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### Device for Steaming Rovings.

This invention, an engraving of which accompanies the present article, has, in our opinion, great advantages over any other device yet made for the purpose of warming and moistening the strands of undressed wool or cotton while on their way from the rolls to the card cylinders. The advantages secured by the steaming process are well recognized, but as hitherto conducted it has been attended with inconveniences which it is the object of this invention to obviate.

The apparatus employed is extremely simple, and there is nothing about it at all liable to get out of repair, and it is readily applied to the cards.

The engraving shows the apparatus attached to a carding machine, the sectional detail in Fig. 2 giving an interior view of the steam reservoir.

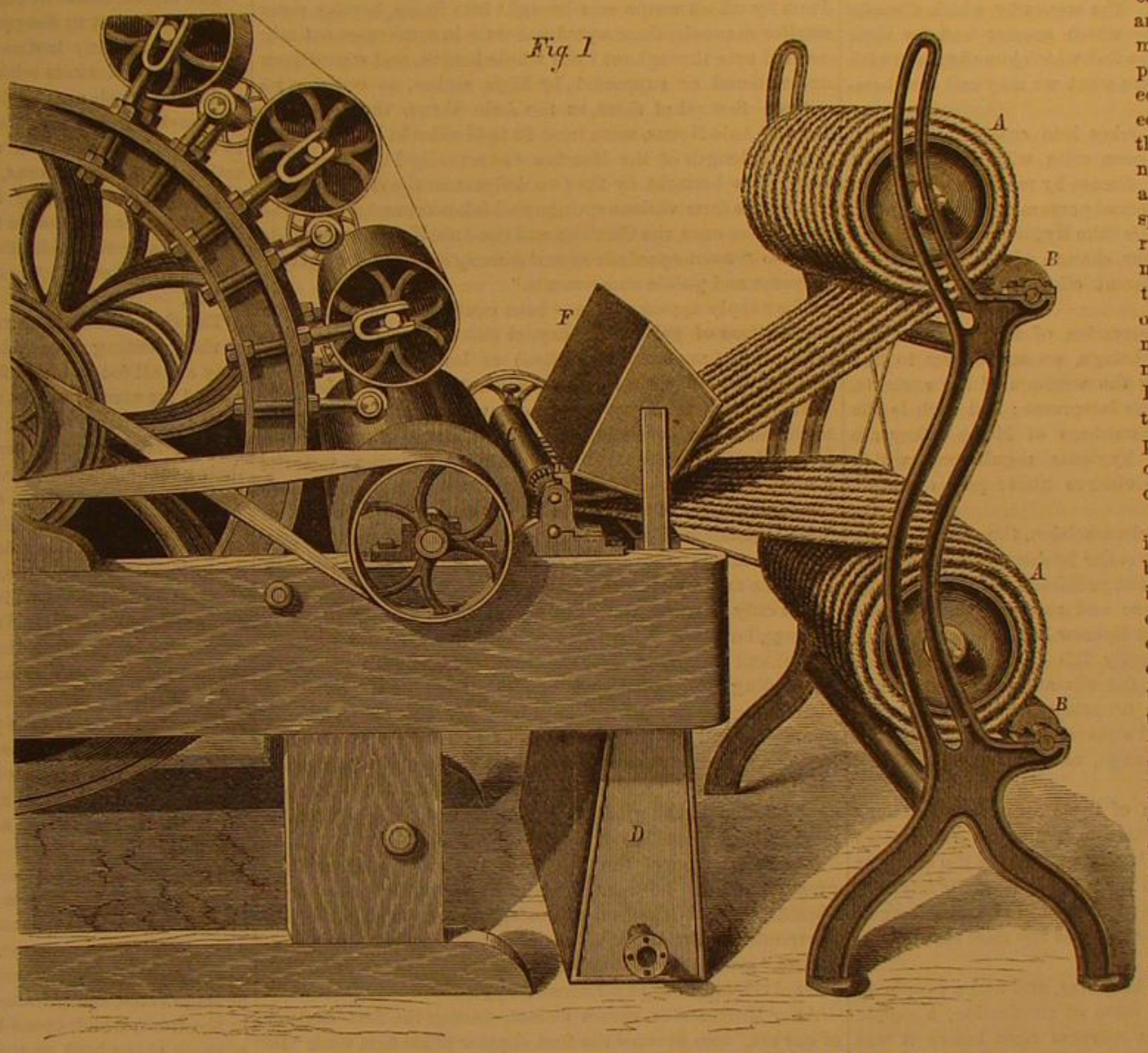
The rovings are wound on rolls, A, Fig. 1. These rolls rest upon wooden cylinders, B, which revolve the rolls, A, by friction merely, so that no tension is imparted to the rovings. The rolls, A, and cylinders, B, are mounted in a suitable frame as shown.

