SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

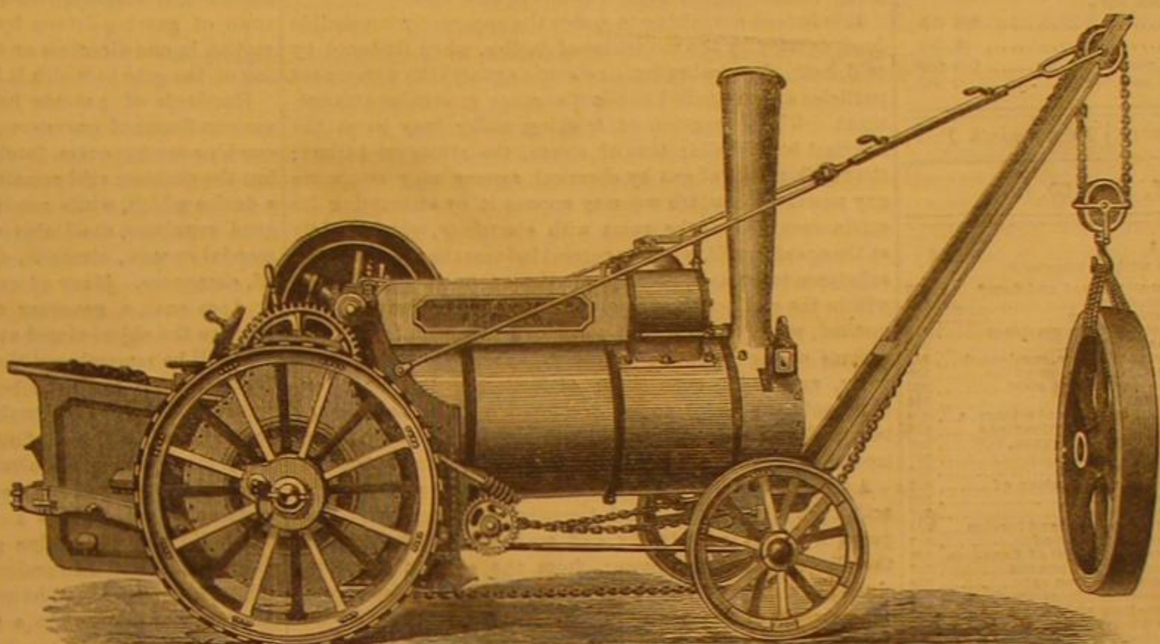
Vol. XXX.—No 22. [NEW SERIES.] | NEW YORK, MAY 30, 1874. | $3 per Annum. IN ADVANCE.

IMPROVED ROAD AND FARM LOCOMOTIVE.

The traction engine and train of wagons which we illustrate are the manufacture of Messrs. Aveling & Porter, of Rochester, England, and were awarded the prize medals for Progress and Merit at the Vienna Exposition of last year. The steam road rollers, built by the same eminent firm, were also awarded similar medals for Progress and Merit.

Since the very important experiments with road engines at Paris, in 1867, and Wolverhampton, England, in 1871, their value, as substitutes for animal power, as feeders for railroads, as pioneers in new districts, and eventually as superseders of horse-drawn portable engines, is becoming generally and intelligently recognized. The number of these engines built up to this time, by Messrs. Aveling & Porter, exceeds one thousand, and the trade is rapidly developing.

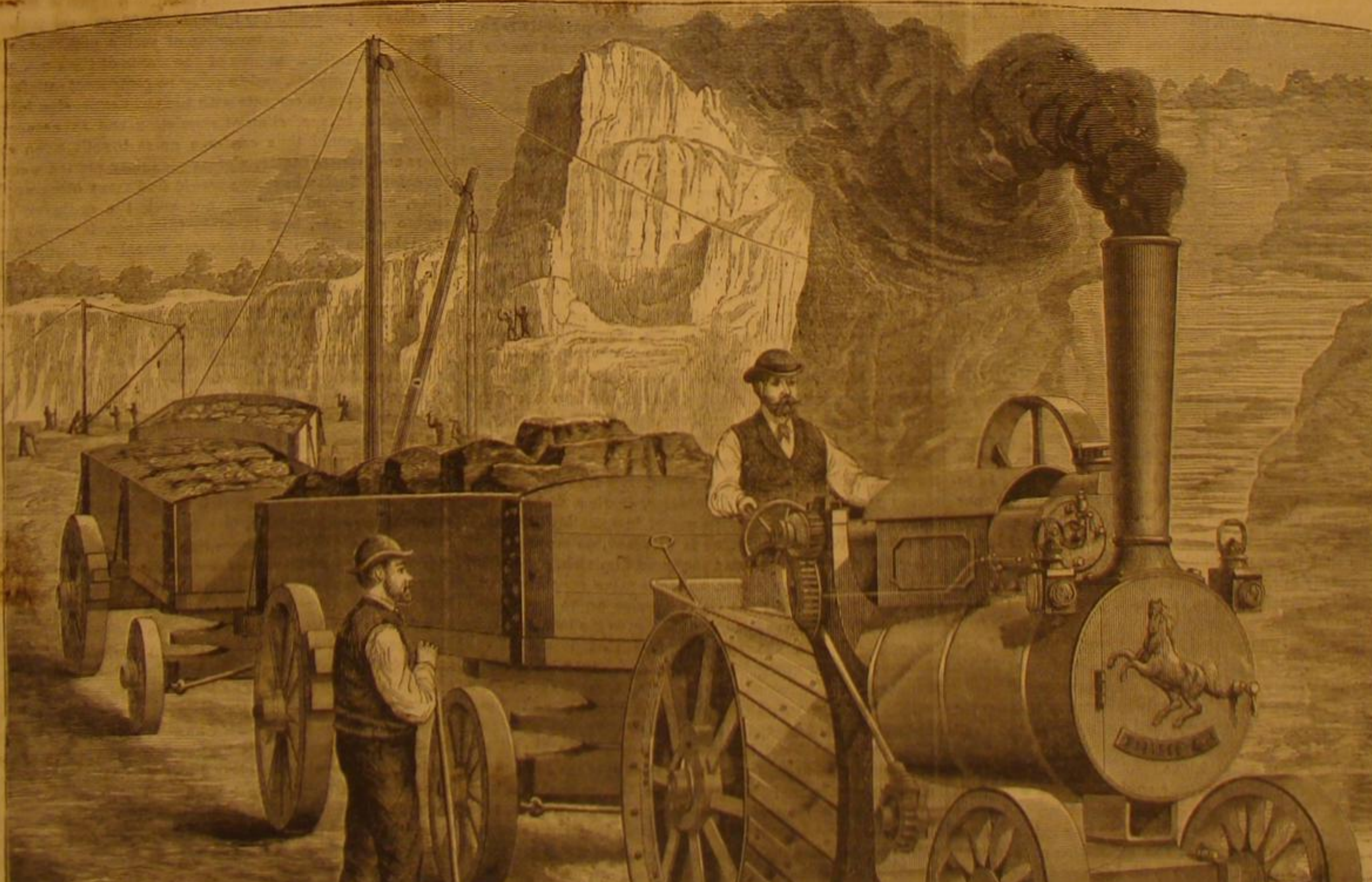
The economy in the cost of removal of heavy material, in certain localities, is certainly very great, and the manufacturers claim that the cost does not exceed one third that of doing the same work by horse power. The variety of uses to which the engine can be applied, such as thrashing grain, hauling farm produce, plowing by direct traction, pumping, sawing, etc., materially add to its usefulness, and make it applicable for different kinds of work all the year round.



The engines are very strongly and simply made, and manifest the greatest care in their construction. The facility with which they are guided and driven, both operations being performed by the same man, exhibits much progress and ingenuity. The simplicity of the machines enables them, it is claimed, to be worked at a small cost for wear and tear, and the liability to accident from breakage is reduced to a minimum. A large amount of boiler room is given to each engine, and the furnaces are constructed to burn either wood or coal. Their economy in this respect is stated to be very great. At the Wolverhampton trials an Aveling 10 horse engine, fitted with a single slide and ordinary link motion, indicated 35 horse power with a consumption of three and one fifth pounds of coal per horse power per hour.

The following testimony of Mr. D. Brennan, the President of the Telford Pavement Company, of Orange, N. J., who has two of these road locomotives, is given, as showing their value for hauling purposes: "We have used, for hauling stone, one of the Aveling & Porter 6 horse power traction engines, purchased of you, and with very satisfactory results. We hauled with this engine (with engineer and one assistant) about 75 tuns per day, a distance of a mile and a quarter, over a new road. There is no doubt that even better results can be obtained at longer distances, where the delays of loading and unloading are not so frequent, especially if on a good road. We consider that these engines will do hauling for one third the cost of the same work done by horses, at $5 per day for for team and driver, hauling one and a half tuns at a load; and we are making preparations for a more extensive use of them in the future."

The smaller engraving shows one of the ordinary road locomotives fitted with a crane to lift two tuns. It has iron



AVELING & PORTER'S ROAD AND FARM LOCOMOTIVE AND WAGONS.

wheels, fitted with compensating motion to its drivers, to enable it to turn very sharp corners with facility. It is also driven and steered by one man. Crane engines similar to this, and built by the same firm, were used at the Vienna Exposition during the erection of the building, and did a vast amount of excellent work in unloading and removing the heavy packages of merchandize as they a rived on the grounds.

Mr. W. C. Oastler, 43 Exchange Place, New York city, is Messrs. Aveling & Porter's agent in the United States.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year	$3 00
One copy, six months	1 50
CLUB RATES { Ten copies, one year, each $2 50	25 00
Over ten copies, same rate, each	2 50

VOLUME XXX, No. 22. [NEW SERIES.] *Twenty-ninth Year.*

NEW YORK, SATURDAY, MAY 30, 1874.

Contents:

(Illustrated articles are marked with an asterisk.)

PRESSURE NOT A MOTIVE POWER.

The error of confounding mere pressure with energy available to produce power is the main origin of the majority of attempts at perpetual motion, and even sometimes causes, among confused minds, exaggerated expectations about the effects to be obtained from mechanical contrivances.

We consider the alleged discovery or invention of Mr. Keely, described on page 273 of our current volume, to be a case of the latter class. He is said to develope, by means which he carefully keeps secret, a gas under enormous pressure; and by the exhibition of this pressure, he has induced a few engineers (who should know better) to testify not only in regard to what they see, but to make inferences as to the enormous power to be expected from such an exhibition. They forget that this pressure cannot be utilized without letting it off; and that the great problem in producing motive power is not simply to originate a great pressure, but to generate it abundantly, cheaply, and as fast as it is consumed in the production of motion.

Fifty tuns weight supported by three small blocks of one cubic inch each, will exert on each a pressure of some 33,000 pounds to the square inch; but this mere pressure of 33,000 pounds is not a horse power; it only becomes so if we cause the 33,000 pounds to descend one foot per minute, and if, at the end of this descent, it can only be restored by lifting the weight back to its original hight.

A wound-up spring is perfectly equivalent to a weight; it may exert a certain pressure, large in proportion to its size and strength; but unless it is allowed to unwind, it cannot produce motion or power; and the exhibition of a spring pressing with a power of 12,000 pounds on one square inch of material does not prove the possession of a principle of motive power, unless we can wind up the spring as fast as the power is expended.

It is the same with compressed air or gases; they are in fact nothing but wound-up springs: with the difference, however, that, in place of needing mechanical power to wind them up, we may use, for their development under confinement and consequent pressure, either heat, chemical agencies, or electricity.

The steam and hot air engines are illustrations of of the first case; expenditure of heat keeps up a continuous generation of steam from water, supplying the loss as fast as necessary; or it expands confined air continually, and so increases the pressure which, when moving the engine, is necessarily released. The chemical fire engine and the so called fire annihilators are illustrations of the second class; the action of an acid on a carbonate (both in water, but kept separate until needed) developes carbonic acid gas, which is set free with such energy that the water may be forcibly ejected with the gas and made useful as a ready substitute for a fire engine.

The pressure which it is possible to generate in this way is something enormous, and has more than once given rise to serious accidents by the explosion, or rather the bursting, of the vessel in which the pressure was generated. It is now twenty years since Natterer, of Vienna, with a very powerful condensing apparatus constructed on the same principles, attempted to liquefy the four gases which thus far have resisted all attempts at liquefaction, namely, nitrogen, oxygen, hydrogen, and oxide of carbon; but he did not succeed, notwithstanding that he carried the pressure to nearly 3,000 atmospheres, or 45,000 pounds to the square inch.

It is indeed surprising to notice the apparently irresistible force exerted by the molecules of bodies, when (induced by cold, heat, chemical action, or electric agency) the component particles are compelled to adopt another molecular arrangement. The expansion of freezing water may burst the heaviest bombshells; that of steam, the strongest boilers; the development of gas by chemical agency may overcome any power with which we may oppose it by attempting its confinement. It is the same with electricity, which, subtle as the agent is, will, when its current induces the change of any substance into gases, serve to produce a tremendous pressure within the walls of the vessel containing the substance. This method, we anticipate, will yet prove available for investigations on the behavior of divers substances under pressures, surpassing even those of Natterer. For such experiments the water to be decomposed is to be confined in a sufficiently strong vessel, in which are also the electrodes conducting the decomposing electric current.

As, in the invention of Mr. Keely, the heat and chemical action are said to be excluded, the only other agent which appears to be left is electricity, and we therefore suspect that the alleged enormous power, from the electric forces included in a drop of water, is in fact nothing but the enormous pressure of the gas developed, from water under confinement, by a galvanic current, or the induced current from a magneto-electric machine, driven by mechanical power. The pretence that the pressure is developed by a mechanical device, requiring little power, may be true, but that the power obtained from the pressure can possibly surpass that of the power employed is absurd and its application to motive power is simply a phantom.

GOVERNORS FOR PRIME MOVERS.

The use of a governor is to preserve a perfectly regular speed in the engine, water wheel, or other prime mover to which it is attached, by varying the supply of steam, water, or other motor, as the work of the machine varies. The ordinary form of fly ball governor answers its purpose very well in most cases. It has the defect, however, of requiring the use of heavy balls, and of demanding a somewhat wide range of action where it has any considerable force to overcome. It also is not perfectly isochronous, that is, it will not compel the engine to "come to speed" with precision, under all variations of load and steam pressure. The Porter governor, in which the balls are loaded down by a heavy weight on the spindle, and which is thus enabled to run at a much higher speed, is a modification of the standard form, and is prompt in action and much more powerful. These are the advantages which have brought it into use so extensively in Europe. In this country, the Pickering governor, in which the same object is accomplished by carrying the balls on stiff steel springs, has come into use quite largely as possessing similar advantages.

The only isochronous governors which are used to any extent in the United States are the Huntoon governor and its modifications, in which a screw, rapidly rotating in a closed tank containing oil or water, exerts a force in the line of its axis which is made use of in operating the throttle valve. While the engine is at speed, no movement of the valve occurs; but should the speed diminish, a weighted arm forces back the screw, and the valve opens. It will continue to open until the engine comes up to the proper speed again, whatever the conditions as to the load or steam pressure. Should the speed exceed that intended, the screw acts more energetically upon the liquid in which it works, and the increased effort is sufficient to overcome the resistance of the weighted arm and to close the valve until the proper speed is again acquired. In Europe, the same object is accomplished by some builders by the use of the parabolic governor, which is so arranged that the balls move in a parabolic instead of a circular arc. It can be shown by a mathematical argument, which cannot be given here, that this produces the effect of isochronism: that the governor will remain without affecting the throttle valve at only one speed, the one for which it has been proportioned and speeded. The late Professor Rankine invented a very neat governor of this class, which is perfectly isochronous.

In a friction governor invented by Professor Thurston, and designed by one of his pupils, the same result is attained by making use of the varying friction of blocks pressed against a drum by centrifugal force. When above or below speed, the valve is compelled to move in the proper direction until the engine is brought to speed, or until the valve has been either entirely closed, or is wide open. Siemens' governor is also a friction governor, but somewhat different from the latter in its general arrangement, and entirely different in details. The Pitcher hydraulic regulator, which was much used some years ago on engines fitted with the Sickles cut-off valve gear, was a pump which forced water into a chamber, having an orifice fitted with a plug which was capable of adjustment to give any desired size of opening. Above the chamber, and communicating with it, was a pump plunger connected with a throttle valve. When the engine ran above speed, the orifice was not of sufficient capacity to discharge the water as fast as it was pumped into the chamber, and the second plunger was forced up, closing the throttle valve. When the speed was less than that proposed, the water issued from the chamber more rapidly than it was forced in, and the plunger, which was attached to the throttle, fell, opening the valve. This was another of the isochronous class of governors.

None of these regulators have sufficient power to overcome any serious resistance or to act through any considerable distance. Water wheel regulators, consequently, are usually of a different construction from those above described. In the best of the common forms, the fly ball governor is employed to move a clutch which engages a train of gearing driven by the water wheel, and puts it in motion in one direction or the other, as the opening or closing of the gate to which it is connected is necessary.

Hundreds of patents have been issued to inventors of various forms of governors, in which it has been attempted combine sensitiveness, isochronism, and strength of action, but the problem still remains unsolved. What is wanted is a device which, while combining these three requisites of a good regulator, shall also combine the requisites for commercial success, strength, durability, simplicity, and, above all, cheapness. Many of our best mechanics have tried to produce such a governor and have failed, but we cannot suppose the object aimed at entirely unattainable.

It will be remembered that our special Vienna correspondent described the next best form of steam engine to our standard drop cut off engine as a plain, neat, beautifully proportioned, and well finished English engine, having a plain three-ported slide valve, with the Meyer expansion valve riding on the back of the main valve—just such an engine as is sold in New York by the agents of some of our best builders. This valve gear is well fitted to produce a sharp cut-off and an excellent distribution of steam. The point of cut-off must, however, be adjusted by hand, and the governor attached to a throttle valve in the steam pipe, because this work is too heavy to be done by the governor without entire loss of its sensitiveness and efficiency.

Putting the throttle valve in the steam pipe, as a regulating valve, is always avoided, if possible, by good engineers, because, by throttling the steam, a loss of efficiency occurs. It is always preferred to regulate the engine by so attaching the governor that, as in the best drop cut-off engines, it shall determine the point of cut-off. We gave the reasons for this preference in our issue of May 23, on page 321 of our current volume. The invention of such a governor, which we have described as one of the wants of the time, would enable this simplest, and in other respects most satisfactory, style of engine to compete with the most expensive forms in the market in perfection of regulation and in economy of steam. It would thus confer a great benefit upon steam users and, consequently, a great pecuniary reward upon the inventor. Such a governor would find many other applications, and would displace, not only the ordinary steam engine governor, but, in many instances, it would probably take the place of the water wheel or disengagement governor.

WHY DO PLANTS ABSORB OXYGEN DURING THE NIGHT?

When a number of freshly gathered and healthy leaves are placed during the night under a bell glass of atmospheric air, they condense a portion of the oxygen; the volume of the air diminishes, and there is a quantity of free carbonic acid formed, generally less than the volume of oxygen which has disappeared. If the leaves which have absorbed this oxygen during their stay in the dark be now exposed to the sun's light, they restore it nearly in equal quantity, so that, all corrections made, the atmosphere of the bell glass returns to its original composition and volume.

Leaves in general have the same effect when they are placed alternately in the light and in the dark there is however a very obvious difference in the intensity with which the phenomenon is produced, according to the nature of the leaves. The quantity of carbonic acid formed during the night is so much the less, as the leaves are more fleshy, thicker, and therefore more watery. The green matter of fleshy leaved plants, of the *cactus opuntia*, to quote a particular instance, does not produce any sensible quantity of carbonic acid in the dark: but these leaves condense oxygen and exhale it again like those which are less fleshy when they are brought into the sun, after having been kept for some time in the dark. De Saussure applied the names of inspiration and expiration of plants to these alternate effects being led by the analogy—somewhat remote, it must be confessed—which the phenomenon presents with the respiration of animals.

The inspiration of leaves has certain limits; in prolonging their stay in the dark, the absorption becomes less and less; it ceases entirely when the leaves have condensed about their own volume of oxygen gas. And let it not be supposed that the nocturnal inspiration of leaves is the consequence of a merely mechanical action, comparable, for example, to that exerted by porous substances generally upon gases. The proof that it is not so is supplied by the fact that the same effects do not follow when leaves are immersed in carbonic acid, hydrogen, or nitrogen. In such circumstances, there is no appreciable diminution of the atmosphere which surrounds the plant. The primary cause of the inspiration of oxygen by the leaves of living plants is, therefore, of a chemical nature. With the facts which have just been announced before us, it seems very probable that, during the nocturnal inspiration, the carbonic acid which appears is formed at the cost of carbon contained in the leaves, and that this acid is retained either wholly or in part, in proportion as the parenchyma of the leaf is more or less plentifully provided with water.

A plant that remains permanently in a dark place, exposed to the open air, loses carbon incessantly; the oxygen of the atmosphere then exerts an action that only terminates with the life of the plant: a result which is apparently in opposition to what takes place in an atmosphere of limited extent. But it is so, because in the free air the green parts of vegetables can never become entirely saturated with carbonic acid, inasmuch as there is a ceaseless interchange going on between this gas, and the mass of the surrounding atmosphere; there is, then, incessant penetration of the gases, as it is called. There is a kind of slow combustion of the carbon of a plant which is abstracted from the reparative influence of the light.

The oxygen of the air also acts, but much less energetically, upon the organs of plants that do not possess a green color.

The roots buried in the ground are still subjected to the action of this gas. It is indeed well known that, to do their office properly, the soil must be soft and permeable, whence the repeated hoeings and turnings of the soil, and the pains that are taken to give access to the air into the ground in so many of the operations of agriculture. The roots that penetrate to a great depth, such as those of many trees, are no less dependent on the same thing; the moisture that reaches them from without brings them the oxygen, in solution, which they require for their development. It is long since Dr. Stephen Hales showed that the interstices of vegetable earth still contained air mingled with a very considerable proportion of oxygen. The roots of vegetables, moreover, appear generally to be stronger and more numerous as they are nearer the surface. In tropical countries, various plants have creeping roots which often acquire dimensions little short of those of the trunk they feed.

If a root detached from the stem be introduced under a bell glass full of oxygen gas, the volume of the gas diminishes, carbonic acid is found, of which a portion only mingles with the gas of the receiver, a certain quantity being retained by the moisture of the root.

The volume of the gas thus retained is always less than that of the root itself, however long the experiment may be continued. In these circumstances, whether in the shade or in the sun, roots act precisely as leaves do when kept in the dark. Roots still connected with their stems give somewhat different results.

When the experiment is made with the stem and the leaves in the free air, while the roots are in a limited atmosphere of oxygen, they then absorb several times their own volume of this gas. This is because the carbonic acid formed and absorbed is carried into the general system of the plant, where it is elaborated by the leaves if exposed to the same light, or simply exhaled if the plant be kept in the dark.

The presence of oxygen in the air which has access to the roots is not merely favorable; it is absolutely indispensable to the exercise of their functions. A plant, the stem and leaves of which are in the air, soon dies if its roots are in contact with pure carbonic acid, with hydrogen gas, or nitrogen. The use of oxygen, in the growth of the subterraneous parts of plants, explains why our annual plants, which have largely developed roots, require a friable and loose soil for their advantageous cultivation. This also enables us to understand why trees die when their roots are submerged in stagnant water, and why the effect of submersion in general is less injurious when the water is running, such water always containing more air in solution than that which is stagnant.

MILK AS A DIET AND ITS EFFECT ON THE SYSTEM.

