

# SCIENTIFIC AMERICAN

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

Vol. XIX.—No. 3.  
[NEW SERIES.]

NEW YORK, JULY 15, 1868.

{ \$3 per Annum.  
{ [IN ADVANCE.]

## Improvement in Portable Forges.

Portable forges, from their neatness of construction and handiness in operation, have in a great many cases belied their name, and become welcome fixtures in shops and manufacturing. In our experience as a manufacturer of machinery and tools, we always gave them the preference, especially for light work, and used them rather than the unsightly masses of brick, cinders, and ashes, generally dignified with the name of forge, structures which are a perpetual eyesore to the tidy workmen. But we have never yet seen an apparatus that seemed to fulfill the requirements of a portable forge so fully as that which is herewith illustrated. The whole apparatus, with its adjuncts, is contained in a chest thirty-one by twenty inches, and weighing but one hundred and fifty-seven pounds. A very few minutes suffices to convert this chest into a perfect operative forge, and when it is necessary to remove it to another point, as in bridge building, repairing railroads, etc., the parts may be separated and packed for removal or transportation with equal celerity. The legs are removable, and with all the other pieces are held in appropriate places provided for each in the chest; the hearth, bonnet, wind pipe, and other appliances, being contained in the same receptacle. When in use, the cover of the chest forms a support for the forge back and bonnet, and a fulcrum for the bellows lever, while the bellows is allowed free play by the lowering of one end of the chest bottom.

For the army, especially when on a march, for emigrant trains crossing the plains, for railroads, for dentists, silversmiths, bridge builders, and others, and on steamboats and ocean steamers, this portable forge is specially adapted. It has received the approval of United States army officers, after thorough trial at the government shops in Washington.

It was patented Dec. 27, 1864, through the Scientific American Patent Agency. Further information may be obtained by addressing the patentees, Samuel Rohrer or Wm. Carson, Palmyra, Mo. [See advertisement on another page.]

## Sawing and Grooving Machines.

The usual method of adjusting the depth of cut of bench saws or grooving heads is to elevate one side of the table to the requisite incline, while the saw or cutter arbor remains fixed in one position. There are objections to this method of adjustment which must frequently have suggested themselves to practical workmen. The incline of the surface of the table interferes with the accuracy desirable in doing the work, as it demands more care in the guidance of the material to be worked; and the table thus alternately raised and lowered tends to become unsteady and liable to vibration, producing inferior and faulty work.

The machine shown in the engraving operates in an entirely different manner. Instead of the table being adjusted to the saws or cutters, they are raised or lowered to meet the demands of the work. The saws or cutter heads are secured to arbors, which run in boxes attached to a sliding frame under the table, mounted on another frame set on an angle with the upright and horizontal portions of the machine. The arbor frame with its saw or cutter head is elevated or depressed by a screw worked by bevel gears and a hand wheel, the latter projecting from the front of the machine. The incline is at such an angle with the center of the driving shaft at the rear of the machine, that in any position of the arbors the belts will always be kept tight. The splitting rest or guide is jointed so as to be inclined at any angle to saw at any bevel desired, and can be readily removed to permit the cutting of long stuff. The squaring guide is hinged to the table and can be turned up on the table for use, or allowed to

drop, as seen in the engraving, so as to be out of the way when not required. It is so constructed as to swivel for cutting miters either way. A light guide, also made to swivel, seen resting against the front of the machine, can be used for light work, its stem traversing a transverse groove in the table.

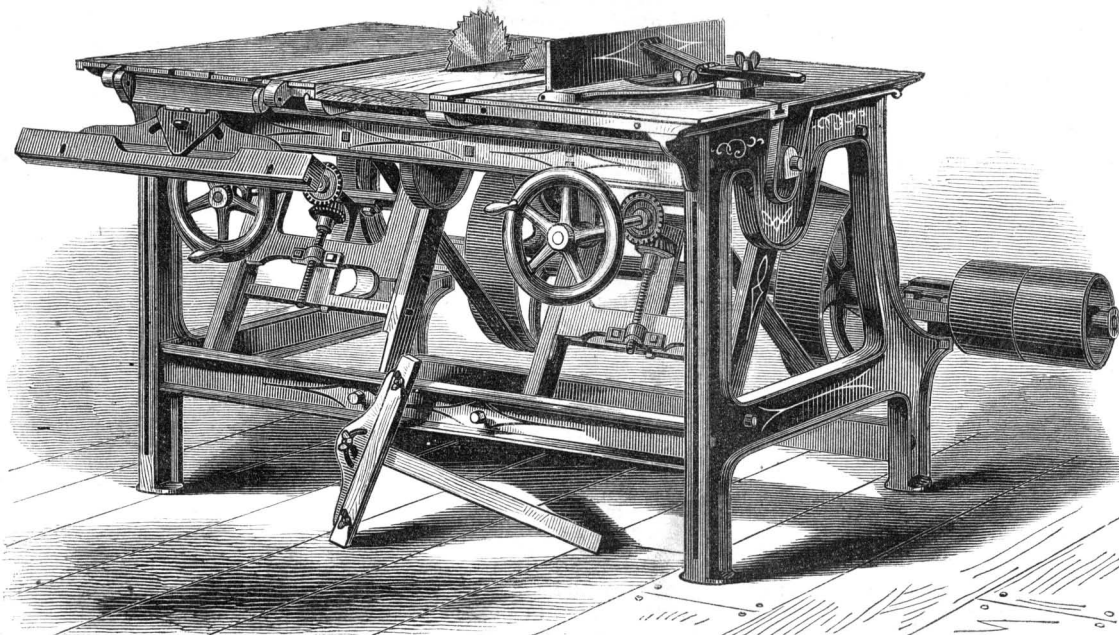
These machines may be made double, as in the illustration, or single, as required, and may be used for splitting, squar-



ROHRER'S PATENT PORTABLE FORGE.

ing, mitering, or grooving. Being of iron, they are solid, enduring, and exact, complete without countershafts, and requiring no braces to keep them in place. By practical wood workers they are highly commended.

The patent was issued to Jonathan P. Grosvenor, of Lowell,



GROSVENOR'S PATENT SAW BENCH.

Mass., and bears the date of May 5, 1868. Address, for further information, the patentee as above.

JUNE-BUGS are so plentiful in France that they are captured in large numbers and from their bodies is expressed an oil said to possess great value as a lubricant.

## A Useful Official.

In the new building of the Department of Agriculture, at Washington, the happiest being will be our enthusiast, Townsend Glover, the naturalist, to whom our farmers apply for a knowledge of what birds eat the pippin apples, and what worm gets into the beet root. Glover is a Brazilian by the accident of birth, a Yorkshire Englishman by parentage, a German by education, American by adoption and enthusiasm. He is a singular looking man, short, thick, near-sighted, peculiar, an Admirable Critchton in the practical arts. Agriculture has been his fanaticism for forty years. He paints, models in plaster, engraves, composes, analyzes, and invents with equal facility. His passion is to be the founder of an index museum to all the products of the American continent from cotton to coal oil, from pitch pine to wine. Heretofore he has had only two little rooms in the dingy basement of the Patent Office; hereafter he is to have a handsome museum room in the new building, 103 by 52 feet and 27 feet high. His objects, already largely perfected, are to methodize, by models and specimens, the natural history, diseases, and parasites, remedies of every individual product in America. For example: A man wants to move to Nevada. What are the products of Nevada? Glover has a series of cases devoted to that State, models of all its fruits, berries, prepared specimens of its birds, illustrations of its cereals, flora, grasses, trees. A small pamphlet conveys the same information; the man knows what to expect of Nevada. A man forwards a blue bird; is it tolerable or destructive, to be encouraged or banned? Glover forwards the names of fruits, etc., which the blue bird eats. He will show you, in living, working condition, the whole lifetime of a cocoon; the processes of Sea Island cotton, from the pod to the manufacture; the economical history of the common goat; the processes of hemp, from the field to the hangman. Every mail brings to him a hawk, a strange species of fish, a blasted potato, a peculiar grass which poisons the cow. He is the most dogged naturalist in the world, probably; a wrestler with the continent. He is a bachelor, married to his pursuit—one of those odd beings hidden away in the recesses of government, whose work is in itself its own fame and fortune.

## Speed of the Senses.

There are thirty one pairs of compound nerves in the human body, the sensory and motor fibers of which are so mingled as to render it an impossible undertaking to separate them by any means at present known. Now if, for instance, a needle be stuck into one of the fingers, the sensory fibers take the impression through the nerve and the posterior root to the spinal cord and thence to the brain. The command goes out to "draw the finger away." The mandate travels down the spinal cord to the anterior root, and thence through the motor fibers of the nerve to the muscles, which immediately act, and the finger is at once removed. All this takes place with great rapidity, but yet with nothing like the celerity once imagined.

The researches of Helmholtz, a distinguished German physiologist, have shown with great exactitude the rate of speed with which the nerve fluid travels; and other observers have given a great deal of time and patience to this and kindred questions. As the result of many deliberations, it was ascertained that the nervous fluid moves at the rate of about 97.1 feet in a second. Now electricity travels with a speed exceeding 1,200,000 feet in a second, and light over 900,000,000. A shooting star moves with a velocity of 200,000 feet in a second, and the earth, in its orbit around the sun, 100,000. A cannon ball has a mean velocity of 1,800

feet in a second; an eagle, 130; and a locomotive, 95. We thus perceive the nervous fluid has no very remarkable rate of speed—a fact which, among many others, serves to indicate its non-identity with electricity.

Prof. Donders, of Utrecht, Holland, has recently been making some interesting experiments in regard to the rapidity of thought, which are likewise interesting. By means of two instruments, which he calls the noematachograph and the noematachometer, he promises some important details. For the present he announces that a simple idea requires the brain to act for sixty-seven one thousandths of a second for its elaboration. Doubtless the time required is not the same for all brains, and that, by means of these instruments, we may obtain definite indications relative to the mental caliber of our friends. What invaluable instruments they would be for nominating caucuses for vestries, for trustees of colleges, for merchants in want of bookkeepers; in short, for all having appointments of any kind to make.

For the eye to receive an impression requires seventy-seven one thousandths of a second, and for the ear to appreciate a sound, one hundred and forty-nine one thousandths of a second are necessary. The eye, therefore, acts with nearly twice the rapidity of the ear.—*Galaxy*.

#### PUBLIC RIGHTS AS AFFECTED BY OPERATIONS OF RAILROAD MONOPOLISTS.

It is well that recent attempts of certain stock-jobbing cliques, headed by men notorious on account of vast wealth, and acknowledged superior skill in controlling the stock market to enrich themselves, have begun to enlighten the people in regard to the extent to which such abuses may be carried, and to demonstrate the wisdom of limiting the powers hitherto granted by legislative action to railroad corporations. They have obtained their power by the abuse of franchises originally obtained from the representatives of the people, through companies in which, by a series of adroit manipulations, they have succeeded in obtaining a controlling interest.

The general indignation which pervaded the public mind, when certain arbitrary restrictions in regard to the shipping of freights over the New York Central railroad were inaugurated, seems to indicate that further imposition might exceed the limit of that forbearance which appears to have been so confidently relied upon in the management of railroad and express monopolies in this country. We are greatly deceived, however, in our estimate of the character of the men who originated and developed the gigantic schemes which have recently created such wide spread apprehension, if the apparent present suspension of attempts to carry out the original plan in all its essential features shall prove to have been finally abandoned. We believe, therefore, that measures should at once be adopted that would immediately and permanently stop all attempted encroachments upon the rights of the public, by the acts of these financial autocrats.

The following exhibit of the manner in which the capital stock of the Hudson River railroad was increased from its original amount, and also of the way in which it was proposed to increase the capital stock of the Harlem and New York Central railroads, is taken from the *Atlantic Monthly* :—

Present capital,—Hudson.....	\$14,000,000
Bonds outstanding Jan. 1, 1868.....	5,000,000
Present capital,—Harlem.....	6,800,000
Bonds outstanding Jan. 1, 1868.....	5,000,000
Present capital,—New York Central... ..	28,990,000
Bonds outstanding Jan. 1, 1868.....	11,347,000

Giving in sum total..... \$71,137,000

The fourteen millions credited to Hudson in the above summary represents only ten and a half millions of actual money, and owes its creation to one of those peculiar financial expedients by which shrewd American capitalists acquire the enviable title of railroad kings. When the head of the dynasty which now dominates over the three affianced companies made his first move by securing possession of the river route, he inaugurated a system of economical management, special traffic arrangements, and vast construction outlays which afforded a specious pretext for augmenting the capital stock. It was therefore voted that the then capital of seven millions should be increased to fourteen by an issue of bonus shares at fifty per cent. Each stockholder paid in fifty dollars, and received scrip, the par value of which was one hundred, but which sold in Wall street at forty-five premium. This splendid maneuver, by which the company obtained three and a half millions for the construction and repair fund, while the stockholders doubled their money, presented features too large and captivating to lapse into desuetude. It was now proposed to repeat the same operation along all the lines, which at the same time were to be consolidated. The scrip dividend in this second scheme was to be 33½ per cent.

