On Plumbers. By C. C. D.
On the Sczaroch. By C. R. S.
On the Crystallization of Carbon. By W. T.
On a Small Engine. By H. D.
On Life and Matter. By R. L.
On the Phylloxera. By J. L.
On Machinists' Tools. By C. M. B.
On Practical Mechanism. By R. E. W.
On the Jewish Race. By S. E.

Also enquiries and answers from the following:

T. J.—A. W.—W. H. B.—C. S.—J. J.—A. R. T.—T. B.—D. S. H.—C. I.—J. H. F.

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 enquiries analogous to the following are sent: "Who makes watch and clock springs? Where can sharpeners for cotton gins be obtained? Who sells celestial maps? Where can hand machines for making cordage be bought? Who sells artificial insulators? Which is the best battery for telegraph sounders? Where can small malleable iron castings be procured? Who sells glass oil cups? Who makes a cow milking machine? Where can filters for maple sirup be obtained?" All such personal enquiries 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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APPLICATIONS FOR EXTENSION.

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

31,080.—SAUSAGE STUFFER.—A. Nittinger. Dec. 12.
31,133.—CULTIVATOR.—D. S. Stafford. Dec. 30.

EXTENSIONS GRANTED.

30,191.—PAPER BAG MACHINE.—H. G. Armstrong.
30,215.—HARVESTERS.—T. N. Foster. Two patents.
30,233.—MARTINGALE RING.—De W. C. Lockwood.
30,234.—PLANING VALVE SEATS.—C. B. Long.

DISCLAIMERS.

16,648.—WAGON GEARING.—E. Huson.
30,191.—PAPER BAG MACHINE.—H. G. Armstrong.
102,462.—COOKING STOVE.—R. M. Hermance.
149,045.—WHIP SOCKET FASTENER.—G. L. Laflin et al.

DESIGNS PATENTED.

7,777.—PRINTING TYPE.—H. Ihlenburg, Philadelphia, Pa.
7,778.—PRINTING TYPE.—P. A. Jordan, Philadelphia, Pa.
7,779 to 7,781.—GRAVE GUARD.—A. Rank, Salem, O.
7,782.—SHIRT.—H. Heath, Brooklyn, N. Y.
7,783 and 7,784.—PRINTING TYPE.—H. Ihlenburg, Phila., Pa.
7,792.—OIL RESERVOIR.—L. F. Smith, Philadelphia, Pa.

TRADE MARKS REGISTERED.

2,000.—FERTILIZERS.—Baugh & Sons, Philadelphia, Pa.
2,001.—FLAX WEBBING.—Boston Mills, Boston, Mass.
2,002.—HAT TIPS.—Christy & Co., London, England.
2,003.—EYE BALSAM.—W. M. Olliffe, New York city.
2,005.—WHISKY.—Shields & Co., Cincinnati, O.

SCHEDULE OF PATENT FEES.

On each Caveat............ $10
On each Trade Mark............ $25
On filing each application for a Patent (17 years)............ $15
On issuing each original Patent............ $20
On appeal to Examiners-in-Chief............ $10
On appeal to Commissioner of Patents............ $20
On application for Reissue............ $30
On application for Extension of Patent............ $50
On granting the Extension............ $50
On filing a Disclaimer............ $10
On an application for Design (3½ years)............ $10
On application for Design (7 years)............ $15
On application for Design (14 years)............ $30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,
SEPTEMBER 30, to OCTOBER 6, 1874.

3,880.—E. F. Herrington, West Horsick, Rensselaer county, N. Y., U. S. Improvements on harvester pitman guides and holders, called "Herrington's Harvester Pitman Guide and Holder." Sept. 30, 1874.

3,881.—I. E. Thompson, Stanbridge, Missisquoi county, P. Q. Improvement in apparatus for cooking vegetables, etc., called "Thompson's Vegetable Steamer." Sept. 30, 1874.

3,882.—A. V. M. Sprague, Rochester, Monroe county, N. Y., U. S. Improvement on can openers, called "The Sprague Can Opener." Sept 30, 1874.

3,883.—T. A. Williamson, Knowlton, Broome county, P. Q. Improvements on milk vats, called "Williamson's Packed Pan." Sept. 30, 1874.

3,884.—H. A. Mandersen, township of Maria, Bonaventure county, P. Q. Improvements on sleighs and carriages combined, called "Manderson's Combined Sleigh and Carriage." Sept. 30, 1874.