There is considerable difference of opinion on the subject of a milk diet. It is surrounded with a mass of whims, of prejudices, and of mistaken ideas, which are based more on individual fancies than upon certain fact. To one a glass of milk imbibed is believed to be a sure provocation of a billous attack, to another, a disordered stomach, to a third, drowsiness, and so on, through such a category of simple though disagreeable ailments that we look aghast at the farmer who drains cup after cup of the fresh pure liquid, time and again during the day, and wonder at the resisting powers which his organization must possess. The truth is, however, that milk is not unwholesome. On the contrary, it contains good substantial bone, muscle, flesh, and brain producing substances, which, assimilating, quickly act rapidly in building up the body. Naturally, we assert, it is nourishing; that it does bring on certain troubles is nevertheless true, but the cause is in the individual stomach, not in the milk, provided, of course, the latter be fresh and sweet. The *Commercial Advertiser* of recent date has some excellent remarks on this subject which are well worthy of repetition. "Milk diluted with one third lime water," it is said, "will not cause any one biliousness or headache, and, if taken regularly, will so strengthen the stomach as to banish these disorders.

"It may be taken with acid of some kind when it does not easily digest. The idea that milk must not be eaten with pickles is not an intelligent one, as milk curdles in the stomach nearly as soon as it is swallowed. When milk is constipating, as it is frequently found to be by persons who drink freely of it in the country in summer time, a little salt sprinkled in each glassful will prevent the difficulty. When it has an opposite effect, a few drops of brandy in each goblet of milk will obviate its purgative effect. As milk is so essential to the health of our bodies, it is well to consider when to take it, and how. It is a mistake to drink milk between meals, or with food at the table. In the former case it will destroy the appetite, and in the latter it is never proper to drink anything. After finishing each meal a goblet of pure milk should be drank; and if any one wishes to grow fleshy, a pint taken before retiring at night will soon cover the scrawniest bones. In cases of fever and summer complaint, milk is now given with excellent results. The idea that milk is "feverish" has exploded, and it is now the physician's great reliance in bringing through typhoid patients, or those in too low a state to be nourished by solid food."

Our contemporary, we notice, says that the persons with whom milk does not agree are the very ones who require it, and whom it would probably regenerate, did they so prepare it as to make it palatable and suitable to their particular constitutions. Not exactly, we think. It should be remembered that "what is one man's meat is another man's poison" is a very frequent case; and while, as we have above pointed out, milk may in perhaps a majority of instances be rendered agreeable to the stomach, still there are certain organizations which persistently refuse it in spite of any assisting admixture. A similar illustration may be found in the case of wine; and we know of instances where persons, of otherwise strong digestion, are utterly unable to drink half a gill of even the purest grape juice without experiencing the same bilious and other derangements which many ascribe to milk. It is a fact, however, that for individuals troubled with dyspepsia, weak stomach, and kindred ills, milk has wrought remarkable and unexpected benefit, and the diet has in cases among our own acquaintances resulted in great relief.

Milk drinking, particularly in this city, has during late years received an unusual impetus through the establishment of dairies, or restaurants where the bill of fare is confined to a few simple articles of farinaceous food and to generous bowls of milk and cream, retailed at very moderate prices. The idea, we believe, originated some five years ago in a small baker's shop, in one of the little down town streets, which had a monopoly of the business for some time, making large receipts. Others, being attracted by the gains, embarked in the business, and now the dairy is as much a fixture in New York city as the more pretentious restaurant. As a matter of curiosity, we recently inquired of the manager of the largest of these establishments as to the people who patronize the diet, and the effect of the increased demand upon the supply. His customers, he told us, comprised every class; the rich banker perches on the high stool beside his errand boy. Clergymen, lawyers, merchants, editors, men whose reputation is worldwide, throng into the doors, proving that, even if this sudden increase in milk drinking be merely a popular mania, it is nevertheless one which has affected all alike.

The milk for the city is brought principally from Westchester and Dutchess counties in this State, and the neighboring counties in Connecticut. In the dairy above referred to, the stocks of several large farms are required to produce the necessary amount. Twelve hundred quarts in cool weather, and upwards of eighteen hundred quarts when the mercury makes excursions into the nineties, are daily consumed by an average of twenty-five hundred persons in the single establishment. This milk is sold at about ten cents a quart, realizing a fair profit.

The greater portion of the milk used in the city does not come direct to the seller, but goes through the same handling, by four or five "middle men," as the often doubtful fluid retailed by the peripatetic milkman. The farmer, for instance, binds himself to supply a certain number of cans to the contractor for a definite period, usually six months, at the price of about 33 to 42 cents per can in summer or 45 cents in winter. The contractor receives the filled vessels from a collector, who gathers them from the different farms and deposits them at the railway stations. Under charge of the latter, they are transported in early trains to the city and sold at the depots to milkmen and dairy keepers at an advance of about five cents per can. The milkmen supply families and grocers with the commodity, *plus* another profit which brings its cost to the consumer, as above stated to about ten cents per quart.

As to the quantity of milk daily consumed in New York, it is difficult to obtain any precise figures; but it is estimated that the supply does not fall short of two million quarts every twenty-four hours. This on a rough calculation is the produce of some thirteen thousand cows and an average of something over two quarts *per diem* to every soul of the population.

THE RESPIRATION OF OXYGEN.

According to the older notions in regard to the provision of Nature for the sustenance of life, the surrounding conditions have been expressly arranged for the benefit of all living creatures, so as to secure not only their existence but their welfare and comfort. According to late ideas, however, as the different living creatures were evolved under previously existing conditions, the mode of their development was such as to accommodate the different organisms to these conditions; and when the conditions changed, a corresponding change occurred in the creatures themselves: those not adapted to the changed conditions perishing, and those most fit for the new era surviving and propagating their species. We will illustrate this by an example: In our atmosphere, the oxygen is diluted with very nearly four times its amount of nitrogen, and all the air-breathing animals, including man, have become adapted to these conditions. If the amount of oxygen became less, a corresponding change would occur in the respiratory system, as is illustrated in the high lands of South America, where, by reason of the rarefied atmosphere, the amount of oxygen inhaled at each respiration is less than near the ocean level; and as a consequence, the human lungs are more developed there, and the inhabitants are remarkable for their largely developed chests, allowing them to make up by quantity for the quality of the inspired air. The reverse is also the case; it has been found that the effect of the compressed air (on those workmen whose constitutions allowed them to withstand the pressure and labor for some length of time in the caissons for the foundations of the Mississippi bridge at St. Louis, Mo., and the East river bridge, New York) was to narrow the volume of the chest, while deep respirations of the highly compressed air were painful.

Now comes an interesting discovery of M. P. Bert, who finds that it is not alone the pressure which is hurtful to the system, which can soon accommodate itself to it, but chiefly the concentration of the oxygen, which even acts like a most violent poison when inhaled pure, under a pressure of three or four atmospheres; consequently when (under a pressure of some 90 or more pounds to the square inch) an amount of oxygen surpassing the normal quantity some six or more times is inhaled at every respiration, its hurtful effects manifest themselves, one of them being a very great increase in animal heat, with a disturbed pulse; this, of course, adds largely to the discomfort. This fact suggests that men who have to submit to conditions of greatly increased atmospheric pressure would be relieved and benefitted by inhaling an artificial atmosphere containing less than the normal amount of oxygen, 10 per cent oxygen to 90 of nitrogen for two atmospheres pressure; 5 per cent oxygen and 95 nitrogen for four atmospheres, and so on. The value of this suggestion is strengthened by the French physicist De Fonvielle, who maintains that the discomfort experienced by travelers on high mountain peaks, or by aeronauts when ascending to high altitudes, is not so much caused by the diminished atmospheric pressure as by the want of oxygen, which, in that rarefied condition, is not given to the lungs in sufficient quantity. He suggested, therefore, the inhalation of pure oxygen at those high altitudes; and two balloonists, Sivel and Croce-Spinelli, have verified this theory during a recent ascent in the balloon *Etoile Polaire*. M. Croce-Spinelli, when he had reached a hight of 16,400 feet, experienced a strong feeling of suffocation; he then resorted to the inhalation of pure oxygen (enclosed in a large rubber bag with which he was provided), and became not only relieved, but recovered his normal condition of perfect comfort. The effect on the pulse was remarkable: while below it was 86 beats per minute, it rose, at a hight of 16,000 feet, to 140; when oxygen was respired, it descended at once to 120.

The published account of this ascent adds the following: "When not using the respirator, the skies appeared to the observers quite dark; but when freely respiring the oxygen, the blue color of the heavens was restored." As the blue color of the sky is due to the refraction of the solar light in the atmosphere, it is an objective phenomenon, and cannot be seen at such high altitudes, where there is little of the atmosphere (and that little very rarefied) left above the observer. The statement that the blue color was restored by the inhalation of the oxygen would infer that the hue is subjective and due to the condition of our eyes, induced by breathing the gas.

In regard to the hight which travelers are able to attain, we may state that Alexander von Humboldt, in his ascent of Chimborazo, was compelled to stop at a hight of 16,000 reet, at which point he had to give up from suffocation; but in late years the brothers Schlagintweit ascended the Himalayas, and slept all night in bivouac at a hight of 19,200 feet, and later ascended the peak Ibi Gamin, 22,200 feet high.

The English astronomer Mr. Glaisher claims that he has ascended to a hight of 26,000 feet without feeling any discomfort, and that only when reaching 32,000 feet he experienced any very serious feeling of suffocation. No doubt, different constitutions are differently affected; some are unable to resist diminished atmospheric pressures, others increased pressure. We met even last summer a consumptive individual on Mount Washington (which is not much over 6,000 feet high), who stated that he felt such a feeling of suffocation that he was obliged to hasten down on the same day.

THE AMERICAN SOCIAL SCIENCE CONGRESS.

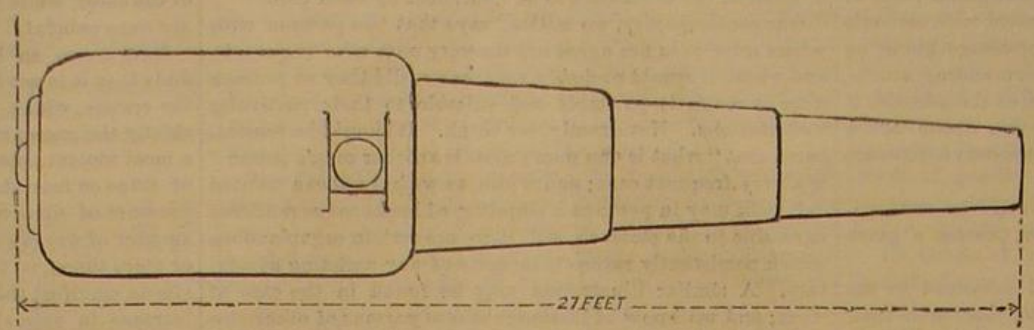
The American Social Science Congress will hold its annual session in New York city, commencing on May 19 and terminating on May 23. The title of this institution is broad enough to cover a vast field of useful knowledge, and the subjects for investigation are very numerous and interesting. Mr. George W. Curtis will preside, and papers by Rev. Dr. Woolsey on exemption of private property from capture at sea, by Mr. W. C. Flagg on the farmers' movement, by President Gilman on California, by Hon. D. A. Wells on taxation, by Professor Peirce on ocean lanes for steamship navigation, by Mr. G. G. Hubbard on railroads, and by Professor Sumner on the Finance Department, will be read. Many other papers relating to public health, penal institutions, charity, and kindred subjects are promised, and the Boards of Health and Public Charities will probably be in session on the same days.

THE bill before Congress for the grant of national aid to the extent of three millions of dollars in behalf of the Centennial Exhibition has been defeated.

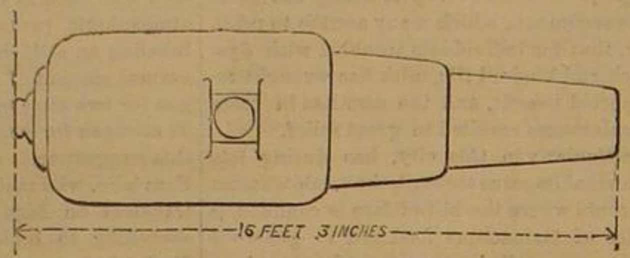
New Eighty-one Tun Gun.

Only two years ago the sobriquet "Woolwich Infant" was playfully applied to a gun which had just been constructed in the gun factories of the Royal Arsenal at Woolwich, of the then unprecedented size of thirty-five tuns. Recent events have, however, proved that the name was by no means ill chosen, for a decision has been arrived at which will necessitate our viewing this gun actually in the light of a mere baby, a series of monstrous successors having been designed which will put its nose out of joint altogether. The first four of these, which are intended to form the armament of the future ironclad Inflexible, will be proceeded with so soon as the experimental one, which is the subject of the present paper, has been completed and proved.

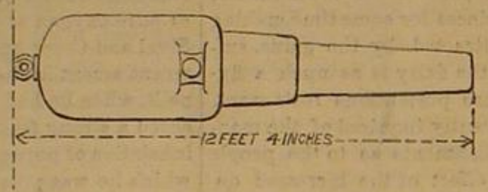
81 TUN GUN. PROJECTILE 1,200 LBS. CARTRIDGE 200 LBS.



35 TUN GUN. PROJECTILE 115 LBS. CARTRIDGE 110 LBS.



7 TUN GUN: PROJECTILE 700 LBS. CARTRIDGE 30 LBS



The new gun will, it is expected, be of a weight slightly over or slightly under eighty one tuns. Its total length, including the plug screwed in at the breech end, 27 feet; the length of bore, 24 feet; the caliber will, in the first instance, be 14 inches, but ample provision is made in the thickness of the steel tube to increase that figure to 16 inches, if deemed desirable. The rifling has not as yet been decided on, but will be a matter for consideration as the gun approaches completion, by which time the result of the present series of experiments with the $\frac{35}{38}$ tun gun will doubtless have thrown considerable light upon this vexed question. The trunnions are to be 16 inches in diameter. The internal construction is similar to that of the 10 inch gun and upwards, except that the chase is divided into three portions instead of two.

The accompanying engraving will give some idea of the appearance of the proposed gun, and exhibits the grandeur of its proportions as compared even with those of its colossal predecessor. The 7 inch gun is also shown as demonstrating the immense advance that has taken place in modern artillery during the past eight years. When we consider that it was positively stated, when the 7 inch gun was produced, that we had attained the highest point we should ever reach in weight of metal, it seems almost incredible that in less than a decade we should be in possession of artillery twelve times as heavy. One is almost tempted to pervert the Latin proverb, and exclaim: "*Tempora mutantur et arma mutantur in illis.*"

Neither the weight of projectile nor quantity of powder to be contained in the cartridge for the 81 tun gun has been positively fixed, but the first will probably range between 1,000 lbs. and 1,200 lbs., while the second may be estimated at about one sixth of that amount. In the following calculations as to the probable energy of the new gun, or force of impact of its projectile, at the various ranges specified, three weights of shot or shell are respectively dealt with of 1,000 lbs., 1,100 lbs., and 1,200 lbs. An initial velocity has been assumed in all cases at the muzzle of the gun of 1,300 feet per second. It would possibly be considerably greater, but we desire to be within the mark. Working by the well known formula:

$$\text{The energy in } \textit{vis viva} \text{ in pounds} = \frac{WV^2}{2g}$$

where W = weight of projectile in lbs.,
V = velocity in feet,
g = force of gravity (32·2),

we find at the muzzle for the 1,000 lbs. projectile a blow of 11,715 foot-tuns, for the 1,100 lbs. projectile one of 12,886 foot-tuns, and for the 1,200 lbs. projectile the terrific force of 14,058 foot-tuns! These forces would, of course, be considerably enhanced by the higher velocity which would doubtless be obtained. When we compare such energies with those of the 35 tun and 7 inch guns, namely, 8,404 and 1,855 tuns, respectively, the latter sink into utter insignificance.

The actual penetrating powers of the 81 tun gun, as distinguished from the striking or racking powers, can only be decided by experiment. With the earlier natures of heavy ordnance, such as the 7 inch and 8 inch, a rough rule gave the penetrative or punching power as 1 inch in excess of the diameter of the projectile. Thus the 8 inch gun would penetrate armor 9 inches thick at a moderate distance. But as we ascend the series, this power developes itself in an increasing ratio, the 10 inch gun piercing armor of 12 inches in thickness, but not going through the backing; while the 12 inch gun of 36 tuns easily pierces 14 inches armor and backing, and only is arrested by the latter after going through 15 inch targets. Hence we may reasonably estimate the power of the gun now under consideration as capable of penetrating at least 19 inches or 20 inches of armor plates and their backing, at a distance of, say, 500 yards. We are aware, of course, that by increasing the diameter of the bore to 16 inches, the charge remaining the same, a loss of penetrative power would result, but we anticipate that (by employment in making up the cartridges of the slow-burning $1\frac{1}{2}$ inches or 2 inch cubes of pebble powder, some of which have been manufactured at Waltham Abbey, and with which good velocities and low pressures were obtained in recent experiments with the 38 tun gun at the proof butts), as the caliber is increased, so the charge may be increased in proportion. That the 81 tun gun will ultimately have a caliber of certainly 15 inches, we little doubt.—*The Engineer.*

THE POLAR CLOCK—THE TIME OF DAY SHOWN BY COLORS.

One of the most beautiful practical applications of the polarizing instrument is presented in Sir Charles Wheatstone's polar clock, shown in our engravings and described in the following passage by the inventor:

"At the extremity of a vertical pillar is fixed, within a brass ring, a glass disk, so inclined that its plane is perpendicular to the polar axis of the earth. On the lower half of this disk is a graduated semicircle, divided into twelve parts (each of which is again subdivided into five or ten parts), and against the divisions the hours of the day are marked, commencing and terminating with VI. Within the fixed brass ring, containing the glass dial plate, the broad end of a conical tube is so fitted that it freely moves round its own axis; this broad end is closed by another glass disk, in the center of which is a small star or other figure, formed of thin films of selenite, exhibiting when examined with polarized light strongly contrasted colors; and a hand is painted in such a position as to be a prolongation of one of the principal sections of the crystaline films. At the smaller end of the conical tube a Nicol's prism is fixed so that either of its diagonals shall be 45° from the principal section of the selenite films. The instrument being so fixed that the axis of the conical tube shall coincide with the polar axis of the earth, and the eye of the observer being placed to the Nicol's prism, it will be remarked that the selenite star will, in general, be richly colored; but as the tube is turned on its axis the colors will vary in intensity, and in two positions will entirely disappear. In one of these positions a smaller circular disk in the center of the star will be a certain color (red, for instance), while in the other position it will exhibit the complementary color. This effect is obtained by placing the principal section of the small central disk $22\frac{1}{2}°$ from that of the other films of selenite which form the star. The rule to ascertain the time by this instrument is as follows: The tube must be turned round by the hand of the observer until the color star entirely disappears while the disk in the center remains red; the hand will then point accurately to the hour. The accuracy with which the solar time may be indicated by

Fig. 1.

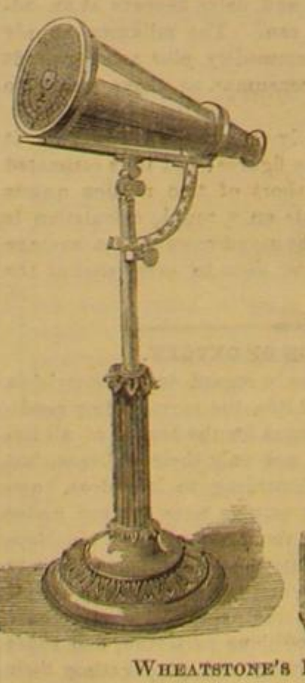


Fig. 2.

WHEATSTONE'S POLAR CLOCK.

this means will depend on the exactness with which the plane of polarization can be determined; one degree or change in the plane corresponds with four minutes of solar ime.

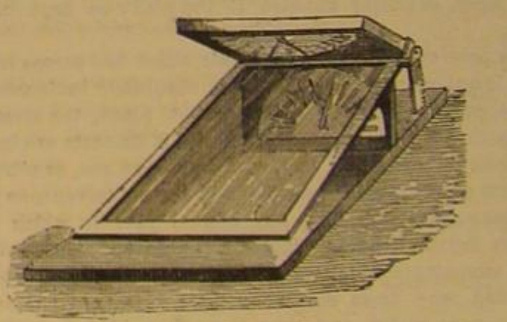
"The instrument may be furnished with a graduated quadrant for the purpose of adapting it to any latitude; but if it be intended to be fixed in any locality, it may be permanently adjusted to the proper polar elevation and the expense of the graduated quadrant be saved; a spirit level will be useful to adjust it accurately. The instrument might be set to its proper azimuth by the sun's shadow at noon, or by means of a declination needle; but an observation with the instrument itself may be more readily employed for this purpose. Ascertain the true solar time by means of a good watch and a time equation table, set the hand of the polar clock to correspond thereto, and turn the vertical pillar on its axis until the colors of the selenite star entirely disappear. The instrument then will be properly adjusted.

"The advantages a polar clock possesses over a sun dial are: 1st. The polar clock being constantly directed to the same point of the sky, there is no locality in which it cannot be employed, whereas, in order that the indications of a sun dial should be observed during the whole day, no obstacle must exist at any time between the dial and the places of the sun, and it therefore cannot be applied in any confined situation. The polar clock is consequently applicable in places where a sun dial would be of no avail: on the north side of a mountain or of a lofty building, for instance. 2d. It will continue to indicate the time after sunset and before sunrise, in fact, so long as any portion of the rays of the sun are reflected from the atmosphere. 3d. It will also indicate the time, but with less accuracy, when the sky is overcast, if the clouds do not exceed a certain density.

"The plane of polarization of the north pole of the sky moves in the opposite direction to that of the hand of a watch; it is more convenient therefore to have the hours graduated on the lower semicircle, for the figures will then be read in their direct order, whereas they would be read backwards on an upper semicircle. In the southern hemisphere the upper semicircle should be employed, for the plane of polarization of the south pole of the sky changes in the same direction as the hand of a watch. If both the upper and lower semicircles be graduated, the same instrument will serve equally for both hemispheres.

"The following is a description of one among several other forms of the polar clock which have been devised. This (Fig. 3), though much less accurate in its indications than the preceding, beautifully illustrates the principle.

Fig. 3.



SELENITE POLAR CLOCK.

"On a plate of glass twenty-five films of selenite of equal thickness are arranged at equal distances radially in a semicircle; they are so placed that the line bisecting the principal sections of the films shall correspond with the radii respectively, and figures corresponding to the hours are painted above each film in regular order. This plate of glass is fixed in a frame so that its plane is inclined to the horizon 38° 32′, the complement of the polar elevation; the light, passing perpendicularly through this plate, falls at the polarizing angle, 56° 45′, on a reflector of black glass, which is inclined 18° 13′ to the horizon. This apparatus being properly adjusted, that is, so that the glass dial plate shall be perpendicular to the polar axis of the earth, the following will be the effects when presented towards an unclouded sky: At all times of the day the radii will appear of various shades of two complementary colors, which we will assume to be red and green, and the hour is indicated by the figure placed opposite the radius which contains the most red; the half hour is indicated by the equality of two adjacent tints."

A CORRECTION.—An accidental error exists in the description of the bolt cutter of the Wood and Light Machine Co., which appeared on the first page of our issue of May 9. The beginning of the detailed reference should read: "A is the face plate of the die holder," etc. Instead of the following sentence should appear: B is the head, caused to revolve by proper mechanism, through which passes a mandrel, moving freely back and forth, in the spindle, C.

THE green color of the boron flame may be very well shown by boiling a mixture of boracic acid, alcohol, and sulphuric acid, and igniting the vapor.