This would give :—

Fresh capital,—Hudson.....	\$6,000,000
“ “ Harlem.....	3,200,000
“ “ N. Y. Central.....	9,663,000
With previous sum total of capital.....	71,137,000

Capital of consolidation..... \$90,000,000

In order that dividends might be realized upon this large increase of stock, the restrictions upon the shipping of freights above alluded to were initiated, and an increase of rates for passenger travel and upon goods in bulk was determined upon. To compel the public to submit to such exactions, it was necessary to destroy competition, and to this end the securing control of the Erie Railroad was deemed necessary. The battle for supremacy was hotly waged between the two greatest stock operators this country has ever known, Messrs. Drew and Vanderbilt. Small operators who had not the good sense to shun danger were mercilessly

crushed, and the financial interests of the country were greatly disturbed by the conflict. After days of suspense it at last became apparent that Mr. Drew was more than a match for Mr. Vanderbilt and the latter executed a masterly retreat, which left him apparently little worse for the conflict, and, we are confident, disposed to renew it whenever the opportunity seems favorable.

The developments of this celebrated struggle were such as to give birth to great apprehensions for the future welfare of the commercial interests which so largely depend upon the proper and just management of all the avenues of trade which radiate from the city of New York and connect it with the other commercial centers of the Union. It was seen that legislatures and courts were made the instruments of these powerful organizations, and that corruption had been carried to an unparalleled extent by unscrupulous agents of the opposing powers. Not these only were found to be adopting such means to attain their ends, but an examination of the contingent expenses of different railroad companies revealed the fact that astounding sums were paid for the manipulation of legislative bodies. “The Union Pacific paid not less than \$500,000 for services rendered to the company by lobbyists at Washington. It recently cost the Missouri Pacific Railroad \$192,178 to secure the possession of that road by State legislation. The New York Central credits \$250,000 to the contingent fund for expenses at Albany in 1866-67. In view of these facts it seems just to modify the popular prejudice against the Camden and Amboy Railroad, which has certainly attained its ends in congress and at Trenton by a far more economical expenditure.”

It is much easier to find fault with the existing state of things than to suggest the proper remedy. We believe that the present system of granting charters to corporations is mischievous in its effects so far as it relates to franchises which involve such large and general interests as public highways, canals, and railroads. At least the government should retain the power to assume the control of all such internal improvements by paying the companies their real value, at any time that their defective management seems to call for such a proceeding. A railroad thus removed from the control of those who desire to make it the means of public extortion might be conditionally leased to another company, or operated by the government itself. We admit that certain objections might be raised against this system, but we think that when compared with the advantages which would be derived from it, they would be found neither so numerous nor so formidable as might at first be anticipated.

Some means must be devised by which officials can be cured of their speculative tendencies; we care not what, so long as they answer the purpose, and provide for the proper punishment of any railroad official who deals directly or indirectly in railroad scrip. The suffering of a road to become so shamefully out of repair as the Erie has notoriously been, should be sufficient cause for the removal of its officials and the appointment of suitable persons to fill their places by the government.

That the existing laws under which railroads are organized and operated need thorough revision, seems the inevitable conclusion of a candid and careful consideration of the subject. That delay is fraught with danger also seems certain. We trust that the public will be aroused to timely action upon this matter, and that the possibility for any one man to obtain hereafter the control of any internal improvement, which affects directly every individual in the commonwealth, shall be forever terminated.

#### Science Familiarly Illustrated.

##### Gunpowder—Its Manufacture and Uses.

Gunpowder is a solid, explosive, mixture, composed of niter, sulphur, and charcoal, reduced to powder, and mixed intimately with each other. The proportion of the ingredients varies very considerably; but good gunpowder may be composed of the following proportions :—seventy-six parts of niter, fifteen of charcoal, and nine of sulphur, equal to one hundred. These ingredients are first reduced to a fine powder, separately, then mixed, intimately, and formed into a thick paste. This is done by pounding them for a long time in wooden mortars, at the same time moistening them with water, to prevent the danger of explosion. The more intimate is the mixture the better is the powder; for, since niter does not detonate except when in contact with inflammable matter, the whole detonation will be more speedy the more numerous the surfaces in contact. After the paste has dried a little, it is placed upon a kind of sieve, full of small holes, through which it is forced. By that process it is divided into grains, the size of which depends upon the size of the holes through which they have passed.

The powder, when dry, is put into barrels which are made to turn round on their axis. By this motion, the grains of gunpowder rub against each other, their asperities are worn off, and their surfaces are made smooth. The powder is then said to be glazed. The granulation and glazing of the powder causes it to explode more quickly, perhaps, by facilitating the passage of the flame among the particles.

When gunpowder comes in contact with any ignited substance, it explodes, as is well known, with great violence. This effect may take place, even in a vacuum. A vast quantity of gas, or elastic fluid, is emitted, the sudden production of which, at a high temperature, is the cause of the violent effects which this substance produces. The combustion is, evidently, owing to the decomposition of the niter by the charcoal and sulphur. The products are, carbonic oxide, carbonic acid, nitrogen, sulphurous acid, and, probably, sulphureted hydrogen. Mr. Cruikshanks has ascertained that no perceptible quantity of water is formed. What remains, af-

ter the combustion, is potash, combined with a small portion of carbonic acid, sulphate of potash, a very small proportion of sulphuret of potash, and unconsumed charcoal. But that water is produced by the explosion of gunpowder is proved by its presence in the piece after it has been fired. A sufficient quantity is developed to moisten and foul the bore of the piece, and necessitate its cleansing, and to hold *in transitu* the unconsumed portions of the charcoal, or other ingredients. Every practical gunner or expert with the rifle or pistol knows that every discharge of common gunpowder develops more or less of water; else why the cleansing of cannon or gun barrels, after successive discharges, when they become fouled by the remains of the discharges? Explosion releases the water held in combination with the components of gunpowder, as well as the lighter gases. The explosion of gunpowder is as surely a means of liberating the combination of hydrogen and oxygen as of liberating the nitrogen and carbonic acid.

We need a gunpowder, or something to take its place, which will not develop moisture to foul the bore of the gun. Such a discovery we believe to be within the limit of inventive talent.

The elastic fluid which is generated when gunpowder is fired, being very dense, and much heated, begins to expand, with a force at least one thousand times greater than that of air under the ordinary pressure of the atmosphere. And, allowing the pressure of the atmosphere to be fourteen and three fourths pounds upon every square inch, the initial force or pressure of fired gunpowder will be equal to at least fourteen thousand seven hundred and fifty pounds upon every square inch of the surface which confines it. But this estimate, which is that of Mr. Robins, is one of the smallest which has been made. According to Bernoulli, the initial elasticity with which a cannon ball is impelled is, at least, equal to ten thousand times the pressure of the atmosphere; and, from Count Rumford's experiments, it appears more than three times greater than this.

Gunpowder, on account of its expensiveness, and the suddenness and violence of its action, is not employed as a regular moving force for machinery. It is chiefly applied to the throwing of shot, and other projectiles, and the blasting of rocks.

When a ball is thrown from a gun, the greatest force is applied to it, by each particle, at the moment of its explosion. But, since the ball cannot at once acquire the same velocity, with which the elastic fluid, if at liberty, would expand, it continues to be acted upon by the fluid, and its motion is accelerated, in common cases, until it has escaped from the mouth of the piece. The accelerating force, however, is not uniform; and hence, the following circumstances deserve attention :—1. The elasticity is, inversely, as the space which the fluid occupies; and therefore, as it forces the ball out of the gun, it continually diminishes. 2. The elasticity would diminish, in this ratio, even if the temperature remained the same; but it must diminish in a much greater ratio, because a reduction of temperature takes place, both from the dispersion of the heat, and the absorption of it, by the fluid itself, during its rarefaction. 3. The fluid propels the ball, by following it, and acts with a force that is, other things being equal, proportionate to the excess of its velocity, above the velocity of the ball. The greater the velocity the ball has acquired, the less, therefore, is its momentary acceleration. 4. From this change of relative velocity, there must be a period when the velocity of the ball will exceed that of the elastic fluid; and, therefore, the proper length for a gun must be that in which the ball would leave the mouth at the time when the velocities are equal; and all additional length of the piece, beyond this, can only serve to retard the ball, both by friction and atmospheric pressure.

The force of fired gunpowder is found to be very nearly proportionate to the quantity employed; so that, if we neglect to consider the resistance of the atmosphere, then the height to which the ball will rise, and its greatest horizontal range must be, directly, as the quantity of powder; and, inversely, as the weight of the ball. Count Rumford, however, found that the same quantity of powder exerted somewhat more force upon a large ball than on a smaller one.

#### Correspondence.

The Editors are not responsible for the opinions expressed by their correspondents.

##### Explosive Gases in Steam Boilers.

MESSRS. EDITORS:—Almost every one practically conversant or theoretically acquainted with steam boilers, has his theory of the cause of explosions, which he adapts to any and all cases; and this may account for the singularly contradictory evidence given before coroners and judges in cases where the explosion of a boiler is one of the items in the cause. The testimony of practical engineers, however, who have no personal interests at stake, and who have given their personal attention to an examination of exploded boilers, generally agrees as to the proximate cause of explosion. This seems to tend to prove the fact that boiler explosions, under ordinary circumstances, may be accounted for, and the subject is one of very great importance. But occasionally there may be cases which puzzle the heads of the most capable engineers.

One of the theories of boiler explosions is, that when the water gets low, leaving fire or heating surface exposed, or covered only with steam—a poor conductor of heat—the iron becomes heated, and will produce a decomposition of the steam, liberating its gases and absorbing the oxygen of the iron. This produces the combination known as oxy-hydrogen gas, highly explosive. It is rarely that enough of oxygen is eliminated, however, to make the mixture dangerous;

but an admission of oxygen from the atmosphere by the leakage through the feed or water pipe, may suffice to make the mixture of gases really dangerous.

A case within the writer's knowledge seems to give color to this hypothesis. On a Saturday afternoon the supply pipe of a boiler refused to deliver water, and the engineer prudently drew his fire and stopped his engine. The pump was overhauled and repaired, but, being late, the boiler was not fired up again. On Sunday, twenty-four hours after, the engineer opened the man-hole at the end of the boiler, to see if any damage had been done by overheating. The interior being dark, he introduced a lighted lamp, when an explosion occurred, sending the engineer through a wooden partition ten feet away, burning his skin and scorching his hair.

What did it? Not steam. Was it gas, and if so, how was it generated, and how did it accumulate in a cool boiler? An answer from thorough-going engineers is solicited. We need facts, not speculations; the results of practice, not the vagaries of theory.

PRACTICAL ENGINEER.

**Mechanical Distribution of Electricity.**

MESSRS. EDITORS:—Your correspondent, Mr. G. Wright, when asserting, page 21, that the established theory is wrong,—which teaches that only the outside of conducting bodies can be charged with electricity,—overlooks the fact that when he brings into the inside of a charged body one end of a conductor, of which the other end projects outside this body, the electric charge must flow towards the outward projecting end, which is now further from the center than the outside of the body itself. This is exactly conformable to the established theory, which teaches that the electric charge is always distributed in such a way that the greatest amount is further from the center of the body, or from the common center of any number of bodies which are in electric communication. Hence an equal distribution takes place only on a globe; in an elongated body it is accumulated at the ends, and more so in proportion that these ends are further apart. Experiments teach that when a body charged with electricity is touched in its interior by a conductor, so small that no conducting portion extends outside, but is attached to a non-conducting handle, then this conductor will receive no charge whatever, in fact this is one of the common lecture room experiments which I have performed hundreds of times, before my classes in physics. On this experiment, and on many other well established facts, the common theory is founded. But when Mr. W. attaches his test ball (in place of an isolating handle) to a small wire, as he states, he of course can not only draw sparks from the inside of any body charged with electricity, but even discharge it entirely, if he keeps the wire in his hand. These facts are familiar to every person more or less acquainted with electrical experiments.