On their way to the cards the rovings pass through the rollers, C, Figs. 1 and 2, which feed the material to the card cylinder.

Between the feed rolls, C, and the rolls, A, is placed the steam reservoir, D, Figs. 1 and 2, the internal construction of which is shown in detail, Fig. 2.

This reservoir, made of tin, is the vital feature of the invention and deserves particular notice. Steam is admitted through a coupling or cock at the bottom of one of the vertical walls, and at once expanding in the open space becomes reduced to a vaporous condition. In this state it passes up through the rovings, gently moistening and warming the fibers, and the surplus collects in the cavity of the dome, F, Figs. 1 and 2. Here condensing upon the walls of the roof of the dome, F, the water of condensation trickles down and is caught and conducted away by the interior gutters, G, Fig. 2, to the lower part of the reservoir.

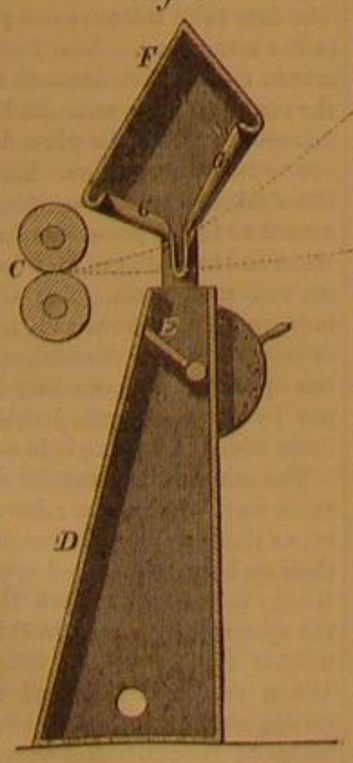
*Fig. 1*




BARBER'S DEVICE FOR STEAMING ROVINGS.

This construction subserves two important objects. By converting the steam into vapor before it reaches the wool, it affords space for the harmless escape of any water which may have been produced in the steam pipe before starting; and by collecting the drip in the gutters, G, Fig. 2, all possibility of the water falling upon the rovings and injuring the work is avoided.

*Fig. 2*




The general advantages secured by this device are, first, a large saving in oil. Wool may be worked, it is claimed, by the use of only one pint of oil to one hundred pounds, or even without any oil. The latter is deemed advisable where the goods are not to be scoured after weaving, as the fabric will then be much brighter and cleaner. The reader will, of course, see that the color of such textures must inevitably be impaired by the use of oil.

Second, the use of steam prevents the generation of frictional electricity, which in dry and cool weather is often a serious annoyance. By the use of this apparatus this annoyance is prevented, and wool can be worked as well in dry cold weather as on a warm, moist summer day. The amount of steam required to produce the required temperature and hygrometric state of the fiber and the surrounding air is regulated by the admission of steam to the reservoir, and further controlled by a damper, E, Fig. 2, which damper is held to any desired position by a handle and semi-circular plate with holes, into which a pin is placed to sustain the handle.

It is scarcely necessary to say the device may be used for mixed wool and cotton, as well as for either of these fibers separately.

It is claimed that the device moistens the roving with much greater uniformity than any other means hitherto employed for the purpose, rendering it extremely pliable, and capable of being drawn out very fine, and not leaving the upper side less moist than the under side, as was often the case in the well known method of steam jets from a perforated pipe.

Patented October 5, 1869, by Solomon Barber, of South Coventry, Connecticut, to whom refer for further information.

### Pressure in Steam Boilers.

There has been much difference of opinion among engineers, says the *Locomotive*, as to whether the pressure in a steam boiler was greatest at the top or bottom. Many have contended that the pressure was several pounds less at the bottom, although no good reason could be given for this theory, while others have maintained that the pressure was greater at the bottom, from the fact that the weight of water must be added to the indicated pressure of steam. We had the pleasure of seeing this question definitely settled a few days since at the Print Works of Messrs. John and James Hunter, Hestonville, Pa. An elbow was put on the end of the blow-off pipe which entered the mud-drum. Into this elbow a plug was screwed, which was tapped to receive a half-inch pipe; to this pipe a steam gage was attached and the blow-off cock opened. On comparing the gages attached at the top of the boiler, and to the mud-drum as described above, it was found that the pressure was greatest at the bottom by about a pound and a half, thus proving the latter theory, that the pressure at the bottom is the indicated pressure plus the weight of the column of water.