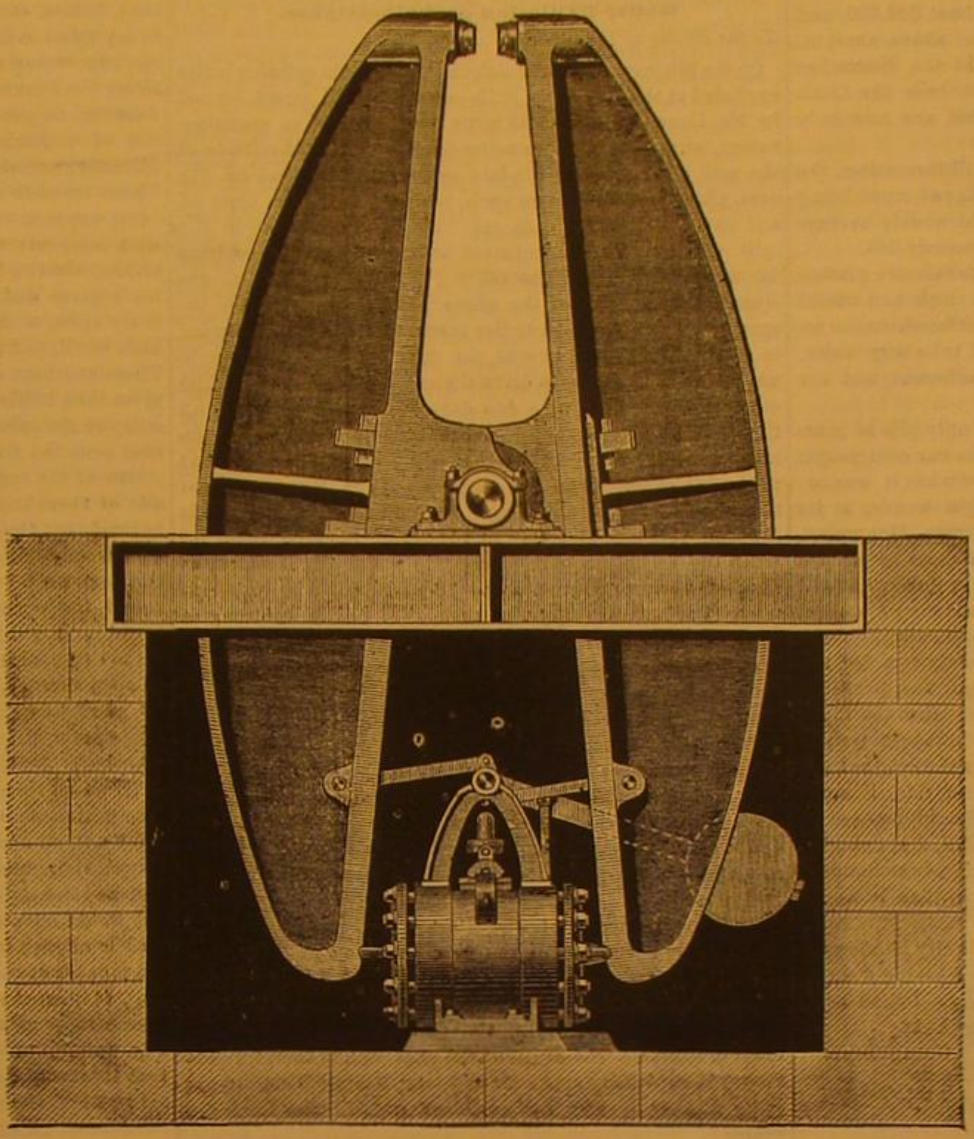
HYDRAULIC RIVETING MACHINE.

It is now no unusual thing to have boilers in use at sea with plates of one inch and even upwards in thickness. Such boilers require to be constructed with rivets of sizes that cannot be satisfactorily set up by mere manual labor; and of late years, after many applications of steam and gearing for this purpose, hydraulic power has been employed with the best results.

The first thing that strikes an observer of this new process, is the entire absence of that most deafening noise, the usual accompaniment of ordinary riveting; and a little further attention will show that this absence of noise is its least merit. By the quiet, steady pressure, rivets are enlarged throughout their length, and fill up all roughness or irregularities inside the punched holes they enter, so that they remain firmly fixed, even when one or both of the heads are cut off, and must be drilled out altogether should it ever be necessary to remove them. The pressure not only forms heads on the rivets, and effects the above named compression, but it holds them up, and the plates also, close together, until the former are sufficiently cooled to bear the strain, and even draws the plates closer together by subsequent contraction.

Our illustration shows Messrs. McKay and Macgeorge's patent hydraulic riveter, which has been for some time in use at the Millwall Docks Engineering Works, London. This machine is one of the most powerful of its class, and gives a pressure of 60 tuns upon the rivet, an amount abundantly sufficient for the largest class of boiler work hitherto required for marine engines. Above the machine stands a powerful traveling crane, from which boilers are suspended over it, their (ordinary) horizontal axis, of course, then being in a vertical position. Circular seams of rivets are brought to the machine by the simple process of turning the boiler round on a swivel, and vertical seams, by raising or lowering it in the usual manner with mechanical arrangements of this class.

The pressure is derived from an accumulator, and it amounts to 700 lbs. per square inch in the present case. This pressure is only admitted into the large cylinder when the dies come in contact with the hot rivet, the slack being taken up by the action of a smaller cylinder. By this arrangement a considerable saving of power is effected; for if the large cylinder took its supply and moved the levers their entire distance by accumulator pressure, it is evident that great waste of power would ensue thereby, and in all direct acting steam-riveting machines this waste must come from the nature of their construction.



HYDRAULIC RIVETING MACHINE.

The hydraulic cylinder, and all valves, levers, weights, etc., are placed in a pit below ground, clear out of the way of men working, and safe from frost or accidental injury. Of course the pit is covered over, and in winter carefully protected from cold; and where, as is sometimes the case, these machines stand practically out of doors, a precaution of this kind should never be neglected.

The upper end of the powerful cast iron levers which form the most conspicuous part of this machine are perfectly free from all surroundings, except only a conveniently placed handle for starting or reversing; this handle stands behind one of the levers, and therefore does not appear in the present illustration. These levers are so strong that any accidental blow given to them can do no harm; and the readiest access is obtained to every part of the machine. Steel dies are simply placed in bored holes, and naturally hold themselves there.

When all is prepared, and a heated rivet in position, a movement of the handle admits high pressure water to the smaller cylinder, the dies rapidly close upon the rivet, the self-acting valves admit water to the larger cylinder, and without noise or vibration, the work is done. The dull, heavy pressure crushes together the thick plates; and after holding them and the rivet together for a moment that the latter may cool, the pressure is released, the dies recede, another rivet is soon completed, and a boiler is finished with astonishing ease and rapidity.

The distance, from the center shaft on which both levers work to the dies or center of the hydraulic cylinder, is 6 feet in the present case; so that, after deducting the center bearing and wrought iron straps to carry the tensile strain, there remains a clear space of 5 feet for boiler plates, and this is found to be ample for the several classes of work for which this particular machine is used.—*The Engineer.*

New Australian Trees and Plants.

Mr. Walter Hill, the Government botanist, has reported to the Queensland Secretary for Lands that his party have examined the banks of the Mulgrave, Russell, Mossman, Daintree, and Hull rivers, and have been more or less successful in finding suitable land for sugar and other tropical and semi-tropical productions. The ascent of the summit of Bellenden Kerr was successfully made by Johnstone, Hill, and eight troopers. At 2,500 feet in hight they observed an undescribed tree with crimson flowers, which excels the *poinciana regia, colvillia racemosa, lagerstroma regia,* and the *jacaranda mimosifolia.* At 4,400 feet a tree fern, which will excel in grandeur all others of the alboreous class. A palm tree at the same hight which will rival any of the British-Indian species in gracefulness. "On the banks of the Daintree we saw a palm tree cocoa, which far exceeds the unique specimens in the garden of the same genera from Brazil in grandeur and gracefulness. While cutting a given line on the banks of the river Johnstone, for the purpose of examining the land, an enormous fig tree stood in the way, far exceeding in stoutness and grandeur the renowned forest giants of California and Victoria. Three feet from the ground it measured 150 feet in circumference; at 55 feet, where it sent forth giant branches, the stem was nearly 80 feet in circumference. The river Johnstone, within a limited distance from the coast, offers the first and best inducements to sugar cultivation."

Effect of Pipe Smoking on Teeth.

Dr. Erich Richter, of Ula, Col., gives, in *Dental Cosmos,* the accompanying engraving of dental abrasion from the use of clay pipes. The patient, a miner, a native of Germany, addicted to smoking, could not refrain from it even while at work. It was his custom, while using the pick or shovel, to support the pipe between the canines and first bicuspids, and, when making heavy strokes, the pipe would move a little. After a few years he could close his teeth and still have room for the pipe.

The accompanying diagram illustrates the effect upon the teeth. The left superior cuspid is worn down nearly to the gum, and looks as though it had been filed for pivoting and then polished. The pulp cavity is not exposed, but is covered with so thin a layer of dentine as to make the touch of an instrument painful. The other abrasions are all in the form of a segment of a circle, and are all highly polished. The second left lower and the first upper bicuspids have been extracted. The teeth are all free from caries, but discolored badly.

New Local Anæsthetic.

Some time since the *Medical Record* quoted from an American source a statement that if camphor be powdered by rubbing it in a mortar with a few drops of spirit, and an equal weight of chloral hydrate added, a liquid is produced which is a valuable local anæsthetic. Mr. Lennox Browne, writing to the *British Medical Journal,* confirms this statement, and says that it is of the greatest value as a local application in neuralgia. Mr. Browne, having employed it during several months, has found great and sometimes instantaneous relief to follow its application in every case. It is only necessary to paint the mixture lightly over the painful part and allow it to dry. The application never blisters, though it may occasion a tingling sensation of the skin. The compound has also been found of great service in the relief of toothache.—*Pharmaceutical Journal.*

Death Valley.

According to the recent expeditionary report of Lieutenant Wheeler, the Death Valley in California is a detrital sink of unique physical characteristics. This whole region presents a series of valleys or detrital plains, each entirely inclosed by the ridges of Cordilleras that are more or less distinct as a series of mountain masses. The Death Valley proper is one of the most remarkable of all known interior continental depressions, and has portions near the center of its axial line below the level of the sea, although far inland, and lying much to the north of the lower border of the great interior basin. It is the sink of the Amargosa river, which has its source in the areas of drainage formed to the south and east of Belmont, Nevada, traverses the desert of that name while passing southward, until, reaching lat. 35° 41′ 5″, it makes an abrupt angle to the west, and thence, at right angles to the north, reaches the point of greatest depression, a little less than 500 feet below the sea level, in the heart of Death Valley proper. This valley, of the ordinary oval form, is fully 70 miles in length, varying from 5 to 15 miles in width, surrounded by frowning mountains of volcanic and sedimentary origin, the Telescope range, rising higher than 10,000 feet. The line crossing this dismal area from the mouth of Death Valley cañon to the thermal springs in Furnace creek, presenting a labyrinthine maze of efflorescent, saline forms, creates at the level of vision a miniature ocean, the vibrations of whose contorted waves has a sickening effect upon the senses. The lurid glare, horizoned by the bluish haze radiated from the mountain sides, appears focussed to this pit, though broad in expanse. It seems, coupled with the extreme heat, to call for the utmost powers of mental and physical endurance.

The journey through the Valley of Death occasioned the utmost apprehension, evinced through the entire season. To this was added the effect of the fearful cloud burst experienced while among the Telescope mountains, to the west, and the absence of the guide who had ventured toward the northwestern arm of the valley, it was feared to return no more. The transit of 48 hours, in a temperature that remained at 117° Fah. at midnight, so exhausted both men and animals that further travel was rendered precarious.

Testing Dyes for Adulteration.

Red dyes must neither color soap and water nor lime water, nor must they themselves become yellow or brown after boiling. This test shows the presence or absence of Brazil wood, archil, safflower, sandal wood, and the aniline colors. Yellow dyes must stand being boiled with alcohol, water, and lime water. The most stable yellow is madder yellow; the least stable are anatto and turmeric: fustic is rather better. Blue dyes must not color alcohol reddish, nor must they decompose on boiling with hydrochloric acid. The best purple colors are composed of indigo and cochineal, or purpurin. The former test applies also to them. Orange dyes must color neither water nor alcohol on boiling; green, neither alcohol nor hydrochloric acid. Brown dyes must not lose their color on standing with alcohol, or on boiling with water. If black colors have a basis of indigo, they turn greenish or blue on boiling with sodium carbonate; if the dye be pure gall nuts, it turns brown. If the material changes to red on boiling with hydrochloric acid, the coloring matter is logwood without a basis of indigo, and is not durable. If it changes to blue, indigo is present.—*Dingler's Polytechnisches Journal.*

Phosphoric Acid on Oats.

E. Wolff describes water culture experiments in which the nourishing solutions, eight in number, supplied graduated quantities of phosphoric acid. The percentage of phosphoric acid in the dry crop varied with the amount supplied. When this percentage fell below 0·33 (with good field oats it is about 0·44) the amount of straw seriously diminished, but an increase of phosphoric acid above this point did not increase the straw. The corn, however, was greatly affected by an increased supply, and gave by much the largest yield when the phosphoric acid reached 1·11 per cent of the dry crop. The ash of the straw contained no silica, none having been supplied; its percentage of phosphoric acid was 4·4—18·9, that in the ash of field oats (silica deducted) being 9·1. In the ash of the corn, the phosphoric acid varied only from 37·7—43·9 per cent, the percentage in the ash of field oats being 41·3.

Correspondence.

Notes from Washington, D. C.

To the Editor of the Scientific American:

The Hon. M. D. Leggett, Commissioner of Patents, having been the subject of a series of scurrilous and defamatory articles in a disreputable paper, published in this city, and called the *Capitol*, has thought proper to strike back, and in a letter to the Zanesville *Daily Courier* makes public a variety of facts concerning the personal history of the editor author of the paper in question, which are anything but complimentary.

Donn Piatt, the editor of the paper, values the character thus given him by the Commissioner at about $20,000, and has therefore brought a libel suit for the above amount. The case will probably come on for trial at the November term of this year, when we may expect to hear the truth about some very peculiar transactions that are now only vaguely hinted at.

The ordinary business of the Office is still increasing, the number of patents issued during the month of April being 1,204, or an average of 301 per week. The weekly average for the corresponding period of last year was only 263.

Among the patents lately issued is one for electro plating with cobalt, which, it is stated, will form a thick and useful covering that perfectly protects the plated surface from the action of the elements, and the coating is said to be very white, exceedingly hard and durable, tenacious, adherent, and not liable to tarnish.

For many years past there has been an ugly pile of marble in this city, which has been an eyesore to our own people and a wonder to the visitors here: a wonder what it was originally designed for and (when informed) a wonder at its unfinished state. I refer to the Washington Monument, which in its present appearance suggests a cross between a factory chimney and a shot tower; and if ever finished, it will serve more as a memento of the want of taste in its design than as an honor to Washington. For ten or twelve years past nothing has been done to it, owing mainly to a lack of funds, which the wretchedly poor design has probably caused, and partly to a very strong suspicion that the foundation is not strong enough to carry the immense weight which finishing the monument, according to the original design, would bring to bear on it. In view of this, Senator Morrill proposes that the material in it should be used to form a large monumental arch, by which plan, it is thought, a structure that would not disgrace him in whose honor it was raised may be erected at less expense than it would take to finish the present abortion.

Mr. Sutro, of Sutro tunnel fame, is in this city looking after his interests before Congress, and has been giving a series of entertaining lectures on mines and mining. I shall send you a few interesting items therefrom in my next.

Washington, May 19, 1874. OCCASIONAL.

The Overflow of the Mississippi.

To the Editor of the Scientific American:

The Mississippi river, its relation to commerce and agriculture, and especially the protection of these alluvial lands by the restriction of the waters which flow near, through, and now over many of them, are points of vital interest to a large section of the great South.

As the Mississippi valley is the home of our chief staple, the nation should have yielded all the aid she lawfully could to every scheme looking to the protection of those lands and to enriching, draining, and cultivating them in a proper and scientific manner; but the government has absolutely refused to do anything, and has altogether withdrawn any semblance of encouragement to agriculture in this region. The water that irrigates this great valley turns the spindles of the Eastern and Middle States. Thousands of the laboring classes of these sections find the bread that we cast upon these waters come to them.

At this time, the condition of this country is attracting unusual attention. The overflow in the Mississippi valley, the consequent damages to the crops, extending perhaps to an entire failure and the terrible results following the same, direct our notice and the action that should arise therefrom to the experience of those whose knowledge of the locality extends over a series of many years. In looking for protection from these waters by embankments called levees, and endeavoring to place metes and bounds to this inland sea, we must admit that the treatment has failed. Levees have proved useless on smaller streams; and agriculturists on the lands of this river, who have had the advantage of twenty-five or fifty years experience, and who were, for the most part, in favor of the levee system as now used, are convinced that it is and always will be a failure. If it could be successful, the advantage is not sufficient to justify the expense. That the lands are more productive, that better crops of corn and cotton are made, in the overflowed regions cannot be doubted.

During the last half century, there has been but one year in which a crop could not have been made as well and better without a levee than with one. That year was 1858. Land sellers, speculators, and theorists on the subject, are the only advocates of that levee system. What we wish to find is some better system of protection. There are two ideas prevalent among practical men who acknowledge the inexpediency of the present system of protection. The one is to straighten the river and levee the outlets; the other is to divert the volume of water by canalling the upper portion of the river and the largest tributaries, and thereby lessen the quantity of water and the danger to this region, and also to level the outlets, as in the other suggestions. Either of these ideas, practically applied, would succeed in the direction of protection to these overflowed lands. And it would be much better judgment on the part of the nation to discuss these ideas in a practical way before expending the public money on a scheme for the protection of the cotton region. The application of these ideas needs science and capital. The government can command both; and as it is a subject of eminent national import, the nation ought to take the matter in hand. It would be a public benefaction; and the whole country, the readers of your valuable paper, would be greatly interested in the discussion of the scientific aspect of this subject.

Austin, Miss. J. F. S.

Boiler Explosion at Philadelphia.

To the Editor of the Scientific American:

On the 8th instant, about 3 o'clock P. M., a plain cylinder boiler exploded at the Keystone Mills on Callowhill street, owned by Mr. Henry Hoppen, who rents portions out to manufacturers, with power. The boiler room was located outside of the mill and contained 6 plain cylinder boilers set on the oven plan, in sets of two each, with separate feed, blow off and safety valves for each set. The two sets next to the mill wall have been in constant use in their present position for the past 8 years. The other two have been out of use since last June. All of the above have been under the inspection of the Hartford Boiler Insurance Company. Owing to getting in a bad lot of coal, the four boilers in use would not maintain pressure to drive the engine up to speed. The other two were fired up a few days back so as to bring up the pressure (60 pounds per square inch) necessary to run the mill at speed. All seemed right until a short time previous to the explosion, when the engineer, Hugh Sweeny, found the outside boiler was leaking. He immediately hauled his fire from this set, and was in the act of blowing them off when the explosion took place. He was badly scalded, as also was Thomas Devoe, a lad 13 years old who was employed in the mill. Both of them died on the morning of May 10. On making an examination of the boiler, I find that it parted at the junction of the second and third rims, through the line of rivets a part of the way. The fourth rim had a new piece along its whole length and about 17 inches wide, which, Mr. Hoppen says, was ordered to be done by the inspector of the Hartford Boiler Insurance Company. My examination shows that the boiler has been cracked through the line of rivets at the point of rupture, no doubt for some years back, as there are no signs of junctions of metals, at the point of separation, in two places of over 2 feet in length.

How the inspector of the Hartford Company and the boilermakers who put on the new patch could have overlooked these cracks passes my comprehension. I am satisfied if the hammer test had been properly applied, followed by the hydraulic pressure, the patch would have shown itself defective. The cause of the explosion is therefore obvious; it exploded from wear and tear, having been in use some 25 years. The average duration of boiler life is 10 years.

This latter is objected to by some people from the fact that a large number of boilers older than the above are working older than the above and have done so for years with steam of an equal or even a greater pressure; still they are continuing to do so only at a risk, and their past exemption is no security against explosion in the future. A year ago a boiler exploded which was 20 years old and killed 11 persons. This boiler, over 25 years old, has killed 2 persons. Now I believe that 13 human lives are worth more than all the boilers over ten years old in this city. The law should be that a boiler after ten year's use, no matter its condition, should be replaced. Our railroad companies understand this; after a car wheel has run a certain number of miles it is condemned, and why should not boilers be also? Man wears out by use, and so does iron.

Philadelphia, Pa. W. BARNET LE VAN.

A National Museum of Science.

To the Editor of the Scientific American:

Would it not be an appropriate and beneficial mode of celebrating our Centennial, for Congress to make an appropriation for the erection of a museum of natural history, mineralogy, and geology, the corner stone of which should be laid on July 4, 1876? It seems to me that it is a national disgrace that a country which is so wealthy, and one which possesses within itself so much material to make a first class museum of the above description, should be contented with the miscellaneous collections now in the Smithsonian Institution, which has been supported almost entirely by the bounty of a foreigner. Let us leave to that institution the formation and development of an archæological and ethnological museum, and let the nation excel the world in the magnificence of its natural history collections, for we can scarcely hope to rival European nations in our strictly art collections.

Now that the time of the year is approaching when our various scientific and educational bodies will hold their annual meetings, I think it would be well for them to take some action upon the subject, and, by memorials, show Congress that there is a large body of learned and thinking men in the country who have arrived at the conclusion that the time has come when our Government, "of and for the people," should expend annually as large a sum, in behalf of science, literature, and the useful arts, as it now expends in supporting one regiment of soldiers or one ship of war. I firmly believe (after extensive travels) that our people are the most interested of any in the world in scientific pursuits; and when we think how much has been accomplished in this country in this way, without the aids which even the smallest foreign nation extends to its investigators, I think that, with such aid, a very few years will not fail to see our land the home of the sciences, and filled with students from abroad. But at any rate, we ought to be as far progressed and civilized as Russia now is; but at present we are far behind even her in our national liberality to culture and learning.

Chicago, Ill. S. G. L.

The Ants of Brazil.

To the Editor of the Scientific American:

An article on the army ants of Central America, their doings, habits, etc., in a recent number of your journal brings to my mind some observations, which I made several years ago concerning a species of ants, inhabitants of the country along the banks of the Uruguay and Paraña rivers in South America, on parallel 35° S. latitude. Their habitations consist of mounds, some of which are at least ten feet in diameter, and rise above the ground some three or four feet. These mounds seem to be built of coarse grass (a sort of bent, common to that section of the country), intermixed with soil. At the base, at intervals of about a foot, were arches, about ½ inch wide and the same hight in the center, for ingress and egress. The country is rolling, lying entirely open, with an occasional patch of dwarf trees on some high knoll, and ravines fringed with trees of larger growth. There are here and there roads, which are really nothing more than cattle trails, leading from the *estanchios* in the camp to the *saladuos* (salting establishments) which are situated near the river.

One of the large mounds was situated within a few feet of one of these trails; and as I was walking along the trail, I noticed that the front of the mound had a different appearance from any I had seen. So I examined it, and found all the ports on the front barricaded. All the rest of the way round, the ports were open and the ants were passing out, seeming very diligent about their business. From each of these little ports or doors leads a path, away into the camp or open country. The first, next the trail, ran nearly parallel, and I traced it more than a quarter of a mile. From the other ports, the paths led off, as spokes from the nave of a wheel.