It has never been claimed by electricians, that a body could not be wholly or partially discharged from its inside by a good conductor, which is in electric communication with other conductors outside; and this is all that Mr. W. has done. When he tries the experiment in the right way, and attaches his ball to a glass rod or silk cord, in place of a wire, and then tries to charge his ball by touching alternately the inside and the outside of a hollow body charged with electricity, and then tests the charge of his ball by means of a gold leaf electrometer, he will see the difference, and it will give him a better understanding of the established theory.

The fault is, that our common text books on natural philosophy are not explicit enough on many points, and this gives rise to misunderstandings of different kinds, the best remedy for which is the study of more extensive works, in which we find the results of experiments and researches which it would take us a life-time to find out ourselves.

P. H. VAN DER WEYDE, M. D.

New York city.

**Loss of Gas—Wet Meters.**

MESSRS. EDITORS:—A correspondent, whose letter is published on page 10, Vol. XIX., of the SCIENTIFIC AMERICAN, says in regard to errors which may occur in wet gas meters:

"When the consumption is large, and the working of the axle easy, a momentum will be acquired by the drum, so that the buckets will be only partially filled as they pass over to the supply pipe. The register records the same as with full buckets."

I think this could never occur in a well constructed meter, as the "vis inertia" of the fluid in which the drum revolves, would always compensate for the momentum which would be acquired by rapid motion. Besides, meters, if properly constructed, will not permit such a rapid flow of gas as would make any assignable error in the rotation of the drum.

S. L.

Brooklyn, N. Y.

**Inventions Needed.**

MESSRS. EDITORS:—I read your notices of "Inventions Needed," in a late number of the SCIENTIFIC AMERICAN, and was pleased to see you stimulating the inventiveness of the country. In imitation of your example, I wish, with your permission, to suggest one or two machines and inventions which might be of service to the inventor. I expect, at no remote day, to put up an indefinite number of bushels of desiccated potatoes. To prepare them for the dry house they should be washed carefully, so as not to bruise them, and not a few at a time, but by the wagon load, or by machinery. In the next place, they must be cut up into pieces not over three eighths of an inch thick, and all of a uniform thickness, so that the drying process will be uniform. If a machine automatically fed and worked with great speed, and not too costly, can be produced, it will pay. Among the parties producing vegetable cutters, no one has yet struck at an apparatus

of this sort. If any one is produced we would like to try its working powers. Address

C. KIMBALL.

Baltimore, Md.

For the Scientific American.

**USE OF RAW AND COOKED FOOD.**

The design in cooking food is not only to make it more digestible (many varieties being as easily digestible raw as when cooked), but the principal use of cooking is the destruction of microscopic seeds and eggs, often existing in raw food, which would produce vegetable and animal parasites in the system. The last are called entozoa, and the study of them, with the injury they produce in man, now constitutes a peculiar branch of medicine.

The most interesting of these are two species of the tapeworm, one of them originating from raw pork. Swine are subject to a disease called measles, and such diseased pork is full of the germs of future tapeworms in men. When human beings are thus affected they discharge daily thousands of microscopic eggs. When one of these—which may become dry as dust without losing its vitality—enters the stomach of a pig with its food, it produces again the measles in this animal. This explains why Jews are rarely affected with tapeworms—cooks and butchers often. Even raw beef has produced tapeworms by being cut with a knife also used for pork. Cooking, thorough salting, and smoking destroys the germs, but cleanliness, of course, is essential. It is only at present that the sanitary measures prescribed by Moses for the Israelites have been fully appreciated.

Dr. Fleming, last year, read a paper before the British Association on the prevalence of tapeworm in Birmingham, Eng. He supposed it was caused by the water containing sewage contamination. If this is so, it would appear that tapeworms may be propagated by impure water as well as by unclean pork. It is a hint to us to take precautionary measures to have our drinking water as clean as possible. Without containing germs of tapeworms, it may contain many other impurities and parasitical eggs. Cooking, of course, destroys all these, and this is one of the reasons why the general moderate use of coffee and tea has been universally productive of increased health. Simple water becomes flat and unpalatable by cooking, as the heat drives out all the air which it contains in solution; therefore a perfect filter, or melted clear ice, is the best thing for obtaining good drinking water when it cannot be obtained from a deep pure well or spring, purified by natural filtration.

The trichinæ are another class of parasites, affecting the human system even more frightfully than the tapeworm. They are also produced by the use of raw meat, but there has lately been published so much on this subject that the mere mentioning of it will be sufficient.

The distoma, or fluke, called by the French douve, is a large class of parasitical worms, of which more than two hundred species have been studied. One of them is very common in the liver of the sheep and horse, and infests also the human liver. The polystoma, an allied genus, has also several species, two of which are sometimes found in the human body, one inhabiting the veins.

We will only mention the ligula, which infests the abdominal cavities of birds and fishes, and proves fatal to them; the hydatids, which are often found in enormous abundance in the abdomen of quadrupeds, especially of the ruminant order; the cænuræ, common in the brain of sheep, destroying the animal by pressure on that organ; the different entozoa, by which cats and dogs suffer in different parts of their bodies; and, finally, the snake-like worm occasionally developed in the interior of the eyeball of the horse.

Now, as regards the origin of these animals, spontaneous production is out of the question. Every living being is produced from an egg; therefore, the only possible explanation is, that the microscopic small eggs are taken into the system with the food. When their vitality resists the digestive power, these eggs are absorbed, enter in the circulation with the blood, and are developed at that part of the body where the conditions are favorable for their growth. This idea is verified by the latest microscopic examinations about the origin of the infusoria, by which it is proved that the very dust of the air is full of myriads of eggs of all kinds, only waiting a favorable opportunity to be developed into the corresponding animal.

The most common of all human internal parasites are the ascarides, of which the largest species have nearly the shape of a common earth worm, attaining sometimes the length of two feet, and cause alarming symptoms. The small variety is very common in children, and is supposed by some to originate from the eggs of flies deposited on or in the food. Most animals of this class are at first worms, the eggs being laid in some dead animal, meat, cheese, or other article, which gives nourishment to the growing worm, which afterward passes through the regular transformation into a fly. When these eggs are hatched in the intestines, under very different circumstances, they are developed into an animal which differs greatly from that developed in the air.

In healthy, vigorous children the digestive powers will resist the hatching of these eggs, and even the worms themselves will be digested, when accidentally hatched or otherwise introduced in the system. Only those of weak digestive powers are subject to worms, and this observation has lately given rise to a different medical treatment successful in many cases of these infantile troubles, namely, in place of administering to the little sufferers vermifuge and purges (which only give temporary relief and do not remove the cause, when this cause is weakness, but even weaken the system still more), tonics and a strengthening diet are prescribed. In this way the primary cause (the weak digestion)

is removed, as in healthy, strong intestines worms cannot exist, but are at once digested.

Occasionally persons are found who have the peculiar notion of frequently eating raw meat and who give it to their children, with the idea that it possesses more nourishing qualities. But, even if this idea be correct, it is more than fully counterbalanced by the perils we have indicated, and experience teaches us that those persons who have apparent good health are subjected to more diseases than others. Freshly cooked food, therefore, is preferable for the reasons above given.

M. D.

**Glyphography.**

Having recently made trial of the process of glyphography in connection with the reproduction of engraved plates from photographs, and having obtained a considerable measure of success, we shall describe the process, if not in complete detail, at least so minutely as to enable any of our readers to practice engraving by the process in question with a fair degree of success.

A polished plate of copper, such as is usually employed by engravers, is blackened by being washed over with sulphide of potassium, sulphide of ammonium, chloride of platinum, or other means. The plate is then washed and dried, and is evenly coated with a mixture of wax, resin, and sulphate of lead, the thickness of the coating not exceeding a thirtieth of an inch. This coating is white and smooth, and the plate when thus prepared is ready for being sketched upon, or, as was the case in our trials, for being photographed upon. The details of our method of effecting the photographic part of the operation shall form the subject of another communication.

On the figure thus photographed, or traced by pencil, the artist proceeds to make his drawing with little tools like needle points, fixed in wooden handles. These tools should vary in size, or rather in the thickness of point, according to the nature of the work intended to be accomplished. It will be found most advantageous to use tools one side of which has been filed flat, and a curve given to them near the point by bending them while heated in the flame of the gas. Every touch or stroke of the artist should penetrate through the waxy varnish to the surface of the plate, which, being black, reveals every touch—the work thus appearing black on a white ground, in the same manner as if it were effected by pen and ink on white paper.

The coarseness or heaviness of the lines depends upon the tool by which they are cut; hence broad lines require a tool flattened at the point like a chisel. The drawing must be made as in nature, or non-reversed.

When the picture is examined and found to be right, it is dusted over with plumbago, which, by means of a bushy camel's-hair pencil, is distributed through every line and over every part of the surface. Although we find that other conducting substances, such as bronze powders, act better than plumbago, we have very beautiful pictures produced by Mr. Palmer, in which the coating is the same as that here described.

The plate thus prepared is immersed in an electrotype cell, and a thin tissue of copper is deposited on it by the battery. When the plate has been immersed at night, we find in the morning that the deposit of copper is sufficiently thick to allow of its being removed. The battery we use is Smee's, and the depositing solution is the sulphate of copper, rendered decidedly acid with sulphuric acid.

The cast thus obtained must be backed up with soft metal, *sec. art.*, and in this state it will, if printed from as a wood engraving, yield an exact fac-simile of the original drawing.

If it be required to lower broad masses of white, this can be effected in one or other of the following ways:

After the drawing has been finished, and before it is brushed with black lead, paint over the broad masses of white with melted wax, and let the thickness of the mass thus painted on the surface be determined by the area of the white portion, care being taken not to approach too closely to the lines of the drawing. This having been done, proceed with the plumbago as already directed.

Another way by which to lower the broad whites is to take a cast in plaster of Paris from the original plate, and in this cast to lower any part required by means of a suitable gouge-shaped tool. From the plaster block thus trimmed may be obtained, by means of recasting in plaster and stereotyping, any number of metal blocks in a condition ready for printing.

We have in our possession some pictures which have been obtained from surface blocks prepared nearly as described, and which are so fine and delicate as to warrant any person unacquainted with the method of their production in believing that they were printed from engraved copper or steel plates.—*British Journal of Photography.*

**Another Invention Wanted.**

Some small, neat thing, to be worn with watch seals, or as a ring, or anywise one pleases, with which to cut open envelopes when one receives letters from the post office, is greatly required. What pulling, tearing, looking for knives, scissors, paper folders, or thrusting in of finger nails, or ripping open and rending by main strength, is daily practiced. Some neat, simple, convenient instrument can be supplied and presented that will sell to nearly every body, and I know the SCIENTIFIC AMERICAN will do the business well, if employed.

K.

ELECTRO-MAGNETIC machines are perhaps the least likely of all inventions to supersede the steam engine. The consumption of a grain of zinc, as Mr. Joule has shown, though much more costly than a grain of coal, does not produce more than one-eighth of the same mechanical effect

## PAPER--ITS MATERIAL AND USES.

From the best authorities it would appear that cotton was the first material used in the manufacture of paper, after papyrus. The exact date is not known, but it is pretty well authenticated that paper from this material was made and used in the eleventh century. The Chinese, since the decadence of the papyrus manufacture in Alexandria, Egypt, may be considered the greatest manufacturers and users of paper. With them this material occupies a place of importance not equaled by any other one substance in use by us. They employ it for clothing, building, decorations, toys, and a hundred other necessities. They utilize linen rags, the inner bark of trees, the fibers of cane and bamboo, and for "rice paper" the stems of a wild leguminous plant. The soles of boots, umbrellas, hats, garments resembling in texture and durability woven fabrics, kitchen and table utensils, boxes, bowls, etc., this ingenious people fashion from paper. Even their pocket handkerchiefs are made of it; and some specimens of their paper are scarcely inferior in toughness and elasticity to the best textile fabrics.

We have scarcely reached their aptness in the quality of the paper, and are far behind them in adapting the material to our every day needs. We make paper water-pipes, row boats, paper hats, and bonnets, paper collars, cuffs, and shirt-fronts. We use it for twine to tie up paper packages; a specimen for machine belting is now on our table. It is doubtful if any other material is susceptible of a greater diversity of uses; yet we seem to lack the means of producing it cheaply enough to supersede other and more costly substances. It is hardly to be believed that knowledge of the manufacture, the various processes to adopt it to manifold uses, is lacking, but rather the difficulty of procuring the material from which it is made prevents us from making a more extended use of it.