### Gold Diggers of Thibet.

The Thibetan gold-field of Thok-Jalung, in latitude 32° 24′ 26″ and longitude 81° 37′ 38″, has been visited by a corps of scientific English explorers, who have just published an account of their observations. The diggers prefer to work in the winter, when nearly six hundred tents are to be found there; the soil when frozen does not "cave in." They have no wood, but use dried dung for fuel, and the water is so brackish as to be undrinkable until frozen and remelted. They live well, taking three meals a day of boiled meat, barley cakes, and tea stewed with butter.

The gold is obtained from an excavation a mile long, twenty-five feet deep, and ten to two hundred paces wide, through which a small stream runs; the implements used are a long-handled kind of spade and an iron hoe.

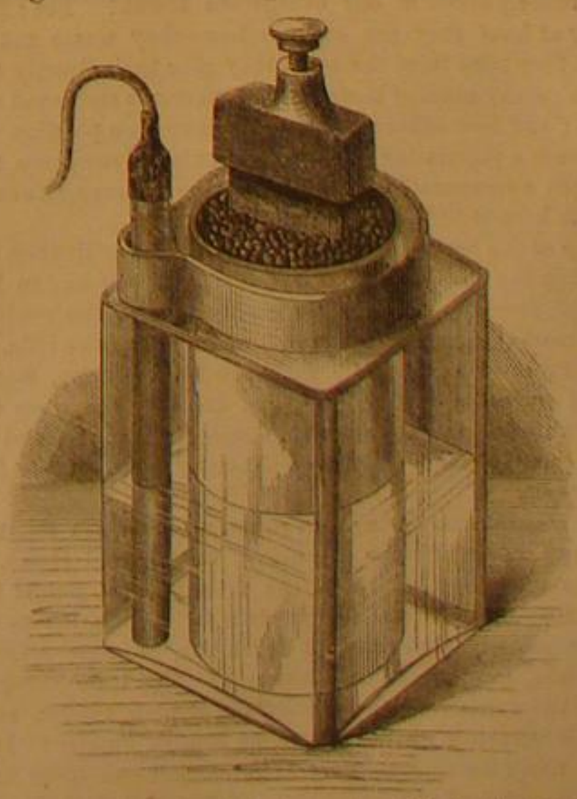
The water is dammed up, and a sloping channel left; at the bottom a cloth is spread, kept down by stones so as to make the bottom uneven; one man sprinkles the auriferous earth over the channel, and another flushes the channel by means of a leather bag, the pieces of gold fall into the inequalities and are easily collected in the cloth by lifting up the stones. The yield is large, nuggets of two pounds weight are found; the gold sells on the spot at rather less than thirty rupees per ounce. A gold commissioner or "sarpon" superintends all the gold-fields, a string of which extends along the northern watershed of the Brahmaputra, from Lhasa to Rudok. Each field has a chief or master, but any one may dig who pays the annual license fee of one sarapoo or two fifths of an ounce.

The curious posture for sleeping, universal among the Thibetans, was observed here. They invariably draw their knees close up to their heads, and rest on their knees and elbows, huddling every scrap of clothing they can muster on their backs; the richer rest thus on a mattress rising toward the head. The poorer avail themselves of a suitable slope on the hill side, or pile stones and earth to a convenient hight. This position is most probably adopted in order to secure as much warmth as possible for the abdomen, the thighs pressing against it and excluding the air.

The gold diggers recreate themselves with tobacco smoked in iron pipes, and, notwithstanding the hardships of their laborious toil, seem very merry, singing songs in chorus, in which the women and children join.

### THE LECLANCHE BATTERY.

We give herewith an engraving of what is known as the



Leclanche cell, the main feature of which is, that peroxide of manganese is used with zinc (amalgamated) and an aqueous solution of chloride of ammonium.

The *Chemical News* recommends it as an excellent form of cell for telegraph batteries, etc. The zinc plate and peroxide of manganese are placed in a porous pot, as shown, and the

opposite pole is a metallic pillar immersed in the solution at the outside of the porous pot, as shown. The smallest size of this cell, with a porous pot 4·3 inches high, can accomplish an annual electric work which may be represented by 620 grains of copper reduced in the voltameter; the medium size, with a 6-inch porous pot, can reduce from 950 to 1000 grains, while the large size gives a work equal to 1,500 or 2,000 grains. The external jar is of glass or porcelain.

[From Nature.]