To watch these ants and see them work and give tokens of recognition as they met each other was very interesting. Each ant, on leaving the fortress, took his path and hurried away; and, on meeting some particular friend, would stop and apparently shake hands and pass on. Returning, each ant would have a piece of the stalk of the grass, from a half inch to an inch long on his shoulder, as a soldier would carry his musket at easy march. When they arrived at the fortress, they would dip down the forward end of their load and march in as naturally as human beings could; and by steadily watching them for a while, you would almost imagine that they were human beings on a small scale.

Stratford, Conn. TRUMAN HOTCHKISS.

Bunsen's Battery Improved.

To the Editor of the Scientific American:

While Bunsen's battery is one of the most intense in use, considering its cost, there are two serious objections to its general adoption. The first is a want of continuous action, which renders it entirely unfit for many purposes; secondly, the offensive and deleterious vapor, which arises from it while in action, is an objection of scarcely less importance.

I have been laboring for some time to improve the constancy of this form of battery, while at the same time preserving its intensity; and this I have accomplished by filling the porous cup around the carbon with coarsely powdered (it should be powdered about as fine as gunpowder) graphite, which is a hard substance obtained from the inside of gas retorts. The battery is set in action by moistening the powder with nitric acid, which is done by pouring a few spoonfuls into the porous cup. I have found that the current developed by this arrangement will be sustained for a long period of time, while its intensity is equal, if not superior, to that when acid alone is used. The poisonous vapor arising from the battery is very little, owing to the small quantity of acid employed.

There is, however, a circumstance attending the use of this battery, on which it will be well to make a remark. Sometimes, in making connections with the carbon, a screw is forced into it; and when this is the case, the screw becomes corroded and partially cuts off the current, and in some instances I have known it to cut the connection almost entirely off. If the points of the screws were plated with platinum or gold, the difficulty would be completely overcome. JAMES POOL.

Friendsville, Ill.

BUT few persons are aware of the magnitude and perfection to which the manufacture of doors and window blinds by machinery has arrived in the United States. It is stated by those who profess to know that the number of doors alone made within the one State of New York, exceeds 30,000 per day, or not far from nine millions per year. From statistics deemed reliable, it is believed that the amount of capital invested in this branch of manufactures in this country cannot fall short of $40,000,000.

THE home of the cactus family appears to be in southern Arizona. Here the grand cactus, *cereus giganteus*, is from thirty feet to forty feet high, and from three feet to four feet in diameter.

The Eucalyptus Tree.

The San Francisco *Bulletin* gives the following account of the *eucalyptus globulus*, or Australian gum tree, obtained principally from Messrs. Sontag & Co., of San Francisco, who have given much attention to its cultivation. (We recently published an engraving of this tree in the SCIENTIFIC AMERICAN).

The eucalyptus is favorably known to all residents of California, where probably not less than 1,000,000 trees are planted. In this city, in front of handsome residences, you will find it, with its magnificent drooping branches, making an effective and graceful shade tree. In Oakland, the broad avenues are lined with them, eucalyptus forests are planted in the country surrounding Oakland, and, in fact, in every country of this State where the cold winter will permit it to live, the eucalyptus will be found growing. The wonderful properties of this tree have only within the past few years been discovered and appreciated. It is justly claimed that when the tree flourishes in low, marshy, and feverish districts, all miasma will cease. It destroys the malarial element in any atmosphere where it grows, and is a great absorbent of moisture, draining the subsoil almost as thoroughly as a regular system of piping. The eucalyptus is an evergreen, and is found in its native country (Tasmania) in boundless forests, both on the hillside and in the lowlands, under extremes of climates, both as to heat and cold, ranging from 130° to 20° Fah. Whether it will endure a greater degree of cold, we think, has not as yet been determined. It is, however, worthy of a trial. Its remarkably rapid growth is a matter of much surprise, attaining, as it does, a maximum hight of about 300 feet, with a circumference of from thirty to fifty. For timber and fuel it is exceedingly useful, being hard and easily worked, and very serviceable for such purposes as the keels of vessels, bridges, etc., where strength and durability are essential. It is estimated that from $4,000,000 to $5,000,000 in value of this timber is exported annually from Australia. The leaves of this tree are of a dark bluish color, about ten inches long, an inch wide, thin, and oddly twisted. They exhale a strong camphor-like odor, quite agreeable and pleasant, which, with the large absorption of water by the roots, causes the beneficial influence of the tree. It bears a small white flower, having no odor. In consequence of its anti-febrile qualities, the English Government has planted it extensively in the East Indies and Africa, in fever districts, with the most satisfactory results. In France, Cuba, Spain, Mexico, and many other places where malaria, fever, ague, and other pestilential diseases prevailed, the eucalypti have been planted. The wonderful properties of this tree have been discussed by many scientific institutions in Europe. In the Academy of Sciences, in this city, its medicinal and anti-miasmatic qualities have received considerable attention. Dr. Pigne Dupuytren testified before that Academy of the virtues of the eucalyptus, and stated that both he and Dr. D'Olivera had tested it in the French Hospital. In the garden surrounding this hospital, a large number of the trees are planted for sanitary purposes. It had been found efficacious in the treatment of affections of the larynx and of the mucous membrane in general. Experiments, carefully made, have proved that, in a medicinal preparation, it cures cases of intermittent fever, against which quinine alone proves powerless. It is also valuable as a disinfectant. In Algeria its cultivation was undertaken on a large scale. Some 13,000 eucalypti were planted in an extremely pestilential and unhealthy section, where fever prevailed to a great extent every year. During the first year of their growth, at the time when the fever used to set in, not a single case of fever occurred, yet the trees were only nine feet high. Since then this place is reported free from its unwelcome visitations. In the vicinity of Constantinople, another fever spot, marshy and sickly, the whole ground was dried up by 14,000 of these trees. In Cuba, marsh diseases are rapidly disappearing upon the introduction of this tree. A railway station in the Department of the Var was so pestilential that the officials could not remain there longer than a year. Forty of these trees were planted, and the unhealthy condition of the place was changed. Two miles from Haywards, in this State, the surveyor-general planted groves of the eucalyptus, one of about ninety acres and the other seventy acres, the whole comprising about 150,000 trees. They are now only about five years old, yet many of trees are forty to fifty feet high, the whole making a most extensive and beautiful forest, being, for fuel and timber purposes, worth thousands of dollars.

Dynamite as a Stump Puller for Land Reclamation.

The following report of experiments with the newly discovered blasting agent, dynamite, which were carried out on Sir W. S. Maxwell's Cadder estate, is from the *Glasgow Herald*. Dynamite is nitro-glycerin mixed with a silicious earth found near Hamburgh, and known as *kieselguhr*, which, being used as a fine powder, absorbs and retains the liquid explosive.

Dynamite is a moist and plastic solid, of a pale brown color, not unlike the finer qualities of sugar. The dynamite is made up in cartridges of various sizes to suit the bore holes, one inch diameter being the general size. The great advantage of this substance over gunpowder is its greater comparative safety, as it will not explode without percussion; when ignited without percussion, rapid combustion ensues, but there is no explosion. In order to make dynamite effective, it is necessary to explode with it some detonating substance. Specially prepared and extra powerful percussion caps are the agents used, in connection with a suitable length of Bickford's fuse, which consists of a line or thread of gunpowder inclosed in a tube made of gutta percha, a piece of this fuse being tipped with one of the percussion caps. The cartridge was placed on the stump of an old tree and ignited. After a short interval there was a loud and powerful explosion, accompanied with considerable splintering of the wood. We quote the actual experiments *verbatim* from the pages of the *Herald*:

The stumps of a number of trees that had recently been cut down were experimented upon. By means of an auger, a hole about one and a quarter inches in diameter was bored vertically to a depth of twelve or fifteen inches in one of the stumps; and when it was found to be quite through the wood of the stump, it was continued by means of a crowbar to a depth of fully two feet. Two or three cartridges were put into the bore hole and firmly driven home by means of a wooden rammer. Then a small cartridge, called a primer, prepared with a cap-tipped fuse, was dropped in and rammed home, and the hole was tamped or stemmed by filling it to the top with water, care having in this case been taken to put a luting of clay round the junction of the cap with the fuse. The latter was fired, the observers betook themselves to a respectful distance, and in a brief space of time a great upheaval took place. The noise of the explosion, however, was in a great measure smothered. When the members of the party returned to the spot, they found the stump to be rent in a most extraordinary manner; but the general opinion was that the bore hole had been made so deep that the energy of the explosion had spent itself too much upon the subsoil and too little upon the wood. The stump next operated upon was bored to a less depth, and the result of the blasting process was more effective. In either case a few strokes with an ax, by way of severing the principal root members, would be quite sufficient to leave the woody masses in such a condition that they could easily be dragged out and lifted away.

It was suggested by Mr. John Scott that the operation of piercing with an auger should be dispensed with in blasting the next root stump, so as to do the work with as great economy of time as possible. In this instance, therefore, the crowbar was brought into requisition instead of the auger, and by means of it a hole was driven horizontally inward between two of the principal root members to about the center of the stump. The whole was charged and fired in the usual way, the result being a much greater amount of eruptive and disruptive action, with a smaller expenditure of time and labor. One or two other root stumps of large size were blasted in the same way, and it was clearly demonstrated that, under certain circumstances, dynamite could be employed to more advantage immediately underneath than in the mass of material to be operated on. Mr. Scott expresses himself to be fully satisfied, from what he has now witnessed, that he could use the new blasting agent with great effect and economy in land-clearing operations in Canada, so far as tree roots were concerned.

Sebacic Acid.*

When castor oil is gently heated with sodium hydrate, the whole solidifies, after much frothing, to a soft yellow waxy mass of sodium ricinoleate. On raising the heat, this salt melts and decomposes, an oily distillate passing over, and the residue yields sebacic acid. This acid, discovered in 1802 by Thénard, usually crystalizes in a multitude of long, fine, feathery crystals, which, when dry, have a peculiar pearly luster, or from dilute saline solution in long thin needles; but under certain conditions, it separates from the ammonium sebates in very thin, brilliant laminæ, with specular bright luster.

Soluble in 700 parts at 20°; in 400 parts at 40°; in 240 parts at 50°; in 50 parts of water at 100°. By prolonged boiling, it is possible to dissolve it in 22 parts of water, of which 1 part in 45 remains in solution at 96°. It is readily soluble in cold alcohol and ether, easily dissolved by hot ether, and extremely soluble in hot alcohol. It crystalizes from hot ether in short, transparent needles, and from hot alcohol in the same manner as from hot water.

It is readily soluble in hot nitric acid, and not decomposed by boiling therewith for a moderate time, but separates out when cold; easily soluble in hot hydrochloric acid without change, crystalizing out on cooling; readily soluble in cold sulphuric acid, extremely soluble in sulphuric acid at 100°, and separates out unaltered on dilution with water; not sensibly attached by digestion with nitrohydrochloric acid, or potassium permanganate and sulphuric acid.

Aqueous sebacic acid reddens litmus strongly, tastes acid and bitter, completely neutralizes the alkaline hydrates, decomposes the carbonates of potassium, sodium, barium, strontium, and magnesium, and precipitates solutions of lead acetate and silver nitrate if dilute, but neither mercuric nor calcium chloride, nor silver nitrate if strong, but precipitates the silver ammonio-nitrate.

Even after being twice recrystalized, it is apt to retain traces of a white solid hydrocarbon, melting below 100°, and a pale yellow hydrocarbon, which can be removed only by repeated recrystalization. A trace of hydrochloric acid is also frequently retained, even after a second recrystalization, and is also best removed by repeated crystalization; but it is probably to this trace of retained hydrochloric acid that one or two of the discrepancies in the earlier descriptions are due.

Of the two classes of salts formed by sebacic acid in its capacity of a bibasic acid, the neutral salts would appear to be the more stable, the second class, or the acid salts, being apparently decomposed more readily, and even in some instances by prolonged boiling of their concentrated solution. The acid salts seem to be all more or less soluble in water, and neutral salts of the heavy metals and of calcium insoluble i water, while the rest are soluble.

By treatment of sebacic acid with the salts of various metals, a great variety of crystals and powders of different colors, blue, orange, green, red, white and purple, some of magnificent character, are produced.

*From a paper read before the Chemical Society, by E. Nelson, Principal Assistant in the Laboratory of the Royal Veterinary College.

Formation of Gum in Fruit-Bearing Trees.

In the wood of a tree diseased with gum, a great number of vessels are always seen more or less completely filled with gum; sometimes they are entirely filled to a certain length, and sometimes the gum only forms a coating either upon all the periphery or only on one side. The gum first shows itself in very small drops, which gradually increase in size and touch each other, forming small irregular masses. Recent German observers have stated that the formation of the gum is due to the disorganization and transformation of the internal part of the wall of the vessel, but the author has come to an opposite conclusion. In examining the wood of an apricot tree from which large masses of gum were extracted, it was found that the vessels were marked with areolated punctures, and with a spiral line due to a thickening of the membrane; also that the surfaces of the masses of gum were marked with deep furrows corresponding with the spiral lines of the vessel wall and even with small projections according with the punctures. It is thus certain, in the author's opinion, that the gum has poured into the interior of the vessel, and that the marks upon it are imprinted from the vessel wall.

In the production of gum in the cellule by the transformation of starch, it has been observed that, on the first appearance of gum in the cellule, the unchanged starch gathers into small masses, around which forms a thin coating of gum. Gradually the starch diminishes, while the coating of gum increases, until at last the starch disappears altogether, leaving generally a vacant space in the center of the mass of gum.

Often the gum, produced in such considerable quantity, is formed neither in the vessel nor in the cellules, but in the spaces between the young tissues, generally between the wood and the bark, yet often also at the different depths in the wood. These gum spaces grow at the expense of the neighboring tissues, which suffer important modifications: the cambium, instead of producing woody fiber, forms cellules in which abundance of starch is deposited, which starch subsequently becomes converted into the gum.—*E. Prillieux* (*Comptes Rendus*).

Geology of the West.

Among the geological deductions of the Wheeler expedition are the following: All that portion of the United States west of the plains is characterized by corrugation, that is, the geological formations once horizontal have been bent and broken and thrown into ridges so as to produce a mountainous country. The ridges vary greatly as to hight and length, but agree in general northerly trend; so that in traveling north and south, it is generally easy to follow valleys, while in going east or west one is confronted by range after range that he must climb or go around. In the lower parts of this great mountain system, the slow but indefatigable agencies of rain and stream have accumulated so great an amount of detritus that the valleys are clogged and the mountains nearly or quite buried. In this way have been produced the great desert plains of Utah, Arizona, and Southern California, vast seas of sand and saline clay, from the surfaces of which a few half sunken peaks jut forth as islands. These intermissions of the mountainous character are mere concealments, not interruptions, of the corrugated structure; but that structure is interrupted in one place—perhaps in others, but in one notably—by a tract in which the strata are almost undisturbed. The general surface of this exceptional region lies from 6,000 to 8,000 feet above the ocean, and it is intersected by the celebrated cañons of the Colorado and its tributaries. By these gorges and by other modifications, chiefly dependent on erosion, it is divided into a great number of plateaus which the surveys now in progress are defining and naming. The geologists of the expeditions have found it convenient to designate the region, considered as a geological province, as the region of the plateaus, or the Colorado plateau system. It is surrounded on all sides by areas of corrugation, the ranges at the east constituting the Rocky Mountain system proper, and those at the west having been designated as the Cordilleras. At the north and south, these mountain areas coalesce.

Explosion and Firing of Volatile Oils.

A mixture of two parts of perfectly dry permanganate of potassium with two or three parts of concentrated sulphuric acid is a most powerful oxydizing agent, owing to the separation of permanganic acid and its immediate decomposition with the liberation of oxygen. Volatile oils are violently affected by this mixture, if about ten drops are placed in a little dish and then touched with a stout glass rod previously dipped into the mixture. The following produce explosions, often most violently: Oils of thyme, mace, turpentine (rectified), spike, cinnamon, origanum, rue, cubebs, and lemon. The following oils are simply inflamed, particularly if poured upon blotting paper and touched with the mixture, though under certain still unknown circumstances explosion may occur: Oils of rosemary, lavender, cloves, rose, geranium, gaultheria, caraway, cajeput, bitter almond, and rectified petroleum. The following substances are ignited without explosion: Alcohol, ether, wood spirit, benzole, chlorelayl, sulphide of carbon, and cotton. Gun cotton and gunpowder are not ignited.—*N. Repert. f. Pharm.*

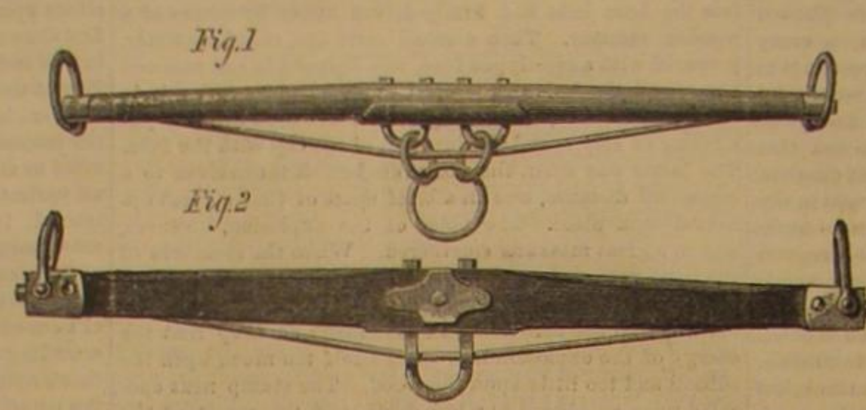
IMPROVED DOUBLETREE.

In the improved sway bar of a doubletree, whiffletree, or neck yoke, represented in our engraving, the strength of the wooden portion is materially increased by a brace rod, so that the bar may be made much lighter while still furnishing the necessary strength.

Each end of the sway bar is fitted with a cap or thimble, whereby it is protected from abrasion and splitting, and to which the clevises are attached in the ordinary way—set up at the ends of these caps. By the use of nuts, it is obvious that any degree of tension can be given to the brace rod, and, at the same time, the caps will be tightly secured to the ends of the bar.

The brace rod, as will be seen, passes through the staple by means of holes made for the purpose at proper distances from the rear side of the sway bar Fig. 2. By using the rod in connection with the wood, as described, the draft on the rod and pressure on the wood are both endwise, thereby, it is claimed, combining the utmost strength of both materials. These doubletrees, whiffletrees, and neck-yokes have, we learn, been thoroughly tested with success. With not very expensive machinery, it is stated, they can be manufactured with great facility. Two arrangements of the device are shown in the separate figures in our illustration.

This improvement is covered by two patents obtained through the Scientific American Patent Agency. For further particulars regarding sale of rights or sale of territory, etc., address A. N. Case, Kingsville, Ashtabula county, Ohio.

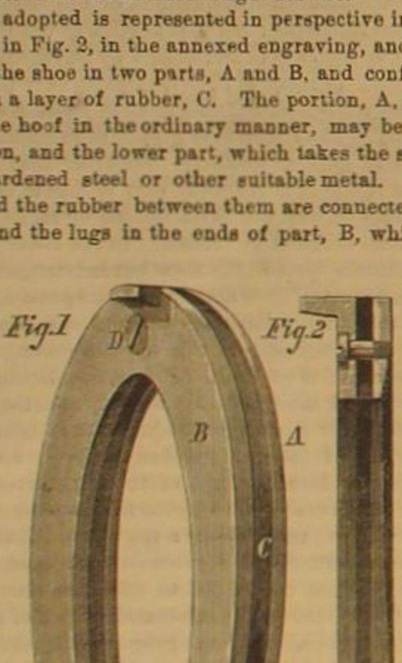


IMPROVED DOUBLETREE.

TODD'S IMPROVED HORSESHOE.

Mr. George H. Todd, of Montgomery, Ala., has recently invented a novel horseshoe, which seems well suited for use on city pavements. The object is to afford an elastic resistance to the step, thus avoiding that pounding action upon the stones which injures the hoof and renders so many city horses valueless. Nature has made the hoof elastic, and to confine it, in a bar or kindred inelastic shoe, produces a similar effect to that of inclosing the human foot in an iron boot. As the abrasion of the covering upon the human member causes corns, so does the badly formed or adjusted shoe produce similar infliction upon the feet of horses, subjecting them to temporary and often permanent lameness. Mr. Todd's invention is, therefore, desirable in both a humane and an economical sense, as it aims to restore the elasticity which is lost by the necessary protection of the shoe, and thus to preserve the animal for longer service.

The plan adopted is represented in perspective in Fig. 1, and section in Fig. 2, in the annexed engraving, and consists in making the shoe in two parts, A and B, and confining between them a layer of rubber, C. The portion, A, which is nailed to the hoof in the ordinary manner, may be made of common iron, and the lower part, which takes the shock and wear, of hardened steel or other suitable metal. The two portions and the rubber between them are connected by the screw, D, and the lugs in the ends of part, B, which enter



indentations in part A, as shown in the sectional view, Fig. 2. It will be observed that the rubber intercepts the force generated by the impact of the shoe and the ground, and by its yielding reduces the shock before the same reaches the animal. We are informed that there is no permanent spreading of the rubber by compression, and that it answers admirably the above purpose for which it is intended. The inventor states that he was enabled to use a horse when thus shod, which, when wearing the ordinary shoe, was too lame to use.

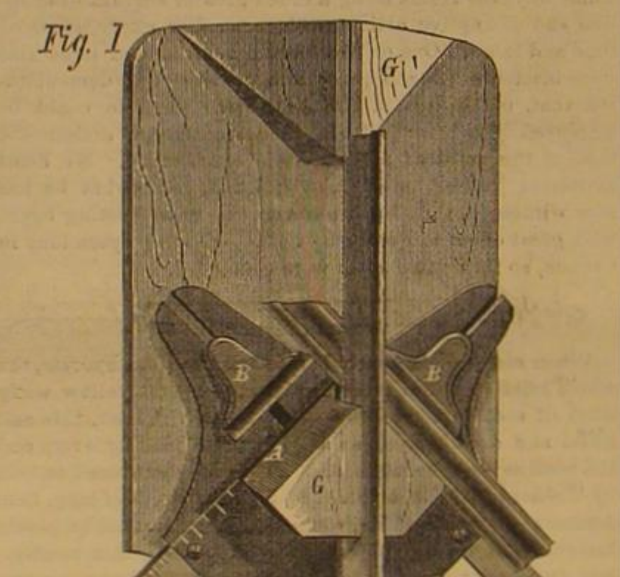
There are advantages other than those noted, which readily suggest themselves. The shoe is rendered much lighter, and the wear comes almost entirely upon the outer portion; the rubber can be cheaply renewed; the foot piece will out wear a number of the outer plates.

The form of shoe, as represented in our engraving, is somewhat modified to adapt it for trotting horses, to gain greater lightness. To this end the outer piece, with the exception of the toe, through which the holding screw passes, is cut down on its inner side to a mere rim, curved in section, inside of which the rubber, also diminished in size, is placed as before. The inventor informs us that, instead of making the rubber simply to line the shoe, it may be left a flat piece, extending entirely across the under portion of the hoof. When thus arranged, the latter may be stuffed and the tow or other material held closely in place, the under surface of the rubber serving as additional foothold. The durability of the portion which is directly nailed to the hoof, offers also an additional advantage, in that, when once accurately fitted, the shoe remains so for an indefinite period, and hence the chances of the animal being injured from improperly adjusted shoes are necessarily not so great as when old ones, on wearing out, are constantly replaced.