For some years past paper "stock" has been very dear. Rags advanced in price, as cotton went up. Wood fibers and straw have been tested with a view of keeping down the continually increasing price of rags and furnishing a cheaper and equally valuable material. Yet these, especially the latter, are not new attempts. So long ago as 1756 the Germans used straw, and in 1776 a book was printed in France the paper of which was made of linden or basswood. In 1800 good white paper was made in England from straw and wood. It is certain that neither straw nor wood have yet been found equal to cotton and linen as a material for the production of paper.

Under these circumstances we have been much interested in the examination of specimens of paper made from the okra plant, which can be grown easily in every state of the union, yielding, even with the most careless cultivation, from four to eight tons of dried stalks per acre. As it can be grown in the immediate vicinity of the mills, and will yield to the cultivator from forty to eighty dollars per acre, exclusive of the market value of the seeds, there would seem to be some reason for looking to this as a proper substitute for the expensive stock now employed in the manufacture of paper. Certainly the specimens of okra paper before us, ranging from coarse brown wrappers to the finest printing, note, and bank paper, seem to offer good evidence of the value of this vegetable production as paper stock.

The subject is worthy the attention of paper manufacturers and others, as in addition to the low cost of the material, the expense of its preparation for pulp is much less than that demanded by the use of rags.

## SILK AND ITS CULTURE.

We have almost every variety of soil and climate, therefore there appears to be no good reason why the production of silk should not ultimately become one of the leading industries of our country. Already the subject is arresting some attention in California; but, like all other new branches of industry, it advances slowly. The workmen need experience, the capitalist needs confidence, and the markets need time. If there is haste there is danger, and there is not wisdom in attempting to do business without a thorough understanding of the conditions under which it can be made to pay. The *Alta California* expresses the belief that those who engage in it under favorable circumstances cannot fail of success. Among these circumstances are unincumbered ownership of the land, of soil favorable to the mulberry, a good knowledge of the method of taking care of the worms, eggs, and cocoons, and the facilities of getting labor cheap, such as that of women or children during the busy season.

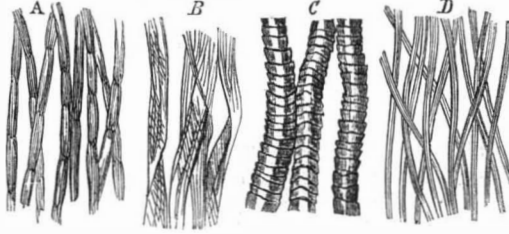
The sale of cocoons raised last year in California numbered 200,000, of which half were killed under a misapprehension, so that 100,000 are supposed to remain for the production of butterflies this summer; and of these 50,000 are females, which should lay 300 sound eggs each. Let us suppose, however, that they lay 200 each, the number of cocoons this year would be 10,000,000; in 1869, 1,000,000,000; and in 1870, 100,000,000,000; that is if there were food and care for all. But neither can be obtained for such a multitude. It is doubtful whether more than 2,000,000 cocoons will be bred this year. There are great numbers of the mulberry trees in nursery, but very few in plantation, as they should stand, to produce leaves for the worms. Until there are extensive plantations of the mulberry, the production of silk must remain unimportant. In the mean time, however, the experience, the confidence, and the knowledge required for success are gradually establishing themselves, so that they will soon be urging the mulberry cultivation ahead instead of lagging behind.

Silk is the produce of a member of the animal kingdom, and occupies the highest position among all the tissues as re-

gards resistance and durability, the average length of each single thread afforded by our worm being about three hundred yards. It has been ascertained that bundles of fibers of equal size, of silk and flax gave the following unequal powers of resistance:—

Silk supported without breaking a weight of.	34 lbs.
New Zealand flax.....	23½ lbs.
Hemp.....	16½ lbs.
Ordinary flax.....	11½ lbs.
Cotton, less than.....	7 lbs.

In order to better appreciate the character of these textile materials, single fibers of each have been selected and placed side by side; and to these have been added fibers of wool.

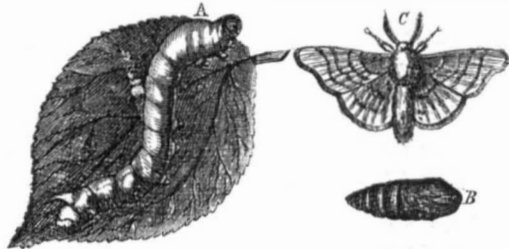


Fiber of flax, A; of cotton, B; of wool, C; of silk, D: placed so that their relative size and markings may be readily contrasted. The fiber or cells of cotton are manifestly much thinner and less resisting than those of the other substances.

The manufacture of silk appears to have been first known and practiced by the Chinese nearly three thousand years before the Christian era, but it was not until the sixth century that the western world received the great boon of a supply of silkworm eggs. The manufacture of silk began to be successful in France in 1521, during the reign of Francis I, and that country now furnishes the world with the finest quality of dress silk.

It will be interesting to consider some of the methods adopted for rearing the worm, and the processes through which the silk passes before it can be used for sewing or clothing purposes. The eggs of the worm are about the size of a pin's head, and are obtained from the moth of the previous year, being deposited on sheets of paper. The Chinese are careful to keep back the hatching of the worm until its food, the mulberry leaf, is sufficiently grown; and to effect which a variety of ingenious methods are employed.

The worm, when hatched, resembles a black thread, and is about a tenth of an inch long. If plentifully supplied with food, it soon increases in size, shedding its external skin as that becomes too narrow for the comfort of its owner—an operation repeated four times during its brief existence of little more than a month. The worm at last becomes sickly, ceases to feed, and begins to spin a delicate thread, which proceeds from two orifices in the head, the two threads being joined together by the mouth. The little creature encloses itself in the fine ball, called a "cocoon"; and having finished this little house, it becomes changed into the chrysalis state, in a similar manner to that noticed in the common caterpillar of our own country.



In the annexed engraving the silk worm is represented. A, the worm feeding, and near its spinning time. B, the chrysalis, as taken from the cocoon. C, the moth, as produced from the chrysalis.

The domestic treatment of the silkworm has been brought to great perfection in Italy. Formerly the eggs were hatched at uncertain periods, depending on the natural warmth of the season, or they were put in manure beds, or were worn in little bags about the person next the skin. They are now hatched in an apartment heated to the proper degree by a stove, but they are first washed in water, and afterward in wine, to separate light eggs, as well as dirt, and the gummy envelope which surrounds the heavy ones.

The temperature of the hatching room is at first 64°, but is gradually raised one or two degrees daily, until, it reaches 82°, which it is not to exceed. Pieces of coarse muslin, or of white paper pierced with holes, are placed over the eggs when they are about to be hatched. Through these the worms creep to the upper surface, and are removed as soon as possible to a cooler place. Young leaves and sprigs of mulberry are laid upon the muslin or paper, when the worms eagerly settle on the leaves, and can thus be transferred to trays, and removed to the nursery. This is a dry room of regulated warmth, with windows on both sides, so that free ventilation may be attainable. Chloride of lime should be in use to purify the air, and a thermometer and hygrometer to regulate the heat and moisture; the latter is apt to abound where silkworms are kept, and is very prejudicial to them, moist exhalations arise from the leaves and from their bodies; fermentation also soon takes place if litter and dung be not speedily removed from their trays; these are fertile sources of disease among the worms, and may carry off thousands in a day.

The silkworm is liable to many diseases which can only be guarded against by careful experience and watching. The improved means, first employed in Italy, for preserving the health of these valuable insects, are due to Count Dandolo, who gave particular and scientific attention to the subject,

and superseded many an absurd custom in the rearing of silkworms. According to his method wicker shelves are arranged in a room at convenient distances, and are lined with paper, on which the worms are placed. Such worms only are placed together as have been hatched at the same time, the space allowed them being, for each ounce of eggs, 8 square feet during the first age, 15 feet for the second age, 35 feet for the third age, 82½ feet for the fourth, and about 200 feet for the fifth age. The mulberry leaves are chopped in order to present a large number of fresh-cut edges to the young insect. Four meals a day, as a regular rule, and luncheons between when the worms are particularly voracious, are the liberal allowance for their subsistence. The temperature at which silkworms are healthiest appears to be from 68° to 75°, though they are able to bear a much higher temperature. Alternations of heat and cold are exceedingly injurious to them.

When the silkworms are about to spin they are provided with little bushes of broom, heath, or other flexible substance, arranged upright between the shelves, their tops being bent into an arched form by the shelf above. The bushes are spread out like fans, to allow plenty of space for the cocoons; for if crowded, the worms are apt to form double cocoons, two working together, and these are worth only half the price of single cocoons.

When the time arrives for reeling off the silk, the cocoons are thrown into a vessel containing hot water, the latter serving to dissolve the gummy matter surrounding the true thread. By means of a small wisp the end of this thread is found, and a number of these are wound on to a reel; the fineness of each of the filaments being too great to permit of its being used in the single state. In thus winding the silk, the threads are gradually spread apart, so that they may not adhere together while moist, which they would otherwise be liable to do, owing to the gum remaining on the surface. The color of the silk varies from a beautiful and brilliant yellow to a light grey, or "French white"; and in this state it is exported for the use of the silk throwsters, whose business it is to convert the reeled silk into a thread capable of bearing the wear of subsequent manufacturing operations.

## HOW TO ASCERTAIN THE AMOUNT OF IMPURITIES IN WATER.

On page 366 we explained in a short article how to test the purity of water, and mentioned seven different tests relating to the most commonly occurring impurities. We will now show how in the most simple manner the amount of each of these foreign ingredients, dissolved or suspended in water may be ascertained.

## QUANTITY OF SOLID MATTER.

The total amount of all kinds of solid matter can only be ascertained by the help of a balance. A certain quantity of water, say a gallon or a pint, is slowly evaporated by a gentle heat—boiling may cause loss of the solid matter also—and after being concentrated to one or two ounces, it is placed in a small porcelain or platinum dish or cup, in which it is finally evaporated to dryness. The weight of the solid matter remaining will tell how many grains there were present to the gallon or pint. To obtain the most correct result, it is best to subtract the weight of the dish when clean, from its weight when coated with the deposit obtained after evaporation.

Fortunately for most of the other tests the use of the balance may be dispensed with in case of necessity, as the amount of impurity may be very correctly arrived at by the amount of the test found necessary to cause a complete precipitation.

## QUANTITY OF COMMON SALT, CHLORINE, AND HYDROCHLORIC ACID.

By the assay of silver a solution of the nitrate is made and then a solution of common salt of certain strength is employed to precipitate all the silver, and the amount of silver is arrived at by the amount of the standard salt solution employed for this purpose. This method may be inverted, and for ascertaining the amount of common salt or other chlorides in impure water, we may employ a standard solution of nitrate of silver of certain strength, and watch how much of it is required to precipitate all these chlorides. It is of the utmost importance to use chemically pure nitrate of silver, and as the commercial article is often adulterated with nitrate of potash to such an extent as to contain only about half the proper amount of silver, it may be well to make it by dissolving pure silver in nitric acid, and evaporating to dryness in a clean dish.

It takes very nearly seventeen grains of nitrate of silver to precipitate six grains of chloride of sodium (common salt,) the precipitate consisting of chloride of silver, nitrate of soda remaining in solution. The reason why these relations of quantities exist in these particular substances, depends on the so-called atomic weights of which they are composed, and may be learned from any good text book on chemistry. If now we dissolve 8x17 or 136 grains of nitrate of silver in an ounce (480 grains) of pure water, it will precipitate 8x6 or 48 grains of common salt, that is, 480 grains of this water will precipitate this amount or every drop the tenth part of one grain of common salt; as a drop is very nearly the 480th part of the quantity of one ounce. This is our standard solution by which we may test all chlorides. If now we take one ounce of the water to be analysed, and drop carefully this standard solution in it, every ten drops required to form a precipitate will indicate one grain of common salt, and a single drop the tenth part of one grain of common salt in an ounce of the impure water.