## SCIENCE AND THE PUBLIC HEALTH.

"Hygiene is the art of preserving the health." But how can we preserve health? Plainly by doing our best to keep away disease. And how can we do this? By checking the causes of disease. To this end we must know these causes,—and here we have the grand object of hygiene; it is the science which studies the causes of disease, and points out means of avoiding them.

The knowledge of causes is the great aim of all science properly so called, and no study ought to be honored with that name which has not this end in view.

"Prevention is better than cure" is an old proverb, and, what is more, a very true one, and it is prevention that the hygienist studies—prevention of disease of whatsoever kind by the removal of its causes. The means by which diseases are prevented are often those which answer best for their cure; and here we perceive the link which joins hygiene with medicine, and which constitutes what we may call the therapeutical side of our science.

Thus we see that hygiene takes into consideration, incidentally as it were, and in connection with medicine, the treatment of many forms of disease by methods other than the employment of pharmaceutical preparations—these methods are what Fonssagrives calls "the Hygienic Modificators," and are such as exercise, baths, change of employment, sea voyages, residence in a different climate, and, above all, regimen.

As the methods for the preservation of health are of the first importance to all human beings, we may expect to find provisions to this end among the writings of the ancients, especially in the codes of the lawgivers; and such is the case; take for example the writings of Moses,—they are replete with most excellent hygienic regulations, which his followers were obliged to observe under pain of severe penalties.

Look at the institution of circumcision, the provisions for the separation of the lepers from the healthy people, the command not to eat swine's flesh, the prohibition of the marriage of near relations. Besides these and many other important generalities, we find the great Hebrew legislator descending to the inmost details of family life—giving a regimen admirable in its adaptation to the climate of the countries for which it was intended; directing the burial of excrementa and refuse matter of all sorts in the earth; fixing the laws of marriage, of concubinage, of servitude, and of all social relations.

It is to the strict observation of these sanitary regulations that one of the best known writers on hygiene of the present day, M. Michel Lévy, does not hesitate to ascribe the singular immunity of the Jewish race in the midst of fearfully fatal epidemics; which immunity was so marked in the middle ages, that it brought upon them "accusations the most absurd, persecutions the most atrocious."

We turn now for a moment to China, and find a people in many respects in a very high state of civilization, a people who had used the mariner's compass ages before it was known in Europe; but a people who, from want of communication with other nations, have made no advance at all, perhaps, for thousands of years, who have gone on increasing in numbers at such a rate that they now form one third of the population of the whole world, so that their country is crowded to an extent hardly conceivable. Surely we can learn something from them which will be of service to us in the management of our overgrown towns! Yes; in one thing at least they are our masters—they waste nothing; what they take from the earth they give back directly to the earth; every atom of their sewage matter is employed as manure; and how otherwise would it have been possible for so immense a population, without any external resources, to live on such a comparatively limited portion of the earth's surface, and to keep it fertile for so many centuries.

One of the best instances of the power of cultivation in improving the condition of a country is to be found in Lower Egypt, formerly the center of civilization of the world, now in a most abject condition; the inundations of the Nile, while the country was peopled with intelligent races, were the great source of its fertility, but are now the cause of the insalubrious marshes that generate the plague, and make that country one of the most unhealthy spots on the face of the globe.

To come nearer to our own country, let us see what were the hygienic conditions of ancient Greece and Rome. Had the practical application of the principles of public health anything to do with the high state of civilization to which those countries rose—a state which has, in some respects at any rate, never since been equaled? Had it anything to do with the success which attended the Roman armies, and led to the formation of that enormous Roman empire? Let the facts speak for themselves. What strikes one more in reading the classical authors of those countries than the continual mention of gymnasia and of baths? We find that a certain portion of time was set apart daily for bodily exercise, and thus a full development of the body was produced, and the greatest resistance given to those two great enemies of mankind, disease and death. It is true that all this training was part of a grand military system, that the youths were thus encouraged to compete for the prizes in the Olympic games and in the Roman gymnasia, that they might become good soldiers; but did this prevent the cultivation of mental acquirements? Again let the facts give the decision. Do you wish to see fine buildings, buildings so well constructed that they have lasted comparatively untouched by decay for centuries? Do you wish to study beautiful sculptures, statues anatomically perfect to the minutest details, and of unsurpassed artistic elegance? You go to Athens! You go to Rome! Do not fancy that we contend for bodily exercise as against mental studies; we merely maintain that a sufficient daily corporal exercise is absolutely necessary for the proper performance of the functions, both of mind and body.