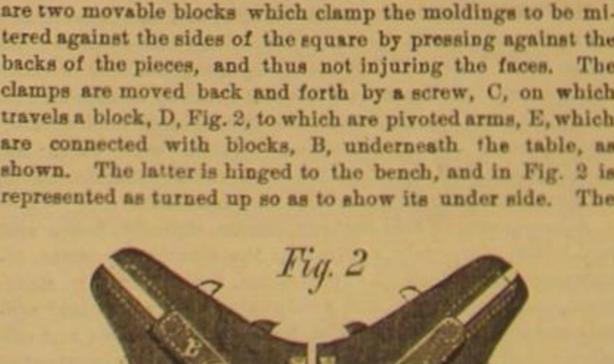
Further particulars may be obtained by addressing the inventor as above, or the shoe itself may be seen at the store of Spies, Kissam & Co., 279 Broadway, New York city.

IMPROVED MITER MACHINE AND FRAME VISE.

Our engravings represent a simple, cheap, and durable device, by means of which frames can be easily made and put together without requiring the work of a skilled mechanic. It consists of a miter box for cutting the ends of the material to proper angles, and a vise which holds the frame firmly while being fastened together. The apparatus, which is



constructed of iron, has on its table a square, A, Fig. 1. B B are two movable blocks which clamp the moldings to be mitered against the sides of the square by pressing against the backs of the pieces, and thus not injuring the faces. The clamps are moved back and forth by a screw, C, on which travels a block, D, Fig. 2, to which are pivoted arms, E, which are connected with blocks, B, underneath the table, as shown. The latter is hinged to the bench, and in Fig. 2 is represented as turned up so as to show its under side. The



motion of the screw and adjacent parts is indicated by the dotted lines.

After one end of the molding is mitered, the piece is placed on the other side of the square, and its extremity adjusted to such a mark on the measuring arm, F, as denotes the length desired. It is then immediately cut by the saw, thus obviating the trouble of measuring and marking each side of the frame, and also the liability of mistakes. After the pieces are mitered, they may be placed on the square and clamped tight by the blocks, when they can be readily nailed together. Thus constructed the sides will be accurately fitted, as, being firmly held during the fastening, they cannot move out of square. This operation repeated for the other corners, completes the frame. If, in fastening, it is found that the molding has become sprung or twisted, the joint, we are informed, may be quickly made perfect by running the saw through it, thus enabling the operator to use moldings which would, in the ordinary manner of working, be of little utility. The saw guide blocks, G, are of wood. One is screwed within the square and the other to the bench. The latter may be made to slide back and forth so as to be brought against the molding. As the blocks wear away, they can be brought together, the screws underneath working through slots for the purpose.

The machine may be hinged to the bench as shown, or may be imbedded in the latter flush with the surface. A circular saw may be employed instead of the hand instrument, if desired.

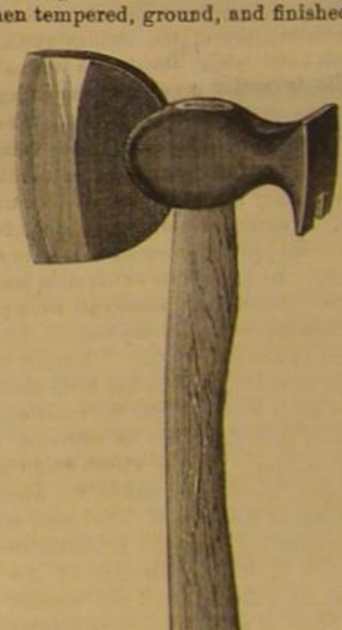
For further particulars address the inventor, Mr. James H. Van Ness, Charlotte, N. C.

Electrical Currents from Albumenoid Substances.

M. Becquerel has shown that, when two heterogeneous liquids are separated by an organic membrane or by a capillary space, they give an electric current capable of producing chemical and mechanical effects, reduction of metals, and double decomposition, etc. M. Onimus finds that the interposition of a layer of albumenoid matter (white of egg, albumen of blood) has the same electro-chemical results. Thus with the solutions of sulphate of copper and of oxalate of potash, separated in a tube by albumenoid substance, beautiful blue crystals of oxalate of copper and potash are obtained. The phenomena, he points out, may throw light on the formation of phosphate of lime in animals.

JENKINS' PATENT COMPOUND HATCHET.

This hatchet is formed simply by punching the blade out of sheet steel, about No. 12, with a hole near the top. The blade is then set in a mold and a head cast on it, the melted iron uniting through the hole and forming a perfect fastening. It is then tempered, ground, and finished.



It is claimed that, in this manner, a hatchet carrying a good cutting edge, and having a head sufficient for ordinary purposes, may be manufactured at a comparatively small cost.

Patented through the Scientific American Patent Agency. The entire right for sale, or a license to manufacture on a royalty may be obtained. For further particulars address Mr. J. Jenkins, Coulter street, Germantown, Pa.

The French expedition which has been exploring Terra del Fuego reports the finding, in the interior, of a large lake, 15 miles in circumference, surrounded by luxuriant vegetation, and literally covered by an army of wild fowl, among which the most abundant were ducks and geese. These regions are inhabited by rude but hospitable tribes; the women especially are very affable and obliging. One of them, in exchange for some pieces of sugar and common handkerchiefs, gave the leader of the expedition an object to which she attached an immense value, and which she preserved as a relic—the lid of a sardine box.

THE SEAFORTHIA ELEGANS.

Few of the larger growing palms, says a correspondent of the London *Garden*, to which we are indebted for the accompanying engraving, equal this species in beauty; and it has, what is many cases a great advantage, the property of being a rapid grower. Its proper place is planted out in a conservatory that is cool in summer, and kept regularly a few degrees above freezing in winter. Planted out in such a position in a bed of rich loam, and abundantly supplied with moisture, it soon makes a noble plant. Although a native of tropical Australia, it is sufficiently robust in constitution to succeed out of doors as a sub-tropical plant during our summer season, when it should be plunged on a well drained bottom.'

Our illustration, showing the way in which it is used in French gardens, exhibits the graceful port of this species at a glance, and also the singularly effective character of the plant when associated with yuccas and other fine foliaged subjects in the open air. Scarcely any other palm is better adapted than this for a center plant in any well arranged group of foliage or flowering plants; and small specimens are useful for this purpose, as well as for the decoration of apartments and reception rooms. It is readily propagated from seeds sown in light soil in pots plunged in a gentle moist bottom heat, and the plants are ornamental from the time they attain 9 or 10 inches in hight until they outgrow the quarters allotted to them. Frequent syringings overhead are beneficial to them, especially during hot weather, in order to keep down red spider; and as soon as the pot or tub becomes filled with roots, a little manure water is advantageous to them.

We have noted several small plants doing well in apartments, but they require a plentiful and regular supply of water at the root, and the hard foliage should be washed at least once a week with a soft sponge and clean tepid water. If soap is used, be particularly careful to remove every particle of it from the plant afterwards, by either syringing or sponging with clean water. If only one palm is required, for either pot culture or for planting out in the conservatory, we should recommend this before all others, on account of its graceful habit and easy culture.

THE SEAFORTHIA ELEGANS.

An Oyster Patent.

One of the great troubles which oystermen have to contend with is the starfish. This rapacious enemy destroys thousands of bushels of oysters every year, and no device has heretofore proved effective as a protection. But the ingenuity of a Connecticut Yankee has at last triumphed. Mr. Oliver Cook, of Darien, Conn., has lately obtained a patent on the subject. His invention consists in spreading a net, under water, on the ground composing the oyster bed. Mr. Starfish puckers his fingers together, squeezes himself up through the meshes of the net, and then extends his digits again. Being now upon the upper side of the net, he will be infallibly captured whenever the oysterman raises the net to the surface. This is to be frequently done until the enemy is cleared from the coast, when the oysters at once begin to laugh and grow fat.

A Metallic Larynx.

The total extirpation of the larynx was performed not long ago, for the first time, by Professor Billroth, in Vienna, in consequence of epithelial disease, so extensive as to be amenable to no less severe procedure. The correspondent of the Boston *Medical and Surgical Journal* reports that tracheotomy was performed in order to accustom the patient to the use of the canula; when this was accomplished, the extirpation of the larynx was undertaken, by carefully dissecting it away from the surrounding tissues, leaving the hyoid bone and sound portion of the epiglottis. That night, brisk hæmorrhage occurred from some of the smaller arteries, and the patient seemed, for a time, in imminent danger of suffocation; it was also necessary, during the first fortnight, to administer liquid food through an œsophageal tube; but the extensive wound has entirely healed, and the operation must be conceded to be a success, and to reflect no little credit on its originator.

After the operation the man still possessed the power of communicating his wants in an indistinct but intelligible whisper. Subsequently a metallic larynx, provided with vibratory reeds, was fitted to the upper convex surface of the tracheotomy tube, and the man "can congratulate himself that, if his voice is a trifle monotonous in pitch, it is by no means unmusical in tone."

Preservation of Telegraph Poles, Posts and Railway Sleepers.

In the course of a recent discussion before the Society of Telegraph Engineers, London, concerning the best methods of preventing decay in wooden telegraph poles, it was stated that an experience of several years with hop poles had shown that, when their lower ends were simply boiled in an open vessel of creosote, the wood was greatly preserved from decay. The more perfect method of creosoting wood is to boil in creosote under a pressure of 120 lbs. to 150 lbs. per square inch. This involves expensive apparatus, but the wood thus treated will last indefinitely.

It was alleged that simply painting the bottoms of green poles with tar hastened decay, as the sap was sealed up at that point. When the poles were well dried, the application of tar was believed to be useful.

Attention was called to the process of Sigismund Beer, of New York city, which was considered to be an important one. It is certainly very simple, economical, and easily practiced. The wood is merely steeped in solution of borax. This salt is supposed to neutralize the decomposition of the vegetable matters in the wood, which are afterwards washed out.

Mr. Von Truenfeld said that he had not been concerned with wooden posts in England, but he knew of tropical trees which would last, he should say, at least 200 years without showing the slightest signs of decay. He had had occasion to take up poles which had been used in building, and which had been in the ground for over 100 years without showing the least sign of decay or corrosion on the ground line. They were poles made of trees growing in the interior of South America, and which were called in the native language the *urunday* and the *curupay* trees. They were generally called by English people iron wood. The wood was so hard that it was impossible to drive a nail into it. It would, perhaps, be an advantage if it could be brought to this country, and used for telegraph poles. He should think that it would last for hundreds of years. It might be worth while for some of our investigators to experiment with the iron wood with a view to its acclimation here.

Galvanic Electricity without Chemical Action.

At a recent meeting of the Physical Society, Mr. Fleming showed his new battery, in which the metallic contact of dissimilar metals is entirely avoided. The arrangement consists of thirty-six test tubes of dilute nitric acid, and the same number of tubes of sodium pentasulphide, all well insulated, alternating with one another. But strips of alternate lead and copper connect the neighboring tubes; by which means the terminals are of similar metal, and a current of sufficient intensity to violently affect a quantity galvanometer obtained. The potential increases, as in the ordinary galvanic arrangement, with the number of cells employed, until sixty cells showed an electro-motive force exceeding that of the same number of Daniell's elements. In this new battery the acid lead is positive to copper, while in the sulphide it is negative. Mr. Fleming further showed how, by using the single fluid nitric acid, and the single metal iron, a similar battery could be constructed, provided one half of each iron strip was rendered passive. This is an important discovery; for it seems to revive the theory that chemical action is not necessary in a galvanic apparatus to produce electricity. At all events it is of sufficient interest to merit the sound inquiry into its principles which physicists seem likely to make.

New Protecting Compound for Iron Ships.

Dissolve thirty-four ounces of shellac in eighty ounces of wood alcohol, which is allowed to stand about twenty-four hours. Then add thirty ounces of Venetian red, and thirty-five ounces of sulphate of lime, and thoroughly mix by passing it through a paint mill.

The paint is now ready for use, and is applied with a brush in the same way as ordinary paint, and will dry instantly, so that the vessel may be lowered into the water within an hour after the paint has been applied to the bottom.

For vessels navigating fresh water, or both salt and fresh water, the proportions of the Venetian red and the sulphate of lime used may be diminished. This paint may also be used upon the inside of the iron work of the vessel. It is the invention of Samuel Williams, of New York city, recently patented.

Condensed Milk Manufacture in Switzerland.

A factory for the production of condensed milk has recently been established at Cham, canton Zug, on the borders of the lake of the same name, in Switzerland. We find the following description of the process in the *Bulletin de la Société d'Encouragement*: The milk is furnished by peasants; and as soon as each person delivers his supply, a sample is taken from the pails, numbered, and allowed to remain quiet over night. The object of this is to judge of the quality of the milk for the rising of cream. Cases of fraud, however, are rare, as the peasantry are generally honest and the penalties imposed by law are extremely severe.

The first operation is to weigh the milk, which to this end is conducted into a copper basin supported by a balance. Its weight being obtained, the milk is allowed to escape into huge wooden reservoirs lined with zinc, and located in the cellar. Here a careful examination is made with the lactometer, and the fluid is drawn off into large cylindrical copper boilers which are placed in a vat furnished with a false bottom under which steam enters. The milk is thus slowly heated, but not boiled. For the latter purpose, it is ladled out into a separate boiler whence it is carried to another tank containing a a quantity of white sugar. In order to facilitate the solution of the latter, the liquid is repeatedly passed along a metal trough from one vase to another. When the operation is completed, it is drawn off into evaporating chambers. These receptacles resemble the similar apparatus used in sugar manufacture, and have double bottoms heated by steam. They are united to a column of condensation which communicates with air pumps. Under these conditions the milk boils at 140° Fah. Every little while the workman takes out a sample from which he judges according to its viscosity whether the condensation is sufficient.

When the latter point is reached, the liquid is led down into the cellar and into a tin receptacle which is surrounded by cold water. The milk is thoroughly agitated by hand for some time until completely cool, when it is carried to other reservoirs and thence drawn off into boxes and sealed. The daily product is about 8,000 boxes, each weighing about 13·5 ounces. The milk may be diluted with five times its weight of water.

The Fastest Steamer in the World.

Such is the title claimed by Messrs. Thornycroft for a boat they have just built to the order of the Government of India, for service in the Orissa canals. The dimensions of this vessel are: Length, 87 feet; beam, 12 feet; draft of water, 3 feet 9 inches. The speed contracted for was 20 statute miles per hour. The hull, the working parts of the engines, and the propeller—Thornycroft's patent—are of Bessemer steel, and the woodwork is of teak. The official trial of the boat was made on the 14th ultimo under the inspection of Colonel Haig, R. E., chief engineer of the Bengal Irrigation Works, and the results were: With tide, 25·08 miles per hour; against tide, 24·15 miles per hour; giving a mean speed of 24·61 miles per hour. In another official trial it was shown that the boat could keep up a speed of 22 miles per hour without losing steam. These speeds are extraordinary enough in themselves, but when it is considered that they are attained by a boat only 87 feet long they become absolutely wonderful. The value of swift steam launches as torpedo boats is acknowledged, and already various foreign governments have ordered boats from Messrs. Thornycroft's yard, near London. If torpedo launches can be built to steam at the rate of 16 or 18 miles an hour in a moderately calm sea, the whole face of naval warfare may find itself changed in a very unexpected way.

Novelty in Ship Building.

At East Boston, Mass., there has been built by N. Gibson, as an experiment, a three masted schooner without frame. The vessel is 138 feet long, 32½ feet beam, and 12 feet 2 inches depth of hold. Long, sharp, large capacity and buoyancy. The vessel is composed of square logs of spruce, one foot square, placed one upon the other, and secured together by iron bolts, three feet long and placed twelve inches apart. The owner expects that this vessel will prove to be stronger, more capacious, and faster than vessels of the ordinary construction. In timber there is a saving of forty per cent. Twenty-six tuns of iron were used. The construction of vessels on this plan was illustrated by engravings in the SCIENTIFIC AMERICAN several years ago. In view of the marked revival of shipbuilding now going on in this country, there is an excellent opportunity for inventors to study out new and useful improvements in maritime devices of every kind. Less attention has been given to this branch of industry by inventive minds, than almost any other.

BURSTING OF A MOUNTAIN WATER RESERVOIR IN MASSACHUSETTS.—A TERRIBLE CALAMITY.

The beautiful valley of Mill river, a tributary of the Connecticut, near Northampton, Mass., was the scene of an awful calamity on the morning of the 16th inst. At about 8 o'clock A.M. the dam of an immense water reservoir, located high up among the hills, above the village of Williamsburg, suddenly burst, and a tremendous flood poured down the river bed, overrunning the banks and sweeping away like chaff whatever stood in its path. Dwelling houses with families peacefully sitting at the breakfast table were instantly swept to destruction. Great factories, mills, bridges, stores, and property of all kinds disappeared in a moment; and upon the summit of the watery crest were to be seen the broken roofs of buildings, timbers, trees, wheels, pianos, and household goods of every description.

The village of Williamsburg was first struck. One third part of the village was instantly plowed through, leaving a broad bed of shapeless disfigured ruins of stones and débris where cottages, flowers, and scenes of peaceful beauty had previously existed. Many of the principal dwellings, factories, and other buildings were taken off, and a large number of the inhabitants perished.

Haydenville seems to have been unfortunately situated between two river curves, and hence, at one end of the town, are to be seen the effects of the madly rushing torrent; in a sweep of highlands at the other, the effects of the devastating undercurrent of the backwater, as it receded from and finally leaped over the lower bank. The great brass works of Hayden Gere & Co. were first swept, by a wall of débris from fifteen to twenty feet high, and with the added momentum the flood went over the road bed, devastating lawns and porticos of houses, leaving a boiler 2,000 feet from its original position, and placing it on an elevated spot in front of a house, tearing out the stone sides of the river and placing the boulders in the bed of the channel or on the sidewalk, and sweeping men, women, and children into eternity. Wooden houses were seen to come bounding along like corks, and from the interior of more than one were heard the shrieks of wives and daughters, whom their husbands and fathers had left a few moments before in fancied security. It was a sight which paralyzed every beholder.

At Skinnersville, the most frightful havoc of all, as regards extent of damage to property, took place in Skinnersville, although fewer lives were lost there than elsewhere. Only three houses were left standing in the village.

On the main street and village green of Leeds only three buildings remain. The Nonotuck silk factory, a solid structure, together with its costly dam, quickly fell, then the Emery Wheel Co.'s premises, the engine house, church, Wagner's button factory, and all the other buildings in the vicinity.

Over one hundred and fifty lives were lost, and property destroyed to the amount of between one million and two millions of dollars.

This terrible calamity was due to the weakness and bad construction of the reservoir dam, built six years ago. Its condition has at all times been a cause of uneasiness to knowing ones at Williamsburg.

THE RESERVOIR AND DAM.

The reservoir was one of a system of dams and reservoirs owned by a corporation called the Mill River and Williamsburg Reservoir Company, which included all the manufacturing establishments on the line of Mill River from Williamsburg to Northampton. It was situated on the east branch of Mill River, about three miles from the village of Williamsburg, in the northeastern corner of Northampton. The stream which supplied it, after joining the west branch at the village of Williamsburg, forms Mill River proper, which flows through Haydenville and Florence, and empties into the Connecticut river at Northampton.

In building the dam a stone wall was first built, which was stipulated to rise from a width of eight feet at the base pan to two feet at the top, which latter was 42 feet above the bed of the stream. This wall was contracted to be laid in the best known cement, and the projectors claimed it would be as strong as a single shaft of granite. Enveloping this wall on either side was a mass of earth, which sloped down on the water side at an angle of 30°, and on the lower side at an angle of 45°; a lateral section of this earthen support measured about 120 feet at the base, the greater mass of which was on the water side. At the center of the stream, inclosed in a stone wall, running at right angles to the main wall of the reservoir, ran an iron tube of two feet in diameter, for controlling the flow of water, extending, of course, a few feet beyond this eastern wall, at both extremities of its base. This wall of earth, 120 feet wide at bottom, was 16 feet across at the top, covering the crest of the stone wall, two feet in depth, in order to prevent danger from frost, and along its top furnished a good drive way. The water never rose quite to the crest of the dam, being kept about two feet below that line by means of a waste way at the western side. The reservoir covered an area of one hundred and eleven acres, and its average depth was twenty-four feet.

Is the Skunk's Bite Deadly?

While it is apparently difficult to add anything to the odium which is already attached to the common skunk, Rev. Horace C. Hovey finds a way of so doing by bringing forward proof that the animal is as dangerous as it is disagreeable. In the *American Journal of Science and Arts* is a paper by the above writer, in which he considers that a new disease has been discovered, which generally resembles *rabies canina* (of which hydrophobia is a symptom), while differing from it specifically. To this he gives the name of *rabies mephitica*. It is transmitted by the bite of the skunk, and occurs when the glands which discharge its offensive fluid are inactive, so that it is possible that there may be a causative connection between this inactivity and the generation of malignant virus in the glands of the mouth. Mr. Hovey gives a large number of instances of men and animals dying from this cause in fearful convulsions. The mephitic inoculation, he says, is sure death. From the diagnosis given of the resulting disease, it seems that the period of incubation is about the same as that of rabies canina—from ten days to twelve months. The characteristic pustules of hydrophobia, which appear under the tongue and near the orifices of the submaxillary gland, are absent. So also is the abhorrence of water, catching of the breath, difficulty in swallowing, and various other symptoms of the rabies canina. There are, however, oscillations of the pupil, rapid alternate contraction and relaxation of the muscles, wiry radial pulse, and rapid action of the carotid, loss of perception, and delirium. The struggles of Nature to eliminate the poison are less prolonged in the rabies mephitica, and may be abridged by morphine, which has no narcotic effect in hydrophobia. In view of the great number of skunks in various portions of the country, it would appear that a further and more extended investigation into the nature and causation of this disease is of much importance. If the animal is so fearfully dangerous, its extermination should follow as relentlessly as that of the rattlesnake.

A New District Telegraph Instrument.

We have recently seen a new telegraph instrument designed by Mr. Hamilton E. Towle, and Mr. William Unger, of this city, to replace the apparatus now employed on the district telegraph lines. The device, like the ordinary instruments, gives three distinct calls, "police," "messenger," and "burglar alarm," and may be used for transmitting signals by sound. The notched wheels which break and close the circuit at certain times, making a distinctive signal, in the ordinary apparatus, are replaced by vertical bars formed of metal and rubber, so arranged that the switch passing over them receives the current when touching the metal portions, which are placed at certain intervals apart, and transmits the same to the sounding device at the main office. The machine is set in motion by pressing a button, which removes a detent from holding the clock work. A rod then rises from the top of the apparatus until the signal is completed, when it is pushed down, thus winding up the mechanism ready for another signal. The burglar alarm is so arranged that, by breaking a wire or connection, the current, which before preferably traversed that wire, passes to an electro-magnet, setting the device in action and transmitting a proper signal. We shall probably present before long an illustrated description of this invention, until which time further details are unnecessary.

How the Germans grasp American Inventions.

Engineering recently devoted a page of its space to editorially discussing the subject of breech-loading ordnance in general, and in particular the system invented by Mr. L. M. Broadwell, an American engineer. Our cotemporary says that, with a few unimportant exceptions, all the breech-loading guns exhibited at the Vienna Exposition were constructed after this plan. The specialty of the invention consists in the combination of a self-adjusting gas ring with an adjustable circular bearing plate, which together forms a perfectly gas-tight joint, and which can be repaired at an insignificant outlay of time and money. The history of the device, published in *Engineering*, is quite detailed, and it seems that the claims of the inventor have been fully recognized in France, Russia, Austria, Turkey, Italy, and Switzerland, and that these countries have paid him large sums for his patent rights.

In Germany, however, the usual course of injustice has been followed. Krupp has adopted the improvement, is manufacturing it on a large scale, and declines payment therefor; while the government has refused the inventor a patent on a clearly absurd pretence. The story is perhaps too long to find place in our columns, but it adds new corroboration to the facts which we have already published regarding the oppressive workings of the German patent laws as regards foreign inventors.