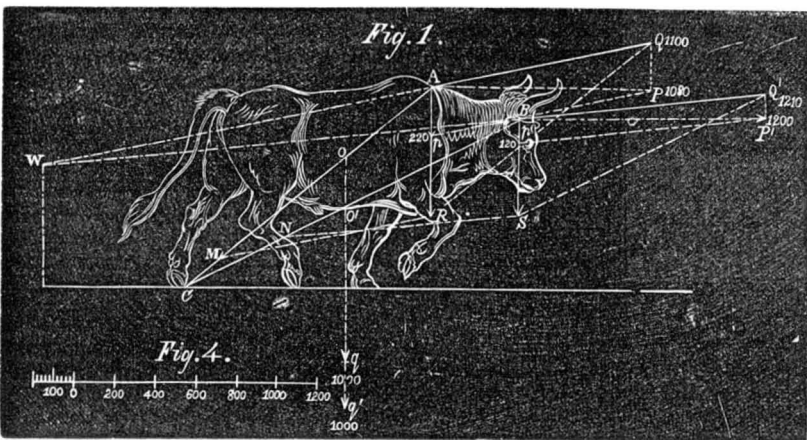
As four grains of nitrate of silver precipitate very nearly one grain of chlorine or free hydrochloric acid each drop will indicate one fortieth part of a grain of these substances

For the Scientific American.  
**THE BEST WAY OF YOKING OXEN.**

Of the three different methods by which the ox is yoked in applying its muscular power as a moving force, the intention of the present article is to determine which is the best adapted to the desired end, or, in other words, how we can employ the ox so as to obtain the greatest amount of work with the least possible degree of inconvenience and fatigue to the animal. The ordinary and almost universal way in this country is to place a collar or bow on the neck so that the ox drags with the shoulder in the same manner as the horse. However well adapted this may be for the horse, it is manifestly unsuited for the ox. That fitting resting place for the collar which the shoulder of the horse presents, is not found in the ox. The ox also carries the head lower, and the bow has then a tendency to rise and come forward at the upper portion and bear entirely against the joint of the leg and shoulder, which has considerable movement and is only lightly covered with flesh. The use of this method, then, involves a considerable amount of unnecessary pain and uneasiness. Second, the most objectionable place of applying the yoke on the ox is on the top of the shoulder bones at the root of the neck. These bones and the top of the backbone being also provided with but little flesh under the skin, present to the yoke sharp ridges, and the animal consequently suffers a hard rubbing pressure on the skin and the sensitive nerves of the back bone. The yoke will likewise rock on these sharp ridges, and has a tendency to slide off. It is also observed that the animal while pulling his load along will constantly move his head up and down, and from side to side, thus expending much of the power to no purpose.

The third and most reasonable and natural method seems to be to put the pressure on the forehead, as we shall endeavor to illustrate. When we apply the draft to the forehead by means of a yoke placed on the neck immediately behind the horns, and a strap running from both ends of the yoke over a cushion placed on the forehead, and secure the side straps or draft ropes to both ends of the yoke, we have a perfectly immovable fixture and the animal will not be disturbed by friction and pressure on sharp edged bones. The backbone near the joint to the head being covered with thick layers of flesh, gives a broad support to the yoke, which is of some importance as there will be some downward pressure on the same. This downward pressure is one component of a power, acting on the yoke in the direction of the foot of the stretched out hind leg, tending to bend the neck down toward that foot and it will not be inconveniently resisted. An ox when attacking an enemy, attempts to take the shock on the horns; and by placing forehead against forehead ability is frequently shown of pushing back an animal of nearly equal weight. Thus nature has clearly shown how we should put an ox to work; the main strength is placed in the neck and use is made of this strength, whenever attacking one another.

By means of the accompanying diagram Fig. 1, we intend to show, according to the rules of mathematics and irrespective of the convenience to the animal, that the yoke is attached by the head with far greater advantage than when against the top of the shoulder bones.



The diagram represents a well proportioned animal in position to work or push a load along. W represents the place of the whiffle-tree to which the draft straps are attached; A, the point at which the yoke is placed in the second case mentioned; B, the forehead; W A and W B, the draft-straps in both cases; C A and C B, lines from the foot of stretched out hind leg to yoke, o q and o' q' represent vertical lines through the centre of gravity of the animal and in length according to the annexed scale equal to the weight of the animal, say 1,000 pounds.

While the animal is pushing on his load, he maintains the represented position by means of the strength of the sinews, and in order to make a mathematical calculation, we shall suppose the animal in this position to be inflexible, so that we have to mark only the points A, B, and C, the lines A C and B C, the points o and o' in which the lines A C and B C are intersected by the lines o q or o' q', the length of the lines o q and o' q', and finally the direction of the side-straps A W and B W.

A C and B C represent levers. At the upper ends, A and B, of these levers the side-straps are attached. These side-straps are represented by the lines in both cases respectively A W and B W, and along these lines on the points A and B of the levers the load will act in the directions from A and B toward W, and tend to turn the levers upward about the point C. The weight of the animal represented by the lines o q or o' q' drawn through the centre of gravity acts vertically on the points o and o' and of levers, A C and B C, and tends to turn the same downward.

In case the load is such that the strain along the side straps is as much as the animal is able to resist, we have the levers, A C or B C, in an equilibrium, neither to be turned up or down by the contending powers, o q, or o' q', and those along the lines, A W and B W. In place of the powers, o q, or o' q', acting at the points, o or o' we can, according to the rules of mathematics, place the powers, A R and B S, acting at the points, A and B, of the levers, A C and B C. The length of the lines, A R and B S, we have found by means of diagrams, Figs. 2 and 3, in which the lines, A C, o q', A R, and B C, o' q', and B S, are parallel, and equal to those of diagram, Fig. 1.

We have now in one case a vertical power, represented by line, A R, acting at point, A, of line, A C, and in the other a power, B S, acting at point, B, of line, B C.

According to the teachings of mathematics, one power represented by a diagonal line of a rectangular or acute angular parallelogram is equivalent to two powers represented by the two sides, all emanating from the same corner. This principle we have applied to diagram, Fig. 1, and to the diagrams, Figs. 2 and 3, which we have given separately to obviate overcrowding of lines. We applied the principles of leverage, the powers being in reversed proportion to leverage.

In one case we have now, power, A R, acting at A, equivalent to the two powers, A M, which is to be overcome by the muscular power of the animal and A Q, or the draft along the side straps. In the other case we have the similar powers, B S, B N, and B Q'. A Q we find by our scale, Fig. 4, to be 1,100 pounds, and B Q' we find to be 1,210 pounds.

By another application of the rule of the parallelogram we find the power, A P, parallel to the load, or the effective power to push the load along, to be 1,080 pounds, or equivalent to A Q, and a vertical power, A p, or pressure on the neck of the animal.

In the same way we find, in the other case, the effective power, B P', to push the load along, to be 1,200 pounds, or equivalent to B Q', and a vertical power, B p', or downward pressure on the head of the animal.

By the scale we find A p to be 220 pounds in the one case, and B p' to be 120 pounds in the other case. Now, to compare our figures, we have:

As 1,080 is to 1,200, so is 100 to 111. By applying the yoke to the head there is a gain of effective power to push the load along of eleven per cent. over the effective power to push the load along when applying the yoke against the top of the shoulder bones.

Further, we have in the latter case a useless pressure to be sustained by the animal of 220 pounds, and by applying the yoke to the head this pressure amounts only to 120 pounds. As we have shown above, this downward pressure on the head will be easier sustained by the animal than the other by applying the yoke at A.

Suppose, now, the animal is able, by yoking as described under the second method, with the effective power of 1,080 pounds, to push along on a smooth road a load, supported on a wagon, of 2,000 pounds, it will be able, by yoking at the head, to push along, with the effective power of 1,200 pounds, eleven per cent., or 220 pounds more, which is a load of 2,220 pounds.

It will be seen that we gain effective power in the last over that in the second case, because the draft straps are nearer to a parallel line with the road, while the downward pressure is diminished from the same reason.

A further advantage of yoking by the head, consequently, is the ability of the animal to regulate the inclination of the draft straps by raising or lowering the head to suit the unevenness of the road.

To use a double yoke seems in any way to be a torture, and the advantages shown under the last case, by using a single yoke with side straps would greatly be reduced by using the double yoke found in some districts of countries.

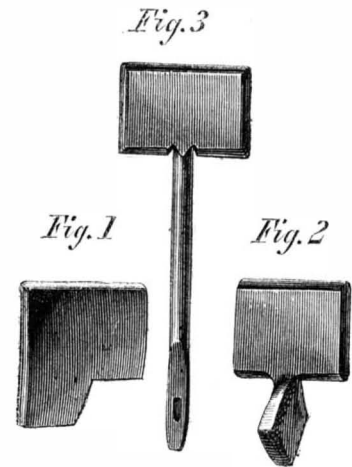
EDWARD WOLFF.

New York city.

**RICHARDSON'S PATENT METHOD OF FORGING HOES.**

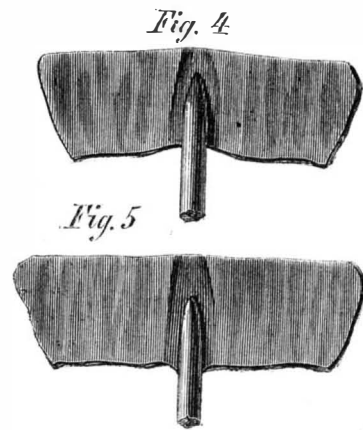
The inventor of the improvements in the processes of manufacturing hoes, illustrated in the accompanying engravings, says that after twenty-seven years' experience in the manufacture of hardware implements, he believes he is safe in saying there is not so much waste of stock and labor in any department of industrial mechanics as in the manufacture of hoes. He saw, a short time ago, a pile of at least one hundred dozen waste or refuse hoes in one manufactory, the remains of only six months' work.

The method of cutting the steel used in forging a hoe generally practiced, is to cut squarely off from the bar sufficient to make two hoes with their shanks, the stock being drawn down in the middle to make the two shanks, and then cut in two. By this plan it is impossible to shoulder down squarely and do the work properly; none but the most skillful being competent, and thus there is great waste.

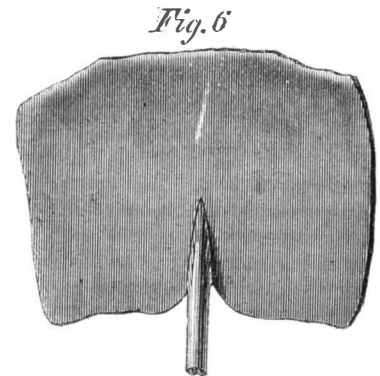


The writer, after a succession of experiments, has adopted the following improvements in preparing the stock:

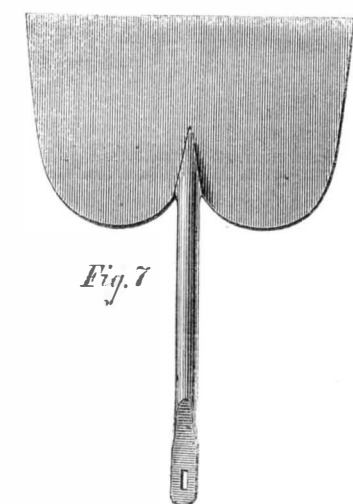
The better method of cutting the steel is that shown in Fig. 1, by which not a particle of the stock is wasted. It will be seen that two of these figures, when joined at the lines of



separation, form a parallelogram. Fig. 2 shows the second process, which is to cut in on the whole side, giving a quarter turn or twist to the adhering portion, and then to draw that part out under the trip to form the shank, as seen in Fig. 3.



Next comes the process of spreading, as seen in Fig. 4, known as "plating" among the craft, a work done only by the skillful. In some manufactories it is done by rolling, which facilitates the work, but does not always obviate the difficulty of giving a proper form to the ears. Fig. 5 is an



extension of the process seen in Fig. 4. Figs. 3 and 5 obviate the difficulties heretofore experienced, as they do away with the necessity of plating up the ears of the hoe before rolling. Thus prepared, the hoes come out uniform, as seen in Fig. 6, when the hoe is ready to go to the press to be trimmed and prepared for the temperer, as seen in Fig. 7. By these processes every hoe is perfect and alike.

This principle of cutting out and forging hoes was patented through the Scientific American Patent Office, May 26 1868, by L. T. Richardson, who may be addressed at Clayville, Oneida Co., N. Y.

## AN ENGLISH ECONOMIST ON RAILROAD REFORM.

The conveyance of letters by post is one of the few industrial enterprises which can only attain its highest perfection by being placed under governmental control. The regularity and precision which are absolutely indispensable for the proper working of the postal system, together with safety and expedition in transmission and delivery of mail matter, and the faculty of realizing an immense revenue with a minimum and essentially uniform rate of tariff, are advantages which, on such a grand scale, could never be attained by individuals nor corporate bodies. Such success attending the working of the postal system, it is quite natural that the idea should suggest itself of putting the coadjutor of the post—the telegraph service—on the same basis. In Belgium, the system has always been under the control of government, one tariff, and that a very moderate one, being charged for the transmission of despatches throughout the kingdom. In Switzerland, likewise, the telegraph lines are the property of the state. A strong movement has recently been made in England to make the British lines government property, the experience gained in the two continental countries before referred to being urged as proof that under a general and more economical system, the lines can be and have been worked at rates greatly reduced below those charged when owned by private companies, and yet with a large profit to the government. The measure has of course met with determined opposition from the existing telegraphic companies, but what its fate has been, we are unable to say. A resolution looking to substantially the same end as the English movement was some time since introduced into Congress but we believe no action has ever been taken upon it.