3,885.—I. Lund, township of East Oxford, Oxford county, Ont. Improvements on corn huskers, called "Lund's Corn Husker." Sept. 30, 1874.

3,886.—C. Barlow, Cookshire, Compton county, P. Q. Improvement in a machine for turning cheeses, called "Barlow's Cheese Turner." Sept. 30, 1874.

3,887.—A. Rodgers, Muskegon, Muskegon county, Michigan, U. S. Improvements in circular saw mills, called "Rodger's Circular Saw Mill." Sept. 30, 1874.

3,888.—J. W. Jones, London, Ont. Composition of matter to be used in the preservation of eggs, called "Jones' Eggnolia." Sept. 30, 1874.

3,889.—W. W. Clay, J. Kay, and T. McCash, Paris, Brant county, Ont. Improvements on wood-drying apparatus, called "Clay, Kay, & McCash's Wool-Drying Apparatus." Sept. 30, 1874.

3,890.—A. O. Kittredge, W. H. Clark, and W. I. Clark, Salem, Columbiana county, O., U. S. Improvement on a machine for marking lines of bend of sheet metal for molding, called "Kittredge, Clark & Clark's Improved Machine for Marking Lines of Bend of Sheet Metal for Molding." Sept. 30, 1874.

3,891.—G. Scott, Montreal, P. Q. Improvements on a machine for lifting wheeled vehicles and other heavy weights, called "Scott's Carriage Lifting Jack." Sept. 30, 1874.

3,892.—T. H. Foote, New York city, U. S. Improvements in telegraph instruments, called "Foote & Randall's Improvement in Telegraph Instruments." Sept. 30, 1874.

3,893.—G. Pye, St. John, St. John county, New Brunswick. Improvements on harvesters, called "Pye's Harvester." Oct. 1, 1874.

3,894.—C. S. Fuller, O. M. Morse, H. J. Burdick, Oswego, N. Y., U. S., and S. Howes, A. Badcock, N. Badcock, and C. Ewell, Silver Creek, Chatauqua county, N. Y., U. S. Improvements in middlings purifiers, called "Fuller's Improved Middlings Purifier." Oct. 1, 1874.

3,895.—O. M. Morse, C. S. Fuller, H. J. Burdick, Oswego, N. Y., and S. Howes, A. Badcock, N. Badcock and C. Ewell, Silver Creek, Chautauqua county, N. Y. U. S. Improvements in middlings purifiers, called "Morse's Improved Middlings Purifier No. 2." Oct. 1, 1874.

3,896.—H. J. Lingenfelter, Glen, Montgomery county N. Y., U. S. Improvements on portable furnaces, called "Lingenfelter's Portable Furnace." Oct. 6, 1874.

3,897.—A. F. Andrews, New Haven county, Conn., U. S. Improvements in annealing and toughening iron, called "Improvements in Annealing and Toughening Iron." Oct. 6, 1874.

3,898.—A. Rodgers, Muskegon, Muskegon county, Mich., U. S. Improvements in devices for moving and barking logs, called "Rodgers' Log Mover and Barker." Oct. 6, 1874.

3,899.—A. Rodgers, Muskegon, Muskegon county, Mich., U. S. Improvements in grate bars, called "Rodgers' Grate Bar." Oct. 6, 1874.

3,900.—P. K. Dederick, Albany, N. Y., U. S. Improvements in horse powers and hoisting machines, called "The P. K. Dederick Horse Engine." Oct. 6, 1874.

3,901.—A. O. Kittridge, W. H. Clark, and W. T. Clark, Salem, Columbiana county, O., U. S. Improvements on a mallet for smoothing sheet metal, called "Kittridge, Clark & Clark's Improved Mallet for Smoothing Sheet Metal." Oct. 6, 1874.

3,902.—J. Bradley and W. H. Pearson, Lowell, Middlesex county, Mass., U. S. Improvements on knitting machines, called "Bradley's Variety Knitting Machine." Oct. 6, 1874.

3,903.—A. Schulte and Myer Stern, New York city, U. S. Improvements on head and face protectors, called "Schulte's Head and Face Protector." Oct. 6, 1874.

3,904.—H. T. Hotchkiss, Rock Island, Stanstead county, P. Q. Improvements on mop wringers, called "Hotchkiss's Mop Wringer." Oct. 6, 1874.

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