Unprofitableness of Government Telegraphs.

Our British friends have no doubt become convinced that, as a financial operation, government management of the telegraphs does not pay. With all the possible manipulation of the accounts and charging to the general post office expenses much that is properly chargeable to the telegraph service, there is a deficit, stated by the *Railway News*, of London, at $5,000 per week, and which is constantly increasing. The private companies which were superseded by the government in the business, most of them, made the said business profitable to the stockholders, and the public was as well accommodated as it is now, to say the least.

Government telegraphy, as a remunerative branch of the postal service, is a failure; but having assumed the owner ship of the elephant, he must, of course, be retained and supported. If government telegraphy in a country like Great Britain, which is densely populated, and whose telegraph facilities are very generally used by the public, the circuits short and easily maintained, and the compensation of employees comparatively very small, cannot be made to pay, what is the prospect in this country? The experience of Great Britain has probably saved our own government and people from the loss, damage, and dissatisfaction inevitably attendent upon government telegraphic administration; but it is well to keep the facts before the public and Congress.—*The Telegrapher.*

Fish Scale Ornaments.

Among recent patents is that of Eduard and Julius Huebner of Newark, who have invented certain new and useful improvements in preparing fish scales for use in the arts, of which the following is a specification:

The object of the invention is to utilize the scales of several varieties of fish, hitherto thrown away as useless, and prepare them for application in the arts, by producing articles of jewelry, artificial flowers, and similar objects. This invention consists in the process of cleansing and purifying the scales till the clear, horny substance or core of the same is obtained, which produces a new article of manufacture, which may be stamped into various ornamental shapes and dyed in all colors, for use in the arts.

Large scales are the most advantageous, taken from fresh fish. Old scales cannot be used, as they lack elasticity and clearness. The fresh scales are exposed for twenty-four hours to the action of pure salt water, for loosening and partially separating the outer layers of organic matter. They are then transferred to distilled water, being placed every two or three hours in clean water and washed therein five or six times, which renders the scales soft and clear. Each scale is then carefully rubbed with clean linen rags, then passed through a press having a linen lining so as to remove the moisture in the scales. The scales are finally placed for one hour in alcohol, and again rubbed and pressed, when they are dry and have a perfectly clear appearance, a mother-of-pearl-like hue, and great elasticity and durability.

The scales are used in this prepared state, or they may be dyed with aniline and other colors, in the usual manner, to be stamped into various kind of ornamental shapes, leaves, and flowers, and applied to the manufacture of jewelry and artificial flowers, for embroidering and inlaying wood, and other uses in the arts.

The New Steam Hammer at Woolwich, England.

To say that it is the largest and most powerful in the world conveys but an inadequate idea of its magnitude and might. The weight of the falling portion is within a few pounds of 40 tuns, and the force of the falling weight is accelerated many times by the use of steam to drive it down from the top. It is at least four times as powerful as Krupp's hammer. It is estimated that the use of top steam is equal to allowing the hammer to fall of its own weight 80 feet. It has been allowed a striking fall of 15 feet 3 inches, and nobody has yet determined what is the actual force of the blow which it will strike. The hammer is 45 feet in hight, and covers, with its supports, a base of about 120 feet square. Above the ground it weighs 500 tuns, and the iron in the foundations below weighs 665 tuns. It has cost altogether about $250,000, the greater part of which has been paid to Messrs. Nasmyth, Wilson & Co., the patentees and manufacturers.

Steam on the Erie Canal.

The Baxter steam canal boat City of New York left this city for Buffalo, with way freight, Saturday 9th inst., at 5:35 P. M. She discharged and received cargo at Utica and Syracuse, and arrived at Buffalo Saturday morning, 16th inst., at 6 o'clock. Time, including all detentions, 6 days, 12 hours, and 25 minutes. She loaded to return on the same day. This seems to demonstrate the perfect practicability of using steam in canal navigation, as the usual time of horse boats is 12 to 14 days. The City of New York is the second boat of the line, and a number more are now being built.

THALLIUM burns in oxygen with a splendid green flame, and its use has been suggested for fireworks in lieu of chlorate of baryta. Thallium is a comparatively new metal. It was discovered in 1861, and has as yet few commercial uses. It resembles lead in appearance and many of its characteristics. Its weight is nearly the same as lead, but it oxydizes much more rapidly than lead.

Recent American and Foreign Patents.

Machine for Matching, Measuring, Singeing, Brushing, and Rolling Carpets.

James Short, New Brunswick, N. J.—This invention consists of an endless belt, with divisions of its length corresponding with the distance from center to center of the figure of the carpet or other woven goods to be matched; also mechanism in connection therewith for drawing the goods alongside of the belt in unison with its movement, and preferably over a table or a cylinder, by which the variation of each piece, in the distance from center to center of the figures, if any, is shown in the aggregate at the end of each piece, where it can be accurately measured with a rule, to be noted on the tag attached to the piece when rolled. The invention also consists in combining, with the mechanism employed for drawing the goods along the matching device and operating the latter, mechanism for measuring, singeing, brushing, and rolling the goods at the same time they are matched, by which one movement of the goods answers for all these several operations. This machine is by the same inventor who devised the very ingenious loom for weaving carpets of any width, illustrated some time ago in our columns. The present invention does away with a large amount of hand labor, and, it is believed, will prove of great utility in the wholesale trade.

Machinery for Burnishing Heels of Boots and Shoes.

Oliver G. Critchet, Belfast, Me.—Steam is introduced into a revolving chamber through a pipe which passes through a stationary head which is tightly packed. On the end of the chamber is a burnishing disk. The chamber is given a rapidly revolving motion, and, being heated by the steam in the chamber, it produces the desired effect.

Improved Pipe Wrench and Cutter.

William W. Micks, Elmira, N. Y.—A clamp-shaped on the inner side, comes in contact with the pipe, and has a round screw-threaded stem that passes through a block, provided with a griping tool and cutter, and enters a handle which is bored and screw-threaded for the purpose. By turning the handle on the clamp stem the distance between the clamp and block may be altered to accommodate different sizes of pipe. The block is arranged to take a new hold on the pipe whenever the handle is vibrated for that purpose. The tenon of the cutting tool has no play. When it is desired to attach one pipe section to another, or to disconnect the same, the jaw is used. When a pipe section is to be cut in two, the block is reversed and the cutter inserted, the handle being adjusted on the stem accordin to the size of the pipe.

Improved Signal Lantern.

James C. McMullin, Chicago, assignor to himself and William H. Masterman, and John Adams Jackman, Jr., Bloomington, Ill.—This invention relates to improvement in the signal lights of locomotives, railroad cars and stations, vessels, docks, lighthouses, and other objects, by which the light is thrown out in such a manner that portions of it are seen at greater, and other portions at lesser, distances, permitting, thereby, the approximate determination of the distance of the lights from the points of observation, and avoiding, to some extent, the danger of collisions or other accidents. The invention consists, mainly, in the construction of the front part of the signal light with a number of lenses of different sizes, arranged with or without colored glasses, or the arrangement of the front part with suitable designs of colored glasses, so that a similar graduation in the intensity of the emitted light is produced.

Improved Compound for Coating Iron Ships' Bottoms.

Samuel Williams, New York city.—This is an improved compound for the outside of iron vessels below the water line, formed of shellac, wood alcohol, Venetian red, and sulphate of lime. The paint is applied with a brush in the ordinary way, and will dry instantly, so that the vessel may be lowered into the water within an hour after the paint has been applied.

Improved Bag Fastener.

Daniel Jones, Hortonville, Wis.—Upon the edge of an arc-shaped plate are formed hooks, the concavities of which connect with fulcrum notches by inclines. To one loop is pivoted the plate, and to another loop a lever, the loops being jointed together and being of such a length that the lever may be fastened on the hooks. The lever is so curved that its short loop may be easily placed in a fulcrum notch, and will allow the long loop to be turned over at great advantage of leverage, drawing the fastener tight around the bag. As soon as this is effected, the loops slip back out of the notches, over the incline, and into the concavity of the hook, where they are securely held.

Improved Watch Chain Hook.

Henry T. Salisbury, Pawtucket, R. I.—This is an improved watch chain hook, by which the watch chain remains always securely attached to the vest without being liable to detachment by accident or pickpockets. The invention consists of a circular pivoted guard hook, which is locked to its stem by means of a central bolt sliding in a tubular sleeve at the inside of the stem. The sleeve is slotted for guiding a projecting rib of the central bolt, which rib is notched and locked by two or more annular bands or rings, and detached from the same when a notch of their inner circumference is brought in line with the slot of the sleeve, so that the bolt may be withdrawn and the hook opened.

Improved Reamer for Earth Borers.

John A. Chandler, Monticello, Iowa.—This invention is a reaming attachment to earth-boring apparatus, by which the lower section of a well below a stratum of quicksand may be quickly enlarged or extended, for the purpose of carrying the curbing down to the bottom of the well, and producing a well of uniform width. After the cut has been continued with the smaller auger till water is obtained, a reaming attachment to the shaft is used, having adjustable guide plates and sliding cutters, for enlarging the narrower section of the well below the curb gradually, from the bottom upward to the full width of the same, so that the curb slides down to the bottom of the well, and produces thereby, after the earth has been removed, a well of equal width.

Improved Saw Table.

Edward H. Hanna and Charles W. Hanna, Dover, Ky.—The pitch board is supported on the bed by means of two screws which are jointed to the board, and work through stands, and are confined in any desired position by nuts. One of two adjusting bars is jointed to the pitch board, and the other to the bed. These bars have each a serrated edge, and lap past each other, so that the serrated edges engage with each other, and are confined by means of a screw clamp when the board is properly adjusted. The pitch board rests on the bed at one end, and is made to stand at any desired angle to the saw. The plank is lapped over the edge of the pitch board, and is sawed by turning the pitch board and bed on the pivot bolt, the desired wind being given by means of the inclination and position of the pitch board.

Improved Burglar Alarm.

George A. Beaver, Richmond, Ind.—This invention consists of the combination of a series of register keys, which are connected in suitable manner to the windows, doors, etc., with a spring match holder, which lights the lamp, sets a clock train and bell in motion, and discharges percussion caps as soon as any one of the register keys releases the spring holder from the catch plate. The change of position of the key indicates the room in which the alarm originated.

Improved Saw Tooth Swage.

Andrew J. McCollum, Indianapolis, Ind., assignor to himself and George D. Emery, same place.—The object of this invention is to provide means for swaging the teeth of circular saws, square or parallel with the saw arbor, so that the saw will run true; and it consists of a slotted arm attached to the saw arbor extending out beyond the saw, having attached to it an adjustable curved arm which carries the swage.

Improved Machine for Cutting Rubber Soles.

George H. Ives, New Haven, Conn.—The object of this invention is to produce for manufacturers of rubber goods an improved machine for cutting out soles, fillings, or any other article from rubber cloth. The usual form of cutters or stamps may be employed. A spring board attached in front of stamps raises the cloth slightly above the stamp after each stroke. The pieces, after being cut, drop on an endless belt or apron, which carries the same off. The rubber cloth is fed from the cloth roller by reciprocating sliding feed blocks, which are operated by the driving shaft, their extent of motion being regulated by adjustable guide pieces. The feed blocks take hold of the cloth after each stroke, and feed the same to the stamp, releasing it on the return motion by passing along inclined guides, which raise the upper feed block.

Improved Rotary Engine.

Truckson S. La France, Elmira, N. Y.—This invention relates to that class of rotary steam engines and pumps in which two revolving cog wheels are employed in a case with semicircular ends, the teeth of the wheels meshing together to cut off the passage between them; and it consists of constructions of the teeth whereby pressure is balanced on the cutting-off teeth to better advantage than in the ordinary arrangements, and water of condensed steam is allowed to escape at the starting of the engine.

Improved Carbureter.

John M. Cayce, Franklin, Tenn.—This invention relates to means whereby air may be carbureted and supplied to the burner with greater uniformity of illuminating power than usual, and in a more economical manner. The invention consists in an air-supply governor that automatically maintains any definite pressure and supply of air; of means by which an over supply of carbon to the air may be prevented, and the relative proportions of oxygen and carbon accurately gaged; in making the carbureter in sections held to joint band by a cohesive that will quickly melt during a fire and enable the apparatus to be easily handled and removed; and finally in means for obviating the jerking movement of a double action air pump, and causing it to move with great uniformity of motion.

Improved Portable Steamer for Potatoes, etc.

Carey K. McDonald and John W. Dewees, Philadelphia, Pa.—This is an improved device for outdoor and street trade, for steaming potatoes, ears of corn, oysters, &c. It is made in the general form of a locomotive engine, and is mounted upon wheels. There is a fire chamber, the flue from which passes back beneath the boiler. Steamers, which pass in through the top of the shell of the latter, receive wire baskets, in which the articles are placed to be steamed. In the rear end of the shell is formed an oven. When the articles are removed from the steamers they are placed in the oven to drive off the moisture, and are then placed in the upper compartment to be kept hot until sold.

Improved Blower for Fire Grates.

William D. Gussman, Morgantown, West Va.—This invention relates to counterbalancing the blower by a weighted lever, and operating it by means of a knob projecting through the front of the fireplace, and applied to the lever fulcrum.

Combined Table Castor and Fly Expelling Fan.

William R. Fowler, Baltimore, Md.—This invention relates to fans turned by clock mechanism for the purpose of frightening flies from the family table at meals, and consists in connecting a fan, castor holder, and clock mechanism so that the fanning device and clock mechanism can be laid aside when fly time is over, and the castor employed in the usual way, the appearance of the latter being graceful and acceptable under either contingency.

Improved Gin Saw Filing Machine.

Louis Monroe Asbill, Ridge, S. C.—This invention relates generally to machines that are used to facilitate the filing of gin saw teeth and to supersede the old means of performing the work by hand. The improvement consists in means for giving a variable adjustment to the pile stroke without changing the position of the forward end or point of the file.

Improved Middlings Purifier.

William Daniels, Brooklyn, N. Y.—There is a vertical tube, of large size, into which the middlings are fed, after being dusted, to be subjected to a blast from the fan, for separating the lighter matters from the heavier by carrying them upward, while allowing the latter to fall to the discharge spout. There is an offset in the upper part of the tube, where it is designed that matters light enough to be carried up by the blast, but containing seconds worth saving, together with some refuse, shall fall, to be conducted into another vertical tube, to be subjected to another blast from the fan, by which the lighter matters are again to be separated and carried upward, while the heavier are allowed to fall to a closed receptacle. Above the blast is turned to a horizontal course, so as to further facilitate the falling of whatever matters of value for flour may yet be in the escaping current, and below is a wide laterally descending portion of the lower wall of the passage, for receiving as much of the droppings as may be of value, and conducting them into a third upright tube, when they are again treated to a vertical blast, and the heavier matters let fall, while the refuse is carried off through a horizontal discharge spout. This upright tube receives a separate blast from the fan. The spouts may all return into one receptacle, for conducting the purified middlings to the stones to be reground together, as the object is not so much to make different grades, as it is to apply blasts in the purifier adapted in force to the gravities of the different grades, for thoroughly purifying both the heavy and light matters of value without waste.

Improved Dress Elevator.

Margaret H. Bergen, Brooklyn, N. Y.—This invention consists of a tape of proper length, having rings attached at proper intervals to receive a cord, the middle of which is attached to the center of the back. The tape is sewed at the proper distance from the bottom, following the curve of the dress. From the center of the tape the ends of the cord pass through the eyelets or rings in opposite directions, and are carried up through slits in the dress to the front, where they are passed through a cord holder which confines them when they have been drawn to the desired degree of tension for the proper support of the dress. The ends of the cord are then confined in a clasp, which is hooked up at one side of the dress.

Improved Fire Extinguisher.

Isaac C. Andrews and Amzi S. Dodd, New York city, assignors to Home Fire Extinguisher Company, same place.—This invention has for its object to improve the construction of fire extinguishers in such a way that the acid vessel may be securely held and readily and surely disengaged to discharge the acid, which cannot be tampered with without indicating it, which will give warning should any one attempt to remove the head while the apparatus is under pressure, and which shall be light and at the same time strong.

Fire Extinguishing Water Pipe Attachment for Buildings.

Thomas Miller, Jersey City, N. J.—This invention relates to utilizing the fire extinguishing water pipe attachments used to conduct the water to the upper stories and the roofs, for fire ladders also; and it consists of, preferably, two pipes side by side, or one separated into two branches above the lower story, with rungs for a ladder crossing from one to the other and connected to them. The rungs are made of tubes, for allowing the water to circulate through them to keep them cool when exposed to fire in the building, and thus form the ladder, available when it would not always be with solid rungs, which heat when solid, so as to render the ladder useless.

Improved Perch for Bird Cages.

Edward Hutchinson, New York city.—This perch is composed of a tubular piece of wood and a cylindrical piece, the latter being for the most part of its length of the same size as the former, but considerably longer, and having a portion of about equal length of the tube reduced sufficiently to enter and fit snugly, and so that the end of the tube and the shoulder of the cylinder will not quite meet together. The reduced portion of the cylindrical piece is provided with small grooves, both longitudinal and circumferential, to afford hiding and nesting places for the small insects which infest birds. By this means the insects may be readily destroyed and cleaned off from the perch by taking it out of the cage from time to time, plunging it in boiling water, and then separating the parts and removing the insects.

Propelling Canal Boats.

H. B. E. Von Elsner, St. Louis, Mo.—This improvement relates to the arrangement of slotted guides and adjustable collars with the paddle levers for the purpose, respectively, of maintaining them in a vertical plane while vibrating, and adjusting the leverage of the paddles, and also the depth to which they shall work in the water.

Improved Gas Regulator.

Charles H. Gartrell, Paducah, Ky.—The object of this invention is to produce an improved gas burner and regulator, which feeds the gas steadily and equally to the flame, and economizes its consumption. The invention consists in forming the burner of different chambers, to which the admission of the gas is regulated, and the flow steadied by means of a distributing cap piece, which spreads the gas and supplies it to the flame.

Improved Circular Sawing Machine.

Oscar A. Dean, Bethel, Vt.—This invention has for its object to improve the construction of circular saw machines, so as to prevent the lumber and slivers from being thrown against the operator, to prevent the operator's hands from being cut while attending the saw, and to prevent the operator from being injured by the saw flying into pieces when running free and when sawing thin lumber; and is an improvement upon the patent granted to the same inventor August 12, 1873. A circular spreader enters the kerf and opens the lumber, so that the same may not bear against the sides of the rear part of the saw. A guard fits over the upper part of the saw, and prevents anything from coming in contact with the upper part of the saw, and also prevents slivers from being thrown by the saw against the operator. It may be raised and lowered as the thickness of the lumber may require, and can be adjusted without disturbing the gage, while the gage can be adjusted without disturbing the guard.

Improved Mincing Machine.

Edward Cluney, New Bedford, and Charles Lepine, Boston, Mass.—This is an improved mincing machine for whalers, for mincing or slicing blubber before putting it in the trying kettles. It consists in a carrier and self adjusting holding device in combination with each other, for feeding the blubber forward to the knives, and in knives for slicing or mincing the blubber as it is carried forward by the carrier. The blades are curved, and are twisted spirally, to correspond with the rapidity of feed, so that the cutting point of the blades may move forward as the piece of blubber, being operated upon by the said blades, is carried forward. The shaft is so arranged, in connection with the carrier, that the blades will cut the slices of blubber not quite off, enabling the blubber to be handled with forks.

Improved Baby-Exercising Corset.

Catherine Tardy, Paterson, N. J.—This is a device which will enable mothers, nurses, and others having the care of children to let them exercise by moving their limbs without creeping about the floor. It consists in an improved baby-exercising corset formed of two parts, connected in front by a cord or lace, and in the rear by cords, straps, or ribbons, and provided with long loops at their upper edges. The long loops enable the attendant to support the child while standing in an erect position.

Improved Carriage Curtain Fastener.

Aaron T. Rise, Beaville, N. J.—This invention relates to an improvement in the class of carriage curtain fastenings formed of annular metallic plates, and a slitted or apertured elastic disk. The improvement consists in providing the elastic disk with a tongue (formed by slitting it diagonally), which engages with the head of the knob; also, in providing the annular plates with coincident notches to adapt them to receive or fit the shank of the button; and in a protective covering applied to the inner metallic plate or ring, to prevent abrasion or wear of the carriage top bow.

Improved Pipe Wrench.

Adam Collis, Altoona, Pa.—The head has a central hole, which allows it to be slipped over the stud which is to be turned. A projecting steel die is placed in one side of the hole, and passes entirely through the head. Its edges are designed to penetrate the stud and prevent the wrench from turning on it. The working lever works loosely in the head. Its end is serrated, and projects into the hole and engages with the bolt. The end of a screw enters a slot in the lever, which allows it to play back and forth. In gripping the bolt, a lip which works through a side slot bears upon the side of the slot, by which a short and most powerful purchase is obtained.

Improved Furnace for Steam Boilers.

Daniel T. Casement, Painesville, Ohio.—This invention consists in a system of inclined tubes in the upper part of the furnace for supporting metal balls, to facilitate the combustion of the gases by their impinging on the red hot surfaces of the balls, in which heat is stored up. The said tubes are arranged in two series, extending from the top or near it on opposite sides diagonally across and downward, crossing each other at the middle forming chambers for storing the balls. They are arranged in this way to facilitate the fastening of them in the furnace walls; also, the cleaning of them from time to time of the deposit that may result from the use of salty or limy water.

Improved Composition for Blackboards.

Richard Sharp, Pittsburgh, Pa., assignor to himself and Robert W. Hare, of same place.—This is a compound composed of ground or powdered pumice stone, colored to the proper shade by ivory black or similar material. The pumice stone thus colored is mixed with coach varnish and turpentine in sufficient quantity to form an adhesive plastic mass, with which wood, stone, metal, or other material is covered. The composition adheres firmly and soon dries, leaving a hard, smooth surface, admirably adapted for blackboards and slates, and for many other purposes.

Improvement in Converting Motion.

James Vivian and Henry S. Mackenzie, Falmouth, England.—This invention relates to means whereby two screw propellers on the same shaft may be conveniently rotated in the same or opposite directions. A shaft is rigidly attached to the screw propeller, and a sleeve, on which is made fast a second propeller, is itself loose on the shaft. There are two wheels, one fast on the shaft and the other on the sleeve, having, respectively, the wrist pins placed on their opposite faces, and each pivoted in sliding blocks. The piston is bifurcated to straddle the shaft, and provided with confined guide boxes placed side by side, and formed by plates and a partition. In these boxes the wrist pin blocks slide from one end to the other at each half revolution of the shaft, going back on the second half revolution. If these blocks are on the same side of the shaft when the piston is operated, the propellers will both move in the same direction, while if placed on opposite sides they will be carried in opposite directions.

Improvement in Preserving Beer and Wine.

William Leist, Milwaukee, Wis.—This is an improved vent attachment to be used in connection with barrels containing fermented liquors, by which the back pressure of the liquids in the casks and their commingling with the liquid in the seal cup are prevented, together with the drawing-up of the liquid of the seal cup into the cask, so that the uninterrupted and effective action of the vent cup is produced. The invention consists in the arrangement of a liquid sealed vessel, provided with an open air pipe and flap valve at the bottom, with a secondary flap valve in the upper part thereof, so that the air enters into the barrel without allowing the liquid in the cask to be forced in the seal cup by the pressure of the gases.

Improved Eaves Trough Hanger.

Lewis E. Gould, Nashua, N. H.—The object of this invention is to furnish an improved eaves trough support which is readily applied to the wall below the roof, and admits of adjustment in horizontal and vertical direction for obtaining the exact position of the trough. The invention consists of a horizontal slotted arm, which is screwed into the wall, and which has adjusted thereon, in horizontal and vertical direction, the upright arm with forked end, for supporting firmly the trough. The connection of the horizontal and upright arms is made by a clamping screw.