An English economist has issued a pamphlet in which he proposes to make even the railroads of the kingdom government property, to be regulated and managed as is the postal service. We have on several occasions stated the purposes of an organization in this country for making the freight railway lines the property of the different States, but Mr. Brandon, the author of the plan under consideration, goes still further than either what Mr. Quincy of Massachusetts, or the American Cheap Freight League has proposed. In a pamphlet entitled "How to make Railways Remunerative to the Shareholders, and Beneficial to the Public" the writer seeks to show that the public have not yet obtained the full benefits to be derived from railway traveling, as well as that the shareholders might reap advantages in proportion to those conferred upon the public by the adoption of a better system. These desiderata, it appears to him can only be accomplished by the government taking up all the railways in the kingdom. He estimates that the average profits of the British railways are 4 2-5 per cent, and suggests that railway shares should be exchanged for government railway stock, bearing 4 2-5 per cent, guaranteed interest, the price at which to convert the shares being the average price for the past seven years. Government is to unite the whole of the railways under one general management, so that they should become a recognized branch of the public service available for the whole population.

Further: Mr. Brandon proposes to establish one uniform price on every road, carrying passengers one journey of any distance in one direction for the equivalent of twelve, twenty-five and fifty cents, for third, second, and first class passengers, respectively, estimating that at these rates six times the number of passengers would be carried, at small, if any additional expense. He calculates—with an exactness which is certainly surprising—that 755,879,586 passengers would travel annually with single journey tickets; of these one-seventh would be first-class, two-sevenths second class, and the remainder third class passengers, yielding an aggregate income of \$133,000,000. The fares for single journeys are to be paid by government stamps, which are to be issued like postage stamps and delivered up on the completion of the journey; a passenger not provided with a ticket to pay double fare. Mr. Brandon regards his scheme as the completion of the postal system, and refers to the advantages already derived from the letter, book, and sample post, and to be anticipated from the annexation of the telegraph as evidence of the benefits derivable from the development of his project.

## Editorial Summary.

"BDELLATOMY" is the name given to a curious practice lately introduced into Germany, whereby the efficiency of a leech in blood letting is greatly increased. This result is effected by making an incision in the side of the animal, which serves as an outlet, while, unconscious of the rupture, the leech continues vigorously sucking until the patient has parted with an ounce or even double that quantity of blood from a single application. The cutting is made preferably on the left side of the leech, and at the moment when the gormandizer has nearly filled himself to repletion. The operation must not be regarded as an act of cruelty, but quite the reverse, as serving a good turn for the animal in allowing him the means for prolonging his rich feasting almost in definitely. After being removed from the patient, if carefully treated, the leech can be kept until the wound is healed, and in this way several incisions may be made in one animal.

METEOROLOGICAL.—Those who have lamented the supposed extraordinary amount of rain that has fallen this year, will be surprised to learn that for the first six months of 1868, the amount of rain and melted snow in this latitude was 4.75 inches less than last year, though being in excess of the average for thirty years past, of 3.03 inches. In the mere number of rainy days, however, this season has been remark-

able, statistics proving that considerably more than half the number of days during this period were rainy, the wind blowing meanwhile from some point in the east on 133 out of the first 172 days of the year.

ONE of the most interesting cases of chemical synthesis recently published is that in which Mr. W. H. Perkins has succeeded in producing artificially the odoriferous principle of new hay. Naturally, the delicious fragrance of freshly mown grass is due entirely to the presence of the species of graminæ known to botanists by the name *anthoxanthum odoratum*, but ordinarily called sweet-scented vernal grass. The same substance constitutes the flavoring principle which the Germans employ in making their favorite beverage, May wine.

It has been found by experiments that a stream of electricity derived from a powerful electro-magnetic machine, driven through a solution of brown unrefined sugar, will bleach it, electricity being thus made to perform the function of charcoal. It appears that one of Wilde's electro-magnetic machines, driven by a 15-horse power engine, has been set up for this object in a sugar refinery in Whitechapel.

EUROPEAN PATENTS are obtained through the SCIENTIFIC AMERICAN office in Great Britain, France, Belgium, Holland, Prussia, Russia, Saxony, Austria, Bavaria, Württemberg, Italy, Spain, and in Provinces wherever patents are allowed. We invite careful attention to our facilities for procuring *Foreign Patents*. We have offices in London, Paris, Brussels, Berlin, through which we are able to prosecute claims with the utmost dispatch, and at prices less than are usually charged by other solicitors. Parties having applications to make will find it for their interest to consult with Munn & Co.

FISH CULTURE.—Seth Green is breeding fish in Western New York and at two or three points in New England. He is now at Holyoke, most actively engaged in propagating shad, and writes: "I am hatching about seven million shad every day." The Connecticut River, at this rate, will in two or three years, be thoroughly stocked with this superior fish. Mr. Green's example could be followed with great profit by others, who, with a little time and study, might acquire the whole art of fish breeding. There is no reason why the Hudson, Potomac, and numerous other rivers extending from the coast should not abound in shad.

THE NORTH GERMAN MERCANTILE NAVY.—The mercantile navy of the three Hanse-Towns consists of 795 ships of 204,589 tons burden; the Grand Duchy of Mecklenburg-Schwerin, 447 ships with 52,452 tons; the Grand Duchy of Oldenburg, 190 ships with 26,863 tons. The fleet of these five States comprises in all 1,432 ships with 287,904 tons. The complete mercantile navy of Prussia alone numbers 5,413 ships, with 321,987 tons. The united mercantile fleet of the North German Confederation consists of 5,845 ships with 609,891 tons.

THE PRODUCTION OF PHOSPHORUS by a direct process from phosphate of lime, is the invention of two French chemists. Apatite, bone, or any other natural phosphate of lime, is mixed with twice its weight of sand, both being powdered. To the mixture is added 25 per cent of the weight of phosphate of charcoal dust, the whole being heated in a retort to an orange-red heat. At this temperature phosphoric acid is set free, and being reduced by the charcoal, the phosphorus is collected in the ordinary manner.

THE ALBERT MEDAL, which was instituted to "reward distinguished merit in promoting arts, manufactures, or commerce," has this year been awarded by the Council of the Society of Arts to Joseph Whitworth, of Manchester.

## Hydrophobia Cured by Salivation.

A new remedy for this most distressing of maladies, comes from Northern India, and is attested by the medical officer at the Hooshiarpor Charitable Dispensary. "The patient on admission was suffering from violent and frequent attacks. He was tied on to a chair, surrounded with blankets, leaving the head free, a large vessel of boiling water was placed under him, and a mixture of equal parts of mercury and sulphur well rubbed together were placed in a broken piece of chatty over a charcoal fire, and put alongside of the vessel of boiling water; 15 grains of calomel were given at once, and 5 grains repeated every hour, the mercurial vapor bath being kept up till all symptoms subsided. In about four hours the man was perfectly calm and free from bad symptoms; he was removed from the chair and placed on a bed. The after treatment was simply tonics, nourishing food, and gargles, etc., to remove salivation. On the 13th he was discharged cured."

## The Loss of Power by the Crank.

The crank is simply a mechanical medium of transmitting motion, or rather of transmitting the direction of power. No loss of the power has ever been discovered by the use of this means, and no real advantage gained by the substitution of other means of changing rotary into rectilinear motion, or vice versa. Practically, the speculative objections against the crank with the experiments based on them have never produced any device superior. The continued battle carried on against the crank, as a means to the end in view, has always ended in the discomfiture of the aggressor; the best method would seem to be to produce a new device and prove its superiority to the crank. The discovery will be welcomed by every earnest and honest mechanic.

## Modern Gunnery and What it can do.

Some interesting practice was carried on the other day at Shoeburyness with the twelve inch muzzle loading rifled gun of twenty-three tons, firing common shell of six hundred pound weight, with the ordinary charge of sixty pounds of powder. The gun is mounted on a wrought iron carriage and platform, placed on a turn table in rear of a wooden structure representing an iron fort, through the portholes or embrasures of which the gun is laid and fired. The object was to ascertain how quickly the gun could be loaded, aimed, and fired by an ordinary detachment of one officer, one non-commissioned officer, and seventeen gunners. The gun was carefully laid each round at a small target one thousand yards' distance, and five rounds were fired in seven minutes and thirty-nine seconds, or at an average of one minute and thirty seconds for each round. The practice was excellent. We leave our readers to imagine what would have been the effect produced on an enemy's ironclad had she been under the above fire with Palliser projectiles fired with battering charges. She would have them struck every time, and in less than eight minutes would have received from one gun alone the impact of 3000 lbs. of iron, representing a total "energy" of 24,300 foot tons.

## A Great Tunnel.

The project has been revived in England of tunneling the channel to France. Evidence has been obtained that the soil over which the sea flows is white chalk, gray chalk, and green sand further below. This fact was ascertained by borings on the English and French coasts, the two points on each side of the channel being not more than twenty miles from each other. It is but reasonable to suppose that the same material will form the submarine soil from coast to coast. The chalk can be easily worked, and the expense is placed at \$50,000,000, gold, twice the cost of the Abyssinian war.

The project of bridging or tunneling this ugly channel is, to say the least, a very doubtful one, but extensive docks might be erected, and much larger and more comfortable steamers put on than the miserable, sea-sickness engendering tubs at present in use. With properly constructed vessels and docks, cars might be run on to boats and easily transported across the channel. The present system seems to us a needless cruelty.

THE peat speculation is unprofitable in Connecticut. The *Hartford Times* says: "Losses have occurred in this and Tolland counties to the extent of about \$150,000 in this speculation, and large sums in other parts of the State."

## Recent American and Foreign Patents.

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

MECHANICAL MOVEMENT.—James See, Mitchell, Ind.—The object of this invention is to furnish a device by which the application of motive power to machinery may be so regulated, controlled, and directed, in conjunction with a set of weights, levers, and ratchets, that a great saving of power shall be effected thereby, enabling the operator, by any given amount of power at the main shaft, to obtain results at the point where the power is to be used, exceeding, by nearly one hundred per cent, the results of any other apparatus hitherto invented for a similar purpose.

PAPER RULING MACHINE.—Wm. S. Wilder, New York city.—This invention has for its object to furnish a simple, convenient, and accurate paper ruling machine for ruling bill heads, etc.

CULTIVATOR.—Major E. Hanover, David D. Bailey, and Fordyce M. Harwood, Lamolite, Ill.—This invention has for its object to furnish an improved cultivator, easily and quickly adjusted, and effective in operation.

NAIL EXTRACTOR.—J. B. Breathill, Arrow Rock, Mo.—This invention has for its object to furnish an improved nail extractor which shall be simple in construction, durable, and cheap.

MACHINE FOR SAWING STAVES.—Miller J. Hine, Equality, Ill.—This invention has for its object to furnish an improved machine for sawing staves, which shall be simple in construction, effective in operation, and convenient in use.

LATHING MACHINE.—O. C. Macklett, Saint Paul, Minn.—This invention has for its object to furnish an improved machine by the use of which laths may be attached to the scantlings and joists more rapidly and accurately than is possible when the lathing is done in the ordinary manner.

CHURN AND ICE CREAM FREEZER.—Charles Higley, Port Byron, N. Y.—This invention has for its object to furnish an improved machine so constructed and arranged that it may be used with equal facility as a churn and as an ice cream freezer, and which will do its work in either capacity more thoroughly and quickly than it can be done with the machines ordinarily used for these purposes.

HANDLE FOR SAD IRONS, ETC.—Stephen H. Cummings, Norway, Me.—This invention has for its object to furnish an improved handle for sad irons, tailors' goose, stove cover lifters, and other metal articles, which it is necessary to handle hot, and which shall be so constructed as to prevent the hand piece from becoming hot, and protect the hand from the heat radiated by the object being.

VARIABLE CUT-OFF FOR STEAM ENGINES.—James McPherson, Brooklyn N. Y.—This invention relates to a new variable cut-off for steam engines which is connected with the governor, so that it will be automatically adjusted as the pressure of the steam comes above or below a certain desired degree.