NEW BOOKS AND PUBLICATIONS.

ARIADNE FLORENTINA: Six Lectures on Wood and Metal Engraving. Given before the University of Oxford, by John Ruskin, LL.D., Slade Professor of Fine Art. Price $1. New York: John Wiley & Son, 15 Astor Place.

The subtle criticism and ornate rhetoric of the eminent Oxford Professor are well shown in these six lectures, which exhibit, in every page, the author's marvelous perception of whatever is genuine in all works of ancient and modern art. It is illustrated with facsimile wood cuts, in every respect worthy of the text.

MY VISIT TO THE SUN: or Critical Essays on Physics, Metaphysics, and Ethics. Volume I: Physics. By Lawrence S. Benson, Author of "Benson's Geometry." New York: James S. Burnton, 149 Grand street.

The author of this work confesses his "respect for the treasured wisdom of ages, but must say that it will amount to nought if it shrinks from the wand of truth, or if it avoids the light of inquiry." The antagonism between the wisdom of philosophers on the one hand, and truth and inquiry on the other, is implied throughout the book; but the author is not likely to disturb the general belief of educated people that the wisdom of Science is the result and not the enemy of enquiry, and that the organic growth of human knowledge is not likely to shrink from its own "wand," which is that of truth. Certainly, if the accumulated knowledge of the ages is ever to be uprooted by some empirical system of philosophy, it will not be by so discursive and pointless a sketch as the one which we so willingly lay down.

NEW ENGLAND HARDWARE DIRECTORY, containing a Complete and Correct List of Importers, Dealers, and Manufacturers of Metals in the New England States. Boston, Mass.: Edward H. Adams, 82 Washington street.

The information promised in the title of this book is fully given in its pages.

THE AQUATIC MONTHLY AND NAUTICAL REVIEW. Edited by Charles A. Peverelly. $4 per annum. New York: August Brentano, 33 Union Square.

This magazine maintains the excellent reputation it has in a short time acquired, and its pages will be read with interest by all lovers of the manly sports of yachting and rowing, the season for which is now fairly on its way.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From April 21 to April 23, 1874, inclusive.

BOILER AND FURNACE.—W. H. Richardson, Cincinnati, Ohio.
BOILER AND GRATE BAR.—A. O. Deals *et al.*, Wilmington, Del.
FIRE PLACE, ETC.—M. A. Cushing, Aurora, Ill.
FURNITURE SPRING.—W. T. Doremus, New York city.
KNITTING MACHINE.—D. Bickford, New York city.
LUBRICATOR.—E. S. Fassett *et al.*, Ann Arbor, Mich.
NAIL MACHINERY.—W. Haddock, Pittsburgh, Pa.
REGULATING SPEED OF ENGINE.—K. H. Loomis, New York city.
SPEED INDICATOR.—E. Brown, Philadelphia, Pa.
TREATMENT OF DISEASE.—W. D. Ludlow, New York city.

Answers to Correspondents

In our answer to H. S. H., p. 15, current volume: "If no heat is lost during compression" should be substituted for "if the temperature is constant during compression."

A. L. M. asks: What is the cost of a machine for making ice? Is a steam engine necessary, and what amount of power does it require? How many pounds will it produce per hour? How much would it cost per hundred pounds, exclusive of first cost? A. Your questions are rather indefinite. A small ice machine, to make from one to two tuns a day, will cost about three thousand dollars. The running expenses would be from five to six dollars a day.

W. F. W. asks: Which gives the most power, a two horse engine or a two horse power of the most approved style? The horses weigh 2,000 lbs. each. How much would one horse raise at the rate of one foot a minute by a good power of the endless floor form? A. Ordinarily, an engine of one horse power will do more work in the same time than a horse, and the engine can be kept at work much longer than the horse.

J. D. R. asks: Would it be practicable to build a wooden railroad (using no iron on rails) on which to run a locomotive of say 7 to 7½ tuns, hauling from 3 to 4 cars at a load, each car and load weighing not over 5 tuns, and to ascend grades of 100 feet to the mile? The rails are to have a bearing surface of 4 inches. What kind of timber would be best for such rails, white oak, rock oak, or maple? A. It would be better to have the rails nearly twice as broad, and to fit the wheels of the locomotive with rubber tires. We would recommend white oak, of the three varieties of timber mentioned.

R. M. R. says: 1. I am building an engine of 2 inches bore and 4 inches stroke, and have finished the cylinder and bed plate. How large ought the balance wheel be, and what should be its weight? It is to take a belt. A. About 10 inches diameter and 2 inches face. 2. How can I make the governor regulate the slide valve? A. There are quite a number of devices in use for regulating the point of cut-off by means of the governor. It would be difficult, however, to make such attachments to so small an engine to any advantage. 5. Would a boiler 4 feet long by 10 inches in diameter with 12 flues ¾ inch in internal diameter, arranged as a return tubular, be large enough to run the engine at 200 revolutions under 60 lbs. of steam? According to my calculation, the engine would be about ⅛ horse power if the pressure were 60 lbs. on the piston during full stroke. A. It will be large enough, if properly set.

J. T. S. asks: 1. What is the best cement for filling millstones? If plaster of Paris and alum will do, how should it be prepared? A. Take baked plaster of Paris, steep in a saturated solution of alum, recalcine, and reduce to powder. Mix with water for use. 2. I have a throttle valve which has a small piece of the edge of the seat broken off; it lets through so much steam that I cannot stop the engine without taking off the cam rod. Is there any way of remedying this, other than getting a new valve? A. Possibly the seat can be repaired, or a new seat can be fitted in.

S. A. T. asks: 1. What is the *modus operandi* of plating by the galvanic battery? What causes the metal to adhere? Is the metal visible in the solution? A. The metal is not visible in the solution. The attraction of the fine particles of the deposited metal for the properly prepared conducting surface of the negative plate causes its adherence. 2. What is the action of the hydraulic ram? A. The water with a certain head raises a valve and flows into a chamber; but in making its escape the passage of the water is relieved and allows another weighted valve which was closed before to open. This permits the water to flow again, when its pressure once more closes one valve and opens another. Again a portion of water escapes, again the pressure is relieved, and so on intermittingly. 3. What is chloride of calcium used for? A. It is employed in many chemical processes. Its avidity for moisture is remarkable. Copies of any of the patents issued can be obtained from this office.

B. R. asks: What is the most accurate rule for finding the friction on the slide valve? A. It is about one quarter of the unbalanced pressure on the valve, increased by one quarter of the weight of the valve.

M. F. J. asks: 1. In your last issue of the Scientific American, the engineer stated that if a piston rod and cylinder head of an engine were lined with lead, it would save an amount of steam. What can I put on the tin so that hot lead when poured on will run evenly over the surface? A. Build a rim around the head. 2. Would copper be better than tin? A. You can use whichever is most convenient.

M. H. H. says: 1. I and a few friends have had an argument as to which was horizontal motion. Some of us contended that a mill burr revolved horizontally, and others that the cylinder of a threshing machine was an example of horizontal motion. We concluded to get your views. A. It is usual to speak of a vertical wheel as one in which the shaft is vertical, and to call it a horizontal wheel when the shaft is horizontal. 2. Why is the equatorial diameter of the earth greater than the polar diameter? A. It is supposed to be due to the action of central forces, when the earth was in a fluid state.

J. H. asks: 1. How are black lead crucibles made? Is the lead mixed with any other substance? A. It is mixed with from one third to half its weight of clay. 2. Could I use plaster of Paris molds for casting small brass boxes? A. Yes. 3. What proportion of copper should I use to make a good box? A. You do not give sufficient particulars. You will find compositions for journal bearings in back numbers.

W. E. P. asks: 1. What would be the capacity in gallons per minute of a force pump 5 inches diameter by 10 inches stroke, running at 60 revolutions per minute, with 4 inches suction? Will you give us the formula for the same? A. Multiply area of piston, in inches, by length of stroke and by number of strokes per minute, and divide the product by 231. 2. For cleaning 100 lbs. of cotton waste, how much bisulphide of carbon should be used? A. See p. 44, vol. 29. As to the blower, address the manufacturers.

A. P. B. says: We run our machinery by water, and have a large surplus of power. Is there any practicable and not expensive method of converting the surplus power into heat for warming the shops? What would be the effect of using, say 10 horse, power in condensing the atmosphere into strong radiators, to 100 lbs. to the inch? A. Some modification of your plan would probably answer very well. So far as we know, this is a novel idea, and it impresses us very favorably.

A. A. W. says: An engineer tells us that our gage glasses kept breaking, and he could not get any to stand; upon enquiry we found that he often took his glasses out and cleaned them with a piece of waste tied on to a piece of stout wire. Upon our trying the experiment with a piece of telegraph wire, by thrusting it in and out several times through the bore, the glass broke into fragments in a few minutes. Can you explain it? If the discovery may be of service to engineers and others, in the way of caution, I hope that you will give them the benefit of it. A. Most housekeepers know the fact that it will not do to use iron rods in cleaning lamp chimneys. The trouble is probably caused by the unequal heating or cooling of the glass by contact with the iron, throwing strains upon some portions of the glass.

F. W. R. asks: Does the lateral pressure against the sides of a reservoir of water increase with the enlargement of the reservoir? A. In some cases, yes, and in others, no. Thus, if the depth remains constant, an increase of size does not affect the pressure

C. E. T. says: The common rule among mechanics for finding the speed of a driven shaft, when the diameter of pulley on the shaft and the diameter and speed of the pulley on the driving shaft is given, is to multiply the diameter of driving pulley by the number of its revolutions per minute, and divide by the diameter of driven pulley. Some of those who should know say that unless one thickness of the belt is added to the diameter of each pulley, the answer will not be the true one. By the latter rule, in driving from a large to a smaller pulley, the result of the calculation is a less number of revolutions than by the first rule, and *vice versa* from a small to a larger pulley. A. The correct method is to add the thickness of the belt. This may be explained as follows: The belt leaves the driving pulley in the direction of a tangent; and neglecting the slipping, the ratio between the velocities of the driving and driven pulleys is the same as would take place with a pair of gear wheels having the same pitch. The part of the belt in contact with the pulley, neglecting the slip, acts as if it were rigidly connected to the pulley, so that the line of connection between the driving and driven pulleys must be in the axis of the wrapping connector, or at the middle of its cross section.

A. R. asks: 1. Are Britannia and white metal the same? A. Yes. 2. What kind of wood is best to use for chucks for spinning? A. A close grained, hard wood.

C. H. C. asks: 1. What can I put on paper to make it impervious to moisture? A. Dissolve 8 ozs. of alum and 3¾ ozs. of white soap in 4 pints of water; in another vessel dissolve 2 ozs. of gum arabic and 4 pints of glue in 4 pints of water. Mix the two solutions and make the mixture hot. Immerse the paper in the mixture and then hang it up to dry or pass it between cylinders. 2. What do 8vo., 16mo., 18mo., and 4to. mean? A. 4to. means quarto (4 to a sheet), 8vo. means octavo (8 to a sheet), 12mo. means duodecimo (12 to a sheet) and so on. 3. Will the moon eclipse any stars or planets next month? If so, which one? A. Consult the *Nautical Almanac*.

H. S. asks: What ready method is there of precipitating antimony from solutions with other metals? A. There is no general method of separating antimony from all the metals, when they are present in the same solution. If arsenic and tin are absent, the easiest way is to precipitate with hydrosulphuric acid as sulphide of antimony. In answer to your other questions, see our advertising columns for booksellers' addresses.

G. N. M. asks: What is "red acaroid of resin," mentioned in a late number of your journal, as part of a recipe for imitating mahogany? A. It is the resin of *xanthorrhea hastilis*, a liliaceous tree growing in New Holland; also called resin of Botany Bay. It has a yellow color, an agreeable odor, and is soluble in alcohol, ether, and caustic potash. Its potash solution, treated with hydrochloric acid, deposits benzoic and cinnamic acids. Nitric acid converts it into picric acid, and so readily that this resin appears to be the best raw material for obtaining picric acid. By distillation, the resin yields a light neutral oil, which appears to be a mixture of benzol and cinnamol, and a heavy acid oil, consisting of hydrate of phenyl, mixed with small quantities of benzoic and cinnamic acids.

W. F. asks: 1. Will a single cell of a sulphate of copper battery do to work a private telegraph about 500 feet long? A. Not satisfactorily. 2. How many cells of the above kind would it take to run it? A. If copper wire is used, three cells. 3. How many cells of zinc and lead, as described in the *Science Record* of 1874, would it take to make it work? A. About three. 4. Would copper wire, No. 26, do for the wire to connect the houses? If not, what size copper wire would it take? A. Use No. 12 galvanized iron wire. 5 In making a horseshoe electromagnet, is coarse or fine wire the best? A. Use 22, silk covered. 6. How should it be wound on, the same way on both poles or in opposite directions? A. Wind in the same direction. Connect both inside and both outside wires. 7. In making an induction coil, is it necessary to have the wire insulated? A. Yes. 8. How would it do to have one coil of the primary inside, and then have 4 or 5 coils of the secondary wire, then another coil of the primary wire, then 4 or 5 of the secondary, and so on through the induction coil? A. There would be nothing gained by so doing. 9. In the Scientific American for April 4, you describe a magneto-electrical machine. About how many feet, and what size of wire does it take to make such a machine, to give shocks? A. Four or five hundred. From No. 32 to 40 will answer.

D. M. T. says: On p. 183 of *Science Record* for 1874, experiments with iodate of calcium are related. Can you inform me how to make this substance? A. Iodide of calcium is prepared by mixing a solution of the iodate of potassium with a solution of chloride of calcium. A large amount of the iodate of calcium thus formed remains dissolved in the water; the remainder crystal'zes out slowly. The iodate of calcium is formed by melting iodide of potassium in a crucible, leaving it to cool till it becomes semifluid, and then gradually adding 1½ parts chlorate of potassium the mass becomes fluid, swells up, and solidifies to a spongy mass of iodate and chloride of potassium. It is dissolved in hot water, the iodate left to crystalize, the crystals redissolved in hot water, and the iodate precipitated by alcohol.

J. N. J. and J. B. ask: Is there a solder that will solder aluminum? A. The largest dealers in and manufacturers of aluminum say that there is no solder that will answer. Try the pure metal.

J. F. A. says: In a factory there is a large belt running over two pulleys. A person standing under the belt with his hat off will have his hair lifted on end; if he raises his hand above his head, a light of a violet blue color will escape from the end of his fingers. What causes the electricity? Can it be collected? If so, how? A. The phenomena are those produced by frictional electricity and are due to the friction of the belts. The electricity could be collected by a series of brass needles placed at suitable points, and directed towards the belts and put into metallic connection with a metallic body presenting the required amount of surface.

H. S. B. asks: 1. How can I purify solutions of sulphate of alumina from iron? They have an acid reaction, and give blue and green precipitates with the prussiates of potash. A. To the dilute solution add a slight excess of solution of ferrocyanide of potassium. Allow the precipitate to settle and separate by decantation and filtration. 2. How can I separate napthaline from paraffin? I have a crude heavy coal oil which contains both. A. We find no process for this operation.

B. W. R. asks: 1. Has there been any substance discovered lighter than hydrogen? A. No. 2. Please give me the specific gravity of the following Oxygen, hydrogen, nitrogen, chlorine, fluorine, and carbonic acid. A. The specific gravity of hydrogen being taken as unity, that of oxygen is 16, nitrogen is 14, chlorine is 35·5, carbonic acid is 44. Air being taken as unity, oxygen is 1·10563, hydrogen is 0·06926, nitrogen 0·97137, chlorine 2·47, carbonic acid 1·524. 3. Please give me directions for making a waterproof glue. A. Add ¼ lb. of common glue or isinglass glue to 2 quarts of skimmed milk; and then evaporate to the thickness of glue. See our advertising columns for booksellers' addresses.

H. K. M. asks: 1. Which is the most successful form of magnetic motor? How are the magnets arranged to give the motion? A. It is said that the best form is that in which electromagnets are arranged in the periphery of a large double wheel, while the armatures are fixed and arranged in such a manner that the accumulative force is obtained. 2. What amount of force does it possess? A. One constructed on a large scale has driven a car, on an ordinary rail track, at the rate of 10 to 15 miles per hour.

J. M. asks: 1. How can I make a solution of gold that can be used to plate small articles with by a Daniell's battery? A. Dissolve one ounce of cyanide of potassium in one quart of nearly boiling distilled water. About half fill a porous cell with the solution, and stand it in the vessel containing the bulk of the solution. Attach a piece of sheet copper to the wire issuing from the zinc of the battery and place it in the porous cell. Put a piece of sheet gold, attached to the copper of the battery by a wire, in the outer solution, and allow the whole to remain in action until the solution has acquired about one pennyweight and a half of gold, which may be ascertained by weighing the gold before and after immersion. The porous cell may now be removed and its contents thrown away. The solution is now ready for use, and should be worked at a temperature of about 130° Fah. 2. How is a composition made, of sawdust, used for making small busts with? A. We do not know the composition you mention. Try plaster of Paris for the purpose.

W. F. G. says: 1. I have a battery and all the appliances for silver plating, and succeed in getting a good thick coating of silver on various articles, but I am not able to polish the articles so as to obtain a nice smooth brilliant surface. What tools are used to burnish silver? A. Burnishing tools, which are made for the purpose and are of different patterns, are used. They are rubbed smooth on a damp cloth, and the polish imparted by rubbing to and fro on the silver plated surface with pressure. 2. Can you tell me what kind of chalk is used to mark on glass, and how it is made? A. By mixing powdered chalk and soap and drying the mixture.

H. L. C. asks: 1. In making an electric engine, is it best to use a U shaped piece of iron or two separate pieces? Which is best, wire 1·32 of an inch in diameter, or a fine thread-like wire, both being properly insulated? A. It is customary now to make the magnet in three pieces, the sides being made of bar magnets screwed into a crosspiece, the whole being nearly in the form of a square. Use No. 22 wire. 2. Does the power of the magnet increase in proportion to the number of layers of wire with which it is wound? A. To a certain point, but the size of the coil should not exceed an inch and a half in diameter.

A. B. asks: 1. What is the cause of mustiness in flour? A. A chemical change which takes place in moist flour. 2. What are the chemical properties of musty flour? A. The gluten of the flour undergoes a change of properties, in consequence of which it slowly loses its soft, elastic, insoluble condition, and becomes converted into a substance closely resembling diastase.

J. K. says: I have been running circular saws for sawing logs for over 12 years, and have not had any two saws with teeth at a uniform distance apart. It seems that it has been demonstrated that a circular saw ought to run 9,000 feet of cutting edge per minute; now if that be so, I think there ought to be some established rule for the distance of the points of the teeth apart. Please inform me if there is any such rule, and state whether there are movable tooth saws that can be used with side set. We never have used that kind, but would if we can use side set. We think the swage set very objectionable. A. The variations in the diameter of saws, the numerous varieties of timber to be sawn, together with various capacities of mills (sawing, as they usually do, from 300 to 5,000 feet per hour), and the fact that solid toothed saws with side set require even numbers of teeth, preclude the possibility of establishing any definite rule. There is no manufacturer of inserted toothed saws who recommends a side set for them; and the fact that inserted toothed saws are fast superseding the old style of solid saws, and are approved by many of our best and most experienced sawyers and lumbermen, who spread the teeth exclusively for the set, seems to conflict with your idea of objectability.—J. E. E., of Pa.

J. W. C. asks: What are the following articles: Pulv. Frondesm Chizeta, Pulv. Milvani Rad., Pulv. Perino Alnifolia, Ext. Bertula Natura? A. A competent authority says that these names have been written by one not unacquainted with pharmaceutical and chemical preparations, but that they are all bogus, names of things which do not actually exist.

S. A. G. asks: 1. How long does it take to send a signal through the Atlantic cable? A. About four seconds. 2. What is the average number of words sent through per minute? A. Three. 4. What is the speed of electricity through copper wire? A. 288,000 miles per second.

J. T. B. S. asks: How can I make a simple muffle furnace for the purpose of enameling photographs? A. Nothing could be simpler than certain forms of muffles, which are already manufactured and sold at low prices.

W. H. S. asks: 1. If a wheel were placed in a perfect vacuum, so arranged that there would be no friction, and set in motion, would it continue to revolve for ever? A. Yes. 2. How is the glycerin commonly sold by druggists manufactured? A. The mother liquor of the soap boiler is first concentrated by evaporation, the saline matter which is thereby gradually separated being removed from time to time. When the fluid is sufficiently concentrated, ascertained by the boiling point having risen to 200° Fah., it is transferred to a still, and the glycerin distilled off by means of superheated steam carried into the still. The distillate is next concentrated and brought to the consistence of sirup in a vacuum pan.

S. P. says, in answer to V. V. V., who asks for a formula for mixing show card paints: The following will answer the purpose: For black, asphaltum varnish 3 parts, dammar varnish 1 part, tube black to suit; temper with spirits of turpentine. For fancy colors with gloss, use any desired shade (tube colors) mixed in dammar varnish; temper as above. These colors should be used freely and as rapidly as possible.

O. K. asks: How can I mend a broken band saw? A. By brazing the ends together. 2. How can I best mend a broken tooth in a circular saw? The saw is 1-12 of an inch thick and of 14 inches diameter. A. File down the rest of the teeth to the same circle. 3. With two horses on a lever power, I run circular saws from 10 to 16 inches diameter, making 900 revolutions per minute. Can I do more work with the same power if I double the speed with countershafting? A. That could only be decided by experiment. There is doubtless a speed at which you will get the best results with a given power; but every piece of gearing you put in consumes some of the power.

J. A. P. asks: Is there any comparatively cheap process by which I can force up a continual stream of water from a well which is 25 feet deep? A. You can possibly employ a windmill.

A. P. R. asks: Has a man, to get steam boat engineer's papers, to be a practical machinist? If not, where would be the best place for a beginner to go to get on? A. It is desirable that he should be, but we believe it is not absolutely essential, provided he can show that he has sufficient practical knowledge to make ordinary repairs to engines and boilers. It might be well for you to try and get a position as fireman or oiler on some steamship line.

L. F. L. asks: Are the hard spots in steel, rendering the same difficult to work, properly called knots? A. This term is not sanctioned by general usage.

T. G. Jr. asks: 1. For a 30 inch diameter steam boiler, about how much should a cast iron head be thicker than a wrought one ¼ inch thick? A. It could not be made as safe. 2. Can small flues be put into a cast iron head in the usual manner and make a good job? A. Not as well as in the case of a wrought iron plate. 3. How thick should a cast iron head 30 inches diameter, without flues or stay bolts, be to stand 100 lbs. per square inch? A. The arrangement would not be advisable.

C. B. K. asks: 1. Are the civil engineering schools of Europe better than those of America? A. They are generally more thorough. 2. Which are the best in the United States? A. We do not feel able to make a strict comparison between the different engineering schools in the country.

S. S. asks: Can you direct me to an analysis of the boiler scale from sea-going vessels that have no condensers? A. An analysis of the scale found in French sea-going steamers gives the following results: Sulphate of lime 85 2 per cent, carbonate of magnesia 2·45 per cent, free magnesia 5 95 per cent, water 6·5 per cent.

C. W. S. says: I have always been instructed to place my valve with the pressure on top of the seat. Now an engineer of 45 years experience tells me this is wrong; the better pressure ought to be underneath the valve seat. I want to know which is right? A. Your method is most generally adopted. Still, there are advocates of the other system, claiming as an advantage the possibility of packing the stem with pressure in the valve.

W. P. B. asks: 1. What causes the lumpy or boggy formations in marshes and wet places? A. It is caused by the accumulation of dirt and vegetable matter at certain points, which are determined by local causes. 2. What colors shall I mix to make brown madder? A. It is best to make an extract of the burnt root of the madder plant. 3. Can you tell me of a book on fossils, and one on the preservation of birds or other animals? A. Consult Dana's "Geology," and Coue's Field Ornithology."

H. J. H. asks: 1. What is the exact difference between a high and a low pressure engine? A. As the terms are ordinarily used, a low pressure engine has a condenser and air pump, and a high pressure engine has not. 2. In your last week's paper you say the horse power equals pressure on the piston in lbs. multiplied by the velocity of the piston in feet per minute divided by 33,000. If a cylinder is 4¼ inches diameter x 6 inches stroke, making 250 revolutions per minute, with steam at 60 lbs. pressure, I make: $4\frac{1}{4} \times 4\frac{1}{4} = 21\frac{1}{4} \times 0{\cdot}7854 = 15{\cdot}9043\frac{1}{4}$; $15{\cdot}9043\frac{1}{4} \times 60 = 954{\cdot}261$; $954{\cdot}261 \times 250 = 238565{\cdot}25 \div 33{,}000 = 7$ horse power. If the engine only made 80 revolutions per minute, what would be the correct result? A. The first example is right as far as you have carried it; for the second, we shall have $\frac{954{\cdot}261 \times 80}{33{,}000} = 2{\cdot}3+$ horse power. 3. What is meant by injection? I am told that 21 times as much water is necessary for injection in a locomotive boiler as is required for steam. A. Injection water is that used in a condensing engine, to condense the steam. A locomotive does not have a condenser.

T. H. D. S. asks: 1. Has table rapping ever been scientifically explained? A. Frequently. 2. What was the conclusion arrived at? A. That the experimenters were self-deceived as to the supernatural character of the phenomena. 3. Did not Professor Faraday lecture upon the subject? A. Consult his "Experimental Researches."

A. D. asks: What articles are used with lime to make blackboards for school purposes? A. Manufacturers of blackboards for school purposes inform us that they do not use substances with lime. They prepare a surface of hard plaster, and then paint it with a thin coating of pumice, some black substance, and a varnish which, when dry, will not crack. [What difficulties have you found in making gelatin for molds? Do you mean in making the gelatin, or in using it for this purpose?—Eds.]

A. O. says: 1. What cement is best for the steam chest and cylinder heads of a small steam engine? A. Take white lead 3 parts, and red lead 1 part. 2. Will one of Bunsen's three quart cells do to plate a watch case? A. Yes. 3. How can I make oxygen gas cheaply? A. By strongly heating black oxide of manganese. 4. What is the best packing for the stuffing box of an engine, also the piston? A. Rubber packing is mostly used now.

H. A. F. asks: 1. What are the ingredients of oroide or some other soft metal that will not tarnish and is susceptible of high polish? What kind of mold should I use to have the work come out very smooth? A. Pure copper 100 parts by weight, zinc 17, magnesia 6, sal ammoniac 3 6, quicklime 1·80, tartar of commerce 9. The copper is first melted, then the magnesia, sal ammoniac, lime, and tartar in powder, little by little; the crucible is briskly stirred for about half an hour, so as to mix thoroughly, and then the zinc is added in small grains by throwing it on the surface and stirring until it is entirely fused: the crucible is then covered and fusion maintained for about 35 minutes; the crucible is then uncovered, skimmed carefully, and the alloy cast in a mold of damp sand or metal. The oroide melts at a temperature low enough to allow its application to all kinds of ornamentation; it has a fine grain, is malleable, and capable of taking the most brilliant polish; when, after a time, it becomes tarnished from oxidation, its brilliancy may be restored by a little acidulated water. If the zinc is replaced by tin, the metal will be still more brilliant. 3. Can I get the Scientific American for 1873 from you already bound? A. Volume XXVIII is on sale. The numbers of volume XXIX are mostly out of print.

S. F. S. asks: How can I take perspiration and grease stains out of Panama hats without injuring the straw? A. They can probably removed by benzine or French chalk.

J. A. F. asks: Is there a liquid preparation that will resist nitric acid as well as if not better than beeswax? A. Yes: melted paraffin.

A. H. T. asks: If a small vessel should be placed in a larger one, and the air pumped out of the large vessel, what would be the effect upon the air in the smaller one? Would there be any pressure outwards? A. If the vessels communicated, the air in the inner vessel would expand, and diffuse itself until the air in both the inner and outer vessel had the same degree of tension.

J. G. C. asks: 1. How many cells of the ordinary Smee battery, each cell consisting of 2 zinc and 1 copper plates, 5½ by 8 inches, will be required to produce the phenomenon of the voltaic arc? A. From 20 to 30 cells, according to the size of the arc required. 2. What number and size of copper wire is best for the inner and outer coils of the Rhumkorff induction coil? A. For a coil giving a 5 inch spark, from No. 32 to 42 wire for induced current, and No. 6 to 8 wire for the primary.

R. A. M. asks: In making a magneto-electrical machine, capable of producing a power sufficient to kill a human being, what must be the power of the permanent magnet? In other words, what weight must it be capable of lifting? A. The power does not depend upon the attractive force of the permanent magnet alone, and the question is founded on an erroneous idea of the principle and mode of construction of such macaines. 2. Are the magneto-electrical machines the best for medical purposes, and are they generally driven by springs? A. They are going out of use, and electro-magnetic machines are now generally employed for medical purposes. They are not generally driven by springs.

G. F. S. asks: Why does the point of the needle of a surveyor's compass, at times, rise and adhere to the glass? A. It is due to magnetic disturbances, and at times to the influence of local attracting forces.

C. C. H. asks: How can I make a glass box to hold a solution of nitrate of silver? I think I could make one of common window glass, if I knew of something with which to fasten it. A. Glass packed with rubber will do.

R. S. asks: What would be the cost of a small swift-sailing steam launch, length of hull 15 or 20 feet? A. About one thousand dollars. 2. What rate of speed per hour would she have? A. Six miles an hour. 3. What would be the power of the engine? A. From four to five horse power. 4. How heavy a load could she carry? A. About 1,000 lbs.

W. E. F. asks: How can I make a cheap Leyden jar? A. We believe there is nothing cheaper than a thin glass candy jar, lined inside and outside with tin foil such as is used to wrap chewing tobacco in. Stick the foil on with mucilage, varnish, or flour paste. A still cheaper plan is simply to fill a glass jar nearly full of water, and place it within another vessel of water, so that the water, both outside and inside, shall be on the same level.

J. B. H. asks: 1. Which time of the year is the best for cutting and transplanting large forest trees, and what shall I do to make them grow again? A. See p. 180, vol. 28. 2. How can I make putty of a bright yellow that will stand when laid in wood? A. Mix the putty with chrome yellow.

W. F. A. asks: Will an electromagnet, wound with one insulated copper wire 100 feet long, produce as much magnetism as two wires 50 feet long? A. It is better to have two spools, 50 feet in each. 2. How many feet of wire are there in a Tom Thumb electromagnet? A. Forty.

B. A. R. says: 1. Is it injurious to inhale the dust of common school crayons? A. It is not injurious in small quantities. 2. What causes whirlwinds? A. It is caused by the inrush from various quarters of the surrounding air into a rarefied atmosphere, produced by the rising of vast bodies of air, over a heated area. 3. I have noticed several times this spring the smoke from a dwelling gathering around a new barn situated about one hundred yards from the dwelling, about 15 feet below the level of the house. What is the cause of it? A. It finds about the barn a stratum of air of density similar to that in which the smoke itself is floating, and the lower level of the barn and the obstruction which it offers prevent the smoke being carried away by currents in the atmosphere.

X. asks: Why is it that the storm glasses sold in shops are hermetically sealed? Do they not all require to be so constructed as to give access to air? A. The storm glasses made by instrument makers are sealed so as to prevent access of air and evaporation of the solution.

T. A. C. says: The lightning rod on my house passes entirely over it in an unbroken line, and enters the ground to the depth of 10 feet on each side; branches of the rod are connected and extend several feet above the chimney, thus:

1. Is this a good way to arrange a lightning rod? A. Your arrangement of rod is good so far as the building is concerned; but the extent of the rods in the ground is insufficient. 2. Would it add to the security to connect the rod and the water conductors? The latter are tin and extend entirely around the house, but do not reach the ground by 3 or 4 feet. A. It adds to the safety to connect the water conductors and roof with the rod. 3. What would be the effect of a pile of scrap iron around the rod where it enters the earth? A. The effect of scrap iron or iron ore placed around the base of the rod would be to increase the security. The best way would be to dig a trench three feet deep, leading away from the house. Bend the lower end of the rod to run in the trench, and lay your scrap iron along the bottom of the trench. Let the extremity of the rod communicate with the iron. The larger the quantity of iron and the longer the trench the better. Lightning rods are of little value unless that portion which enters the ground is extensive or is placed in connection with a large mass of conducting material, such as iron, iron ore, coke or charcoal.

J. M. says: 1. I have a scroll chuck to a foot lathe which will not run true on the spindle. How shall I remedy it? A. It is a good plan to bolt the chuck to a plate, which can be turned true whenever required. 2. What wages do machinists get during apprenticeship? A. About fifty cents a day. 3. Can a machinist become a mechanical engineer by studying during the time allowed him out of work hours? A. It can be done, but few have the necessary perseverance. 4. On p. 316, vol. 29, you give an engraving and description of an induction coil. How can I make one? A. See p. 264, vol. 25. You should consult some good work on the subject, such as Noad's "Text-book of Electricity." The sketch is not sufficiently complete to enable one to build the coil without other information. 5. Is the current of a battery changed in quantity or in intensity by making the acid solution weaker? A. All the qualities are affected relatively. 6. Can I melt brass in a cast iron crucible in a charcoal fire, with a hand bellows to supply the air? A. Yes. See p. 74, vol. 28.

S. F. R. asks: 1. How can I braze cast iron and wrought iron? A. Tin the surfaces, secure them together, and apply the solder, heating the articles. 2. How can I case-harden wrought iron? A. Place the articles in an airtight case, together with animal or vegetable charcoal, and expose the box to a low red heat for a few hourss. 3. How can I soften steel? A. Steel plate is softened for engraver's use by putting it in a cast iron box with a well closed lid, with half an inch depth of pure iron filings over every part of it. The sides of the box must be at least three quarters of an inch in thickness. Expose the box and its contents for 4 hours to a white heat.

T. C. H. asks: 1. Is litmus paper reliable in testing for a minute quantity of nitric acid in a solution of nitrate of silver in water? A. Litmus paper, properly prepared, is reliable. 2. How are the names of subscribers printed on the margins of newspapers? A. With stamping machines, made for the purpose. 3. How can I coat a plaster cast of type, etc., with black lead, for electrotyping? A. By rubbing the black lead upon it with a brush. 4. I have attempted to make small stereotype plates by pouring type metal into shallow casts of type, but could not get a sharp cast, what is the reason? A. You should sink your molds into a deep vessel full of molten metal, so as to get a pressure on the cast. 5. What is the best treatment of steel instruments, guns, etc., to prevent rusting? I have heard that opodeldoc rubbed over them was better than oil. Is it better than good oil? A. Gunsmiths say that it is not. A. Did the Pneumatic Transit Railroad prove a success, and how much of it is completed? A. You will find full particulars, dimensions, and engravings of this railway in back numbers of the Scientific American. It operates with success, and is to be enlarged.

A. W. says, in reply to J. A. McC. Jr., who asked why the paper is not blown off the card: The air which is compressed by being driven through the tube suddenly expands on issuing between the disks, and rushing out in all directions carries with it part of the air separating the disks. This causes a partial vacuum, and the pressure of the air upon the surface of the upper card is greater than that below it, consequently the card is forced toward the tube instead of being blown away.

J. W. C. says that O. W. H. Jr. may fasten cloth to iron by soaking it in a dilute solution of galls, squeezing out the superfluous moisture, and applying the cloth, still damp, to the surface of the iron, which has been previously heated and coated with strong glue. The cloth should be kept firmly pressed upon the iron until the glue has dried.

H. B. says, in reply to J. A. McC., who inquires for the explanation of the experiment described on p. 299: If a vessel or pipe contains a liquid or a gas of a certain pressure, in a state of rest, the pressure on every square inch of the walls of the vessel is the same. This, however, is no longer the case when the liquid or gas is in a state of motion. Where the stream of liquid or gas has to contract by reason of the diminution of the section of the pipe, and consequently has to increase its motion, the pressure increases. In the hydraulic ram, the section of the stream is suddenly reduced to zero, and hence the increased pressure. At places where the section of the pipe widens and the velocity of the liquid has to diminish, the actual pressure will decrease. In the experiment in question, the air is bound to escape from the center in a radial direction between the pasteboard and the paper disk; and as the section of this current of air is rapidly increasing, its pressure is diminished to a degree somewhat below that of the atmosphere, and the surplus of the atmospheric pressure on the back side of the paper disk balances the impact of the current in the center.

C. G. L. says, in answer to correspondents who ask for the method of photographing from tracings on vellum: The negative is made on paper, on which the lines show white on a brown ground. This negative is taken from the tracing without a camera, the transparency of the tracing allowing it to be used as a negative is used in printing a positive. Tints show with greater or less intensity according to the colors used.

H. M. says, in answer to P. J. F., who asks: What is the proper charge of powder for a 12 caliber shot gun? A. 1·3 scruples, but you might use double that quantity without any hurt.

M. S. T. says, in answer to W. H. D., who asked whether powder of a coarse grain shoots more strongly than one of a fine grain: When powder of a fine grain is used, only a part of it, nearest the point of ignition, is exploded; the rest is thrown out before it has time to explode. This may be seen by noticing the non-exploded powder inside of a gun which has been fired with fine grained powder. With a coarser powder the explosion is nearly complete, and consequently the force is increased. If blasting powder were used in a gun, the force would be less, because there would be so much space between the grains as to give the gases an opportunity to expand easily. Coarse sporting powder is the best for shot guns.

J. W. R. says, in reply to E. C. B., who wishes to know what jewellers use to clean diamonds: I clean all diamonds and precious stones by washing them with soap and water with a soft brush, adding a little ammonia in the water, and then dry in fine boxwood sawdust. If E. C. B. will put a little pot or pearl-ash in the water, it will answer the same purpose.

H. M. says, in answer to M. F. B.'s query (1) as to which will shoot the greater distance, a breech or a muzzle loading gun: A. If the charge is the same there will not be the least difference. 2. Is 30 inches long enough for a 10 gage barrel? A. Yes, for any gun barrel; but it would not hurt if it were a little longer. 3. What are the different strengths of the materials used for gun barrels? A. A barrel of any kind of twisted or laminated steel is stronger than a common iron barrel.

O. P. K. says, in reply to B., who asks what is the proper slope in left-handed penmanship: "I have written with either hand for over twenty years; and I hold the pen and slope according to the ordinary rules of penmanship. I am naturally left-handed, but at school I learned to use both hands in writing, and have found it to be of utility. I also use both hands in mechanical work, which is a saving of time." [Our correspondent's letter is written partly with one hand and partly with the other, and it is not possible to see any difference in the penmanship.—Eds.]

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

C. R. M.—Your specimen appears to be a mass of feathers and parts of feathers rolled up into a spherical form.

J. H. S.—It is an old Dutch gold coin, and has no particular value as a curiosity.

J. M. B.—It is a minute fragment of quartz.

E. P. F.—It is a twenty-four sided crystal of lime aluminium garnet, of the form known to mineralogists as the tetragonal trisoctahedron.

D. S. F.—The specimen you sent is metallic zinc, and the ore is zinc ore, probably calamine or blende.

COMMUNICATIONS RECEIVED.

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

On Measuring the Width of a Stream. By S. N. M.

On Matter and Intellect. By J. E. E.

On the Mensuration of the Circle. By H. E. A.

On a Draft of a New Patent Law. By T. C. H.

Also enquiries and answers from the following:

P. H. B.—V.—J. M.—S. V. P.—W. S. S.

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.

Several correspondents request us to publish replies to their enquiries about the patentability of their inventions, etc. Such enquiries will only be answered by letter, and the parties should give their addresses.

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

[OFFICIAL.]

Index of Inventions

FOR WHICH

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WERE GRANTED IN THE WEEK ENDING

April 28, 1874,

AND EACH BEARING THAT DATE.

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APPLICATION 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:

29,490.—GRAIN AND APPLE MILL.—C. B. Hutchinson. July 22.

EXTENSIONS GRANTED.

28,105.—FRUIT BASKET.—J. K. Park.
28,122.—HOIST MACHINERY.—R. A. Wilder.
28,130.—BAKER'S OVEN.—D. McKenzie.
28,133.—KNITTING MACHINE.—E. Tiffany.

DISCLAIMER.

28,133.—KNITTING MACHINE.—E. Tiffany.

DESIGNS PATENTED.

7,394 to 7,396.—CARPETS.—H. S. Kerr, Philadelphia, Pa.
7,397 and 7,398.—COFFIN PLATES.—W. Parkin, Taunton, Mass.
7,399 to 7,402.—CARPETS.—C. A. Righter, Philadelphia, Pa.
7,403.—BILL FILE PLATE.—F. R. Seidensticker, Meriden, Conn.
7,404.—PEN RACK STANDARD.—F. R. Seidensticker, Meriden, Conn.
7,405.—DOOR HINGE.—E. J. Steele, New Haven, Conn.
7,406 and 7,407.—RUCHES.—A. A. Rockwell, New York city.
7,408.—STOVE.—W. A. Spicer, Providence, R. I.
7,409.—BOTTLE STOPPER.—R. D. Young, Brooklyn, N. Y.
7,410.—TEA SET.—H. G. Reed, Taunton, Mass.

TRADE MARKS REGISTERED.

1,737.—PALE ALE.—Bass & Co., Burton, England.
1,738.—NEEDLES, ETC.—Cooley *et al.*, New York city.
1,739.—GRAIN BAGS.—E. Detrick, San Francisco, Cal.
1,740.—TOBACCO.—Frishmuth & Co., Philadelphia, Pa.
1,741.—OIL FINISH.—B. R. Heisler, Wilmington, Del.
1,742.—LARD.—V. W. Macfarlane & Co., New York city.
1,743.—BUTTONS.—N. C. Newell, Springfield, Mass.
1,744.—HAIR RESTORATIVE.—L. & Ph. Frass, N. Y. city.
1,745.—SAWS.—E. C. Atkins & Co., Indianapolis, Ind.
1,746.—BURTON ALE.—Bass & Co., Burton, England.
1,747.—STOUT OR PORTER.—Bass & Co., Burton, England.
1,748.—CARBOLIC SOAP.—J. Buchan & Co., New York city.
1,749.—FUMIGATING WAFER.—Colgate & Co., N. Y. city.
1,750.—WHISKY.—Dunville & Co., Belfast, Ireland, and New York city.
1,751.—HAMS, ETC.—P. T. George & Co., Baltimore, Md.
1,752 and 1,753.—PLOWS.—Higganum Manufacturing Co., Higganum, Conn.
1,754 and 1,755.—COTTON BATTING.—F. R. Josselyn, New York city.
1,756.—COTTON WARP.—F. R. Josselyn, New York city.
1,757.—COTTON BATTING.—F. R. Josselyn, New York city.
1,758.—COTTON WARP.—F. R. Josselyn, New York city.
1,759.—IRON COOKING UTENSIL.—St. Louis Stamping Co., St. Louis, Mo.

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
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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA.

APRIL 29 to MAY 1, 1874.

3,377.—J. Goodwin, Lennoxville, Sherbrooke county, P. Q. Improvements on invalids' bedsteads, called "Goodwin's Invalid Bedstead." April 29, 1874.

3,378.—J. Goodwin, Lennoxville, Sherbrooke county, P. Q. Improvements on churns, called "Goodwin's Improved Rotary Reversible Churn." April 29, 1874.

3,379.—E. Baines, Toronto, York county, Ont. Improvements on valve motion for steam hammers, called "Baines' Improved Valve Motion for Steam Hammers." April 30, 1874.

3,380.—D. Judd, Hinsdale, Cattaraugus county, N. Y. Improvements on a machine for excavating earth, called "Judd's Rotary Excavator." April 30, 1874.

3,381.—J. S. Garner, Galena, Jo Daviess county, Ill. Improvements on washboards, called "Garner's Improved Washboard." April 30, 1874.

3,382.—J. Sanderson, Jr., Lindsay, Victoria county, Ont. Improvements on washing machines, called "Sanderson's Washer." April 30, 1874.

3,383.—T. Fetherston, Fitzroy, Carleton county. Improvements on window blinds, called "Fetherston's Window Blind." April 30, 1874.

3,384.—William Gowen, Wausau, Marathon county, Wis. Improvement on table castors, called "Gowan's Table Castor." April 30, 1874.

3,385.—J. Oliver, South Bend, St. Joseph county, Ind. Improvements in plows, called "Oliver's Chilled Plow." April 30, 1874.

3,386.—J. Wood and R. Wood, Leith, Scotland. Improvements on apparatus for straining pulp, called "Wood's Pulpstraining Pulp Machine." April 30, 1874.

3,387.—H. M. Baker, W. F. Stone, and J. H. Vermilya, Washington, U. S. Extension of No. 3,054 for "Hunter's Sewing Machine." April 30, 1874.

3,388.—D. F. Jones, Gunanogue, Leeds county, assignee of J. L. Shaw, Grand Rapids, Kent county, Mich. Improvement on shovel handles, called "Jones' Shovel Handle." April 30, 1874.

3,389.—I. A. Kley, Chicago, Cook county, Ill., U. S. Improvements on chemical fire extinguishers, called "The Improved Babcock Fire Extinguisher." April 30, 1874.

3,390.—P. Mallaby, Weston, York county, Ont. Improvements in cultivators, called "Mallaby's Improved Cultivator." April 30, 1874.

3,391.—P. K. Dederick, Albany, Albany county, N. Y. Improvements on hay presses, called "P. K. Dederick's Perpetual Baling Press." May 1, 1874.

3,392.—A. Swingle and F. A. Huntington, San Francisco, Cal. Improvement on fire arms, called "Swingle & Huntington's Improved Fire Arm." May 1, 1874.

3,393.—T. H. Cobley, Turin, Italy. Improvements on processes for treating copper pyrites, copper blendes, and other sulphuretted copper ores which contain iron, called "Cobley's Improved Process for Treating Copper Pyrites, Copper Blendes, and other Sulphuretted Copper Ores which contain Iron." May 1, 1874.

3,394.—D. W. Dake, Beloit, Rock county, Wis. Improvement on a machine for working butter, called "Dake's Victoria Butter Worker." May 1, 1874.

3,395.—D. W. Dake, Beloit, Rock county, Wis. Improvements on a process for preparing a coloring matter for butter, called "Dake's None-Such Butter Coloring." May 1, 1874.

3,396.—J. T. Fewkes, Philadelphia, Philadelphia county, Pa. Improvements on anchors, called "Fewke's Reliance Anchor." May 1, 1874.

3,397.—H. Whiteside, Jr., Ottawa, Carleton county, Ont. Improvements on spring beds, being an improvement on Whiteside's patent spring bed, called "Whiteside's Improved Folding Bed." May 1, 1874.

3,398.—L. W. Boynton, Hartford, Hartford county, Conn., U. S. Extension of a New Brunswick patent for "An Improved Machine for Pointing and Counting Skewers." May 1, 1874.

BAIRD'S BOOKS FOR PRACTICAL MEN.

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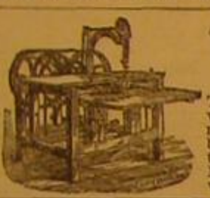

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