HOP PRESS.—Henry Taylor, Middletown, Wis.—This invention consists of a of a stout frame, composed of two vertical posts and two horizontal beams, which compose the sides, top, and bottom walls of the same, the posts being jointed to the bedplate or beam in a manner to allow them to be spread out after the bale has been formed, to facilitate the release of the same, and provided with removable side planks, a follower, and operating screws.

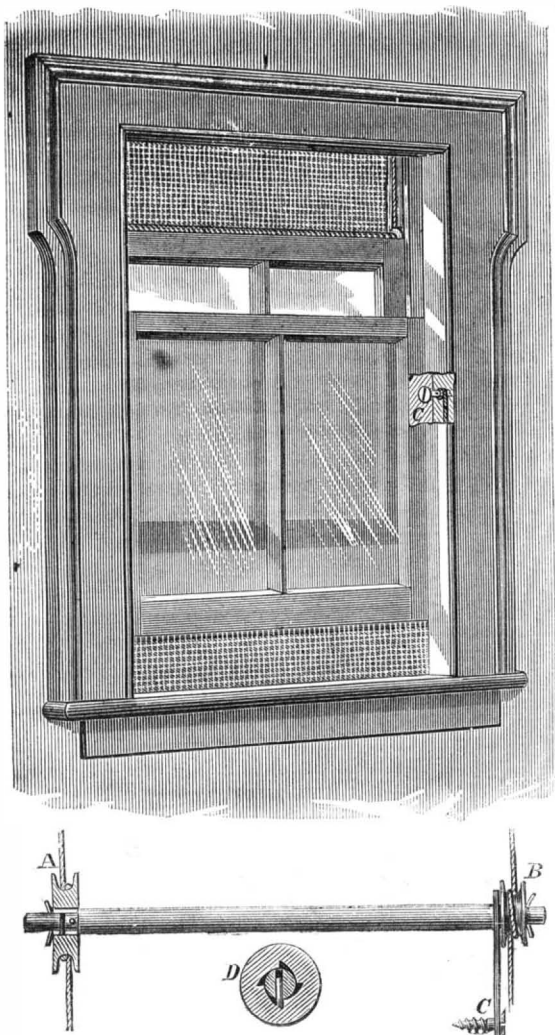
COW-MILKING MACHINE.—L. O. Colvin, New York city.—This invention consists of a simple, cheap, and effective apparatus for operating the milking device, so arranged that the latter may be readily applied to the udder of the cows, while standing in any position within the stall, wherein the machine is arranged, and which may operate the milking device in a manner to assimilate the action of a sucking calf, either when the cow gives down her milk freely, or when she refuses to give it freely, as is sometimes the case.

EXPANDING REAMER FOR PETROLEUM AND OTHER ARTESIAN WELLS.—A. J. Salisbury, San Buenaventura, Cal.—This invention relates to a method of expanding branches of a well reamer by a positive downward thrust of the superincumbent shafting by which the reamer is actuated in the operation of reaming, and consists of a toggle joint attached to and between the said branches at certain suitable distances from the points of the cutter and operated by the direct vertical thrust of the shafting to which the reamer



**WARREN'S PATENT AUTOMATIC MUSKETO BAR.**

The accompanying engraving represents a musketo bar for windows, applicable to either the upper or lower sash. It not only prevents the entrance of flies and musketoos, but adds greatly to the comfort of rooms by allowing the upper sash to be lowered and the lower one raised, which is always essential to ventilation. The contrivance is simple, durable and effective. It can be applied to any window, whether actuated by spring or weight. Its cost is slight, and its construction does not necessitate the change of appliances according to the season now demanded by the devices in common use. With this appliance a room can be kept free from insect pests without the costly and smothering nettings over beds and berths now required, while ample room for the admission and exit of air is afforded. Thus, it will be seen, that while it is adapted to use in dwellings, it is specially convenient for steamboats, sleeping cars, etc., adding much to the comfort of the traveling public.



In the transverse rail of the upper and lower sash a semi-circular groove is made for the seating of the roller. The netting is wound around the roller, one edge being fastened to the frame of the window by tacks. On each end of the roller is a pulley operated by a stationary cord, which is fastened at the top and bottom of the sash. When either sash is closed no part of the machinery or netting is visible; but when the bottom sash is raised or the upper sash lowered the netting fills the space otherwise left open.

For convenience of opening the window to adjust outside blinds, the lower edge of the netting connected with the lower sash, may be secured to the window ledge by hooks and loops, or hooks and a wire stretched across, so as to be readily unfastened as desired, and as easily secured again to place.

The pulley, A, being as large as the roller when filled by the wound netting, will not let the netting over-issue, but keeps a tension sufficient to secure a perfect plane surface. The small pulley, B, runs loose when the roller issues the netting, and being as small as the roll when the netting is delivered, keeps a tension upon the netting and tends to take it up. If the cords should get slack they can be tightened or taken up by turning a screw, C, having a hole through its shank for the reception of the cord, as seen in the engraving, similar in operation to the screws on a violin, harp, or pianoforte. The action of the roller, A, can be readily understood by reference to the section, D. The design is well worthy the attention of housekeepers.

Patented through the Scientific American Agency June 30, 1868. All orders for State and County rights and all communications for information should be addressed to Warren & Co., No. 54 Pine street, New York.

**PHILOSOPHY OF THE USE OF BLUEING IN THE STARCHING OF LINEN.**

It is often worth while to think upon and discuss those things which are apparently of small importance. The laws of nature apply to small as well as to large operations, and the explanation of phenomenon of great importance may frequently be found in the investigation of trifling occurrences.

Mr. Ruskin, should this meet his eye, would no doubt smile, while he would acknowledge the truth of the statement, that the same natural principles, by the observance of which the great Turner (who he asserts was the only artist who ever did paint water true to nature), obtained his effects, include

the one by which a washerwoman makes a bosom assume a whiteness of snowy purity.

All tints are heightened by transmitted light. No artificial pigments or dyes whatever can approach the glory of the prismatic colors; but if artificial colors are laid upon a transparent surface, and light permitted to pass through them, the effect of transmitted light will at once be seen. The stained windows of churches are good illustrations of the increased beauty of color by the transmission of light.

The effect of transparency may however be produced in some degree by artificial means. Light in passing through transparent substances is more or less separated into its primary colors by differences in thickness and density, and the form of the surface. Moreover the color of the transparent body itself has effect in the absorption of other colors, so that light rarely passes through transparent bodies unchanged. It took a long time to discover a means by which the dispersion of light, when it passes through the lenses of optical instruments, could be obviated, so that the image presented to the eye should exhibit the colors of the object inspected by their aid. It is obvious then that if a tint be added to a color so delicately that the impression produced by it does not change the original tint essentially, something of the effect produced by the transmission of light will be attained. The less of admixture with other colors any tint possesses, the more easily will light be transmitted through it; or perhaps it would be proper to say, that unless the mixture be so perfectly compounded that a distinct new tint is produced without a muddy crude appearance, the transmission of light will be more or less interfered with. This perfect blending is what is called by artists purity of tint. It is seen in perfection everywhere in nature, in the clouds, in water, in flowers, leaves, and fruit. An absolute white has a dead, dreary appearance, caused by the utter absence of the effect of transparency. It is, therefore, rarely used in ornamental work unless it be so placed as to be enriched by delicate reflections from adjacent objects. What is generally called a pure white has more or less of a very delicate yellow, green, or blue tint, the absence of which would be very sensibly felt, although its presence, as a tint, is scarcely perceived. This is why blueing is used in the starching of linen, though we venture to say, that the reason for it has rarely been thought of sufficient importance to repay analysis.

**MILITARY TELEGRAPHS.**

The Military Telegraph system now used in the U. S. Army is probably the most perfect in the world. At the recent examination of Cadets, at the U. S. Military Academy, West Point, N. Y., the operation of the Telegraph Corps attracted great attention. Wires were laid, and the telegraph put in operation at the rate of a mile in ten minutes. The best wire for such purposes is a fine steel wire, covered with copper. This makes a splendid line wire, and only weighs twenty pounds to a mile. A soldier starts off on the run, carrying on his back a couple of reels containing two miles of wire, which he lays along on the ground; he is followed by others, who carry and set the insulating stakes, attach instruments, batteries, etc. But ordinarily the wire is laid from a wagon carrying the reels from which the wire is unrolled, followed by the insulator wagon, and the instrument and battery wagon. Reels are also provided for use on horse-back.

**CHEAP FIREPROOF COVERING FOR STEAM BOILERS.**

Many complaints are made that the common felting used to retain heat in steam boilers sometimes becomes charred and burned above the water line, when the boilers are so arranged as to be able to carry dry steam, or steam superheated to a slight degree, and that this constitutes a cause of danger for fire on board of steamboats. Nothing is easier than to cover a boiler with an incombustible and cheaper substitute, such as paper pulp, or the pulp of prairie grass or pembo, mixed with equal parts of powdered soapstone and half the quantity of asbestos; when this is mixed with a solution of silicate of soda or waterglass, it may be made into a thick paint or paste, which being applied to boilers in several layers or coats, will adhere strongly, and form a nonconducting covering. Waterglass which once had the reputation of being waterproof, does not possess this quality, but is fireproof, and at the same time a nonconductor of heat.

**A SCOTTISH "CRAN-NOG."**

During twelve years past great archaeological interest has been centered in Scotland from the fact that in various parts of the country lake-dwellings have been discovered, which, though differing in size and structure from the Swiss and Italian lake-dwellings, are evidently sufficiently similar in idea, to form another link between the ancient populations inhabiting these widely-separated lands.

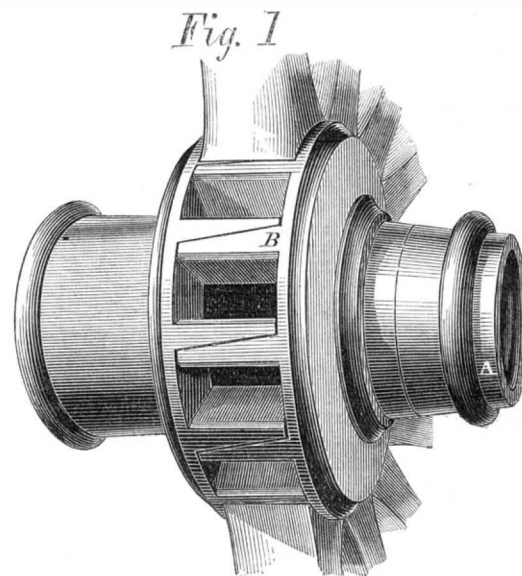
The first cran-nog was found upon draining a fresh-water loch in Arisaig. It appeared to have been placed in deep water, as the soft and wet mud around it is not fathomable by a long pole; the nearest point of land is about two hundred and fifty yards distant. It is formed of the trunks of trees, some of which are of very large size; one that was measured is twenty-eight feet long and five feet in circumference, at two feet from the base; another is thirty-nine feet long, and five feet eight inches at the base. The structure consists of several tiers or layers of these trees; two layers have been partially washed away by returning tides; four layers were exposed to view in examining the building, and a probe of eight feet long detected timbers at that further depth. Each layer in succession lies across the one below it, forming a strong, firm structure of rectangular shape; the sides are

forty-three feet by forty-one feet. On the floor were several flagstones in three or four places, which evidently had been the fire-places of the inhabitants. At a distance of about two feet six inches from the building was a rampart, formed of upright posts, inclined inwards and sharpened at the top, across which are placed large trees that were fastened at the corners by a hollow scooped out of the wood.

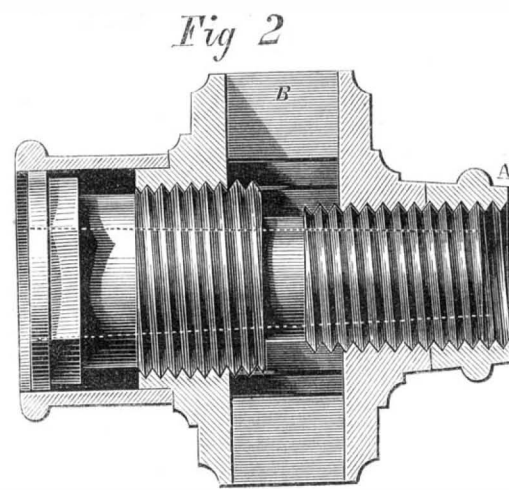
**THE PATENT METALLIC WHEEL HUB.**

The two engravings show a patent hub for securing the spokes in carriage wheels, which was patented through the Scientific American Patent Agency, May 9, 1868.

On the outside of the sleeve, which is of two different diameters, are cut screw threads, one engaging with one half of the hub and the other with the other half. On the outside end of the sleeve the cap, A, is screwed. Each half of the hub is furnished with wedge-shaped radial projections, B, which, when screwed together, make a mortise for the spokes, holding them very firmly.



The engravings present very plainly the peculiarities of the device. The rims may be made of good cast or malleable iron, or gun metal. The back band—that nearest the stock of the axletree—may be shrunk on the sleeve or threaded to screw on, as may be desired. If required, the front band or cap may be dispensed with by casting that side of the hub long enough to cover the thread on the sleeve. The practical wheelwright will understand how the mortises should be tapered to give the proper dish to the wheel, and he can have his patterns made according to his judgment. To drive the spokes it is necessary only to remove the caps from the fin-



ished hub and turn the box back two or three threads, enough to open the space from one sixteenth to one eighth of an inch, then drive the spokes, with slips of leather on the tenons of the spokes, if desired. Then the parts of the hub may be screwed up by a wrench and the flanges will hold the spokes locked as though dovetailed. If the parts of the hub are properly finished and the rim true, the spokes and the rim of the wheel will also be true.

For other information relating to this invention, and for rights for all the states, address Henry Poth and E. Deckenbach, 73 Diamond street, Pittsburgh, Pa.

**The Centrifugal Machine.**

In our article on the balancing of machinery, page 9, No 1, current volume, we inadvertently neglected, in comparing the amount of power required to drive the old and new styles of centrifugal machines, to notice the constant friction of the engine and shafting, which absorbed 16.04 H. P. This being deducted from 32.27, the power required to drive the seven old style machines, would leave 16.23 total, or 2.32 H. P. for each machine; and deducting from 22.48, the amount required for the new style, would leave 6.44 total, or .92 H. P. for each self-balancing machine.

**BLACK VARNISH.**—An aniline black varnish, of recent Parisian production, is the following: In a liter of alcohol, twelve grammes of aniline blue, three grammes of fuchsine, and eight grammes of naphthaline yellow, are dissolved. The whole is dissolved by agitation in less than twelve hours. One application renders an object ebony black; the varnish can be filtered, and will never deposit afterwards.



Scientific American.

MUNN & COMPANY, Editors and Proprietors.

PUBLISHED WEEKLY AT NO. 37 PARK ROW (PARK BUILDING), NEW YORK.

O. D. MUNN, S. H. WALES, A. E. BEACH.

The American News Company, Agents, 121 Nassau street, New York... Messrs. Sampson, Low, Son & Marston, Booksellers, Crown Building, 155 Fleet street, London, are the Agents to receive European subscriptions...

VOL. XIX., No. 3... [NEW SERIES]... Twenty-third Year.

NEW YORK, WEDNESDAY, JULY 15, 1868.

Contents:

Table listing articles such as 'Improvement in Portable Forges', 'Sawing and Grooving Machines', 'A Useful Official', etc., with corresponding page numbers.

THE CAUSE OF STEAM BOILER EXPLOSIONS--THE BOWERY ACCIDENT.

One thing can be said of the verdict of the coronor's jury on the bodies of those killed by the recent explosion of a steam fire engine in this city, which cannot be said of all similar investigations. Much common sense was exercised by the jurors, and some intelligence. As usual in so-called investigations there were froth, foam, ignorance, brought before them, with a modicum of reason and educated intellect.

Just here we wish to notice some of the nonsense which our journals published in relation to these occurrences; evidently written by anybody but a practical engineer. In this case one published statement was that the "steam gage was corroded;" another that the "tubes leaked;" another that only "sixty pounds pressure was on the boiler at the time of the explosion," and still another that the machine was a "perfect powder magazine."

The corrosion of a steam gage will strike our engineers as a new thing; that the leakage of tubes could produce an explosion will also interest them; that a boiler of the build of that which blew up could be even ruptured by a pressure of sixty pounds will amuse them, and that one of the Amoskeag fire engines is a perfect powder magazine under any circumstances would be believed only by those who have no knowledge of the excellence of material and perfection of work used and turned out by that concern.

In reviewing the testimony we cannot forbear a tribute to the straightforward and manly evidence produced by Messrs. Coffey and Powers. The former is well known as a competent engineer of large experience; the latter appears to be a thorough mechanic. No attempt has been made to impeach the testimony of either of these gentlemen. Both agree that the disaster was caused by an over pressure of steam, which a personal examination of the exploded boiler enables us to confirm.

The testimony of Mr. Bean, the superintendent of the Amoskeag works, Manchester, N. H., is somewhat of a curiosity if correctly reported in the daily papers. He says the boiler was braced from five to seven inches apart. Now if seven inches--area of forty-nine square inches--were sufficient, why put braces five inches apart leaving an area of twenty-five inches? But on an examination of the boiler we found a place on each side of the fire box that had nothing but "blind" stays in a space of eleven by eight inches, exposing a large space of three sixteenths iron without a support.

To return to Mr. Bean; he says: "from the general appearance of the boiler I think the top part of the fire box and flues must have been nearly red hot." What reason has he for this statement? The morning after the explosion there was no reliable evidence of over heating or burning. The clinches or rivetings of the lower ends of the tubes had not started, the tube sheet bore a coat of soot, and the edges of the ruptured sheet were bright, which they could not have been had they been exposed to 400° of temperature.

Our conclusions are that the sheet that gave way was too thin to be stayed with screw stays; that the space between stays--eighty-eight square inches--was too great, and that the cause assigned by the coronor's jury for the explosion--over pressure of steam--is the correct one.

We cannot but suggest to the builders of these upright tubular boilers the insertion of a less number of tubes, giving more water space. It must be difficult to keep a sufficient quantity of water in a boiler built as this one was; probably but for the jarring and shaking of these machines while working, the flue plate and sheets surrounding the fire box would sometimes be bare.

VISCERA AND VITALITY VS. STEEL, CORD, AND WHALEBONE.

The devotees of fashion are no less abject in their worship at her shrine, no less willing to throw aside all considerations of reason, and to obey blindly her dictates, than the veriest slaves of heathen superstition are to sacrifice everything to the "gods which their own hands have made." We are struck with horror when we read of people prostrating themselves beneath the wheels of the car of Juggernaut, or of mothers throwing their children into the mouths of crocodiles, but such acts are tender mercies compared to practices in vogue at the present day among those who claim the highest degree of civilization as yet attained in the history of the world.

The votaries of fashion do not scruple to impose these diseases upon themselves and their children, and although they refuse to believe it, and sin through ignorance, it is willful ignorance, and therefore all the more culpable. Parents who permit young children to go with bare necks, and almost bare legs, in the changeable climate of this latitude, are as heartlessly cruel as the heathen mother who immolates her child; and although the result is not so certain in regard to any particular victim, yet we believe that more children are thus annually sacrificed upon the altar of fashion, in proportion to our population, than are destroyed in the superstitious rites of people who are less culpable, because their ignorance is not the result of obstinate refusal to accept truth and obey its precepts.

It is of no use whatever to reassert facts which are patent to every physician, and which, if listened to, would speedily condemn the wearing of corsets to immediate and total extinction. People will not listen, and, to use the words of an English cotemporary, "so long as 'society' is ruled by women of fifty, who want to conceal the obesity which refutes their pretensions to thirty-five," there will be no lack of champions to defend, and examples to encourage the young to adopt the pernicious practice.

Neither is it of use to yield to the temptation which any sensible man must feel, no matter how little given he may be to profanity, to substitute u for the o, and insert an i before the t, in the word corset, whenever he hears the subject mentioned. To reason or to denounce is equally futile. The only way is to let Steel, Cord, and Whalebone "fight it out on this line," until Viscera and Vitality succumb. Let the "poor ghosts" of women now seen so frequently dragging themselves along through the streets, passionless, colorless (unless bedaubed), useless, listless, waistless, less every thing except pain, increase and multiply. Unfit for wives and mothers, they shall at last feel the weight of the disgust their unnatural practices excite; and as the number of old maids and consumptives increase, peradventure common sense may at last resume its sway.

SMALL PHILOSOPHERS.

The world is full of small philosophers, ready at a moment's notice to give you reasons "as plenty as blackberries" for anything whatever. They as a general thing believe that the changes of the moon have an important influence upon the weather, that if the new moon lies horizontally it is a "dry moon," and if it stands vertically it is a "wet moon." They will generally tell you that the moisture which gathers upon the outside of a pitcher of ice water in a warm day, is the "sweating" of the pitcher; and they believe that a wagon draws easier because the hindwheels are much larger than the others. They are men who believe implicitly in all the traditions of their fathers, and who carry with them through life the prejudices which they imbibe in their youth.

tions; and words, so long as they seem to mean something, are enough for them without sense.

Upon them charlatans thrive; and it is sufficient evidence that the mass of society is made up of just such people as we have described that so many imposters, in medicine and law, and in politics and religion, are enabled to fatten themselves upon it.

The tendency of mechanical study is to sweep away prejudice, to enlarge and liberalize views, and to induce men to subject to rigid and logical analysis, everything which demands belief. The vast interest which is now shown in mechanical science, is producing a set of hardheaded and determined thinkers, who are not likely to be deceived by such arts as have in past times, so to speak, led the world by the nose.

We see hope for the future in the developments of the present, and even in some of the vicious tendencies of the times we see agencies at work which will, we are confident, effect their own cure. Meanwhile let us all not only hope but labor for the speedy coming of the new era.

THE HAVRE EXHIBITION.

Punctually on the date first announced, the International Marine Exhibition, at Havre, France, was formally opened on the 1st ult., in the presence of the largest assemblage ever gathered in that city. So far as the display of goods was concerned, the exhibition, at last accounts, could not with propriety be called a success, the chaotic state which seems inseparable to the early records of all exhibitions, holding full sway. But if the first impressions were thereby rendered unfavorable, the committee seemed determined to make amends in the opening exercises, by rendering them of a character worthy of so important an event.

The exhibition is of no mean size, the buildings and garden occupying a space of twelve and a half acres. The former consist of closed galleries one story in height, having a more pretentious building at each corner of the square, formed by the galleries, for offices, etc. Inside the galleries, opening upon the gardens, is a covered promenade, monopolized by the representatives--either imported or improvised from native talent--of foreign nationalities, Jews, Turks, Arabs, and Hottentots, where they dispose of trinkets or refreshments, the latter being served in the style with which the representatives are supposed to be the most familiar. The garden boasts of a number of buildings of unique style of architecture. The leading attraction is probably the mammoth aquarium, situated in a grotto beneath what is designed to represent the Island of Fingal with its basaltic columns. The island is surrounded by a miniature sea, in which sport a variety of fishes and a small school of seals.

The number of exhibitors is about three thousand. The two groups of navigation and fishery occupy the front gallery of the building, the place of honor. Here are to be found the models and plans of vessels of every conceivable species and description, rigging for the same, fittings, stores, instruments and charts, systems of signals, boats and apparatus for saving life; also, the chief articles of exportation, the latter comprehending river and sea fishing, with all that appertains to both. These two groups include the goods of seventy-five per cent of all the exhibitors, a much larger proportion than was anticipated, so that nearly the whole of the gallery originally set aside for works of art has been taken for industrial purposes.

The United States is but sparsely represented in the exhibition, and the same may be said of Great Britain; but every thing sent is of first class character. As the exhibition develops we shall present further particulars of novelties displayed.

CHEMICAL NOMENCLATURE AND SYMBOLS.

The chemical nomenclature and symbols now in use were founded by the great Swedish chemist, Berzelius. His large work in six volumes is still a standard authority in chemical science, a remarkable fact when we take in consideration that it is nearly forty years old, and that it treats a modern science, not yet one century old, and which in late years has made enormous progress. Immense additions have been made to the total stock of our knowledge, but no change of any importance has been made in the principles laid down by the great Swede in regard to the facts stated by him, as far as inorganic chemistry is concerned. Organic chemistry was in Berzelius' time only in its infancy, and it required, in later time the genius of a Liebig to elevate this branch to the same level.

Berzelius considered it preferable to use for the chemical compounds the Latin names, as they would be the same for all nations. The idea, however, has not been carried out, but the chemical symbols which he founded on those Latin names have universally been adopted, and are now intelligible to all chemists, in all countries, no matter what language they speak, in the same way that numbers written in our Arabic numerals are equally well understood by the English, French, Germans, or others, and named by each in his own language. The reason is simply that the chemical symbols, like the numerals, do not represent the sounds of the names, but the substance, or objects themselves. They are not phonetic, but objective.

The first letter, or two letters of the Latin name which the elementary substances had at first received, have been adopted as the symbol representing not only the substance, but