But we have not yet done with Rome. We have mentioned the baths of that city; but how were they supplied with water? Ah! here we have need to hide our faces with shame. Surely we, with all the immense advantages of scientific engineering, manage to supply our cities with water as well as the people of two thousand years ago; at any rate, with all our steam engines and manufactories, we require at least as much as they did. When we turn to the pages of Frontinus, what do we find? That at the time at which he wrote, about A. D. 92, there were actually nine large aqueducts by which water was brought into Rome, besides some smaller channels; these aqueducts were in some cases entirely covered over throughout their whole length, and were driven underground or supported by high arches, as occasion required. Several of them, as the Anio Vetus, the Claudian, and the Anio Novus, were from 42 to 49 miles in length, while the total length of the Marcian was actually 54 miles. The water was brought by the two Anios from the river Anio, by the others from various springs and lakes around Rome; the two newest ones, the Claudian and the Anio Novus, were made because "*seven aqueducts seemed scarcely sufficient* for private purposes and public amusements."

The supply appears to have been equivalent to more than 332 millions of gallons per day, or (since the population was certainly not more than a million) at least 332 gallons per head per day—say, six times the amount now used in London.

But besides the aqueducts, there was a capital system of sewers at Rome, consisting of the "Cloaca Maxima" and a series of smaller channels flowing into it. The above remarks give an idea of the admirable manner in which the means for the conservation of the public health were made a subject of State legislation in ancient Rome, and of the determined way in which all obstacles were vanquished, in order that the city might be made as healthy as possible.

Not only have we the example of the ancients in these matters, but we have hygiene reduced to a system by Hippocrates) and associated, as it should always be, with medicine. In reading his Aphorisms, one is struck by the excellent dietetic regulations which he gives, for the observance of gymnasts, and for the guidance of physicians in treating acute and chronic diseases. His third section, which treats of the influence of the seasons of the year, and of the various ages of man in the production of diseases, is also very remarkable

The very names of the works of Hippocrates show how great a hygienist he was. "About Food," "About the Use of Liquids," "About the Diet of Healthy People," and especially his treatises on "Air, Water, and Localities," and on "Epidemics," are works which well entitle their author to be considered the father of experimental hygiene.

After Hippocrates comes Celsus, during the first century of our era, who devotes the first chapter of his first book "De Re Medica" to the exposition of rules concerning diet, and recommends the avoidance of too great regularity by healthy persons.

But we must not pass over the works of Galen, which were so numerous as to form a complete treatise of medicine, and which exercised so enormous an influence over the medical practice of the whole world during many centuries. Galen flourished during the latter part of the second century after Christ, and was for some time physician to the gymnasia at Rome. He revived the doctrines of Hippocrates, especially the celebrated one of the four humors (blood, bile, phlegm, and atrabile), and considered that the different temperaments were produced by mixtures in various proportions of these humors with the four elements—earth, air, fire, and water, and with the four physical qualities—heat, cold, moisture, and dryness.

The Sicilian School sprang up in the eleventh century, and was the offspring of the ancient Greek and Arabian medical schools. Its practice is handed down to us in a quaint Latin poem, in which a great deal of truth is mixed up with a great deal of trash, and in which we find bad therapeutics based upon faulty pathology. It is from this school that the doctrines of Hippocrates and Galen, together with the fancies of later times, were spread abroad over Europe. Thus we find that the experimental methods of the fathers of medicine were confused with a host of traditions derived from the Arabian alchemists; so that the rational methods of treatment, adopted by Hippocrates and his more immediate successors, were neglected; and diseases were treated instead by host of supposed infallible remedies, of which the action was not at all investigated. And what do we find as the result of this change of practice? That epidemics raged with the most fearful intensity all over Europe, epidemics which were only known accidentally before, and which, finding favorable conditions for their spread in the utter neglect of hygienic observances, came from their natural seats in hot eastern countries, and committed unheard-of ravages in Europe. Look at the plague, that fearful epidemic of the eastern part of the Mediterranean! It is true that we have accounts of terrible visitations of it in Greece, and particularly of one which depopulated Athens in the second year of the Peloponnesian war, when the disease was introduced into that city (then fearfully overcrowded) by a ship from Egypt, that entered the Piræus; at various times also, and particularly in the years of the city 389 (before the building of the aqueducts), the Roman capital was visited with the same calamity; but this is nothing to the fearful visitations with which all Europe was afflicted during the fourteenth, fifteenth, sixteenth, and seventeenth centuries.

The last appearance of the plague in Europe was in 1719, when it was introduced into Marseilles by a ship that had been refused admittance into the port of Cagliari in Sardinia. Even then its course might probably have been stopped, had its malignant nature been recognized soon enough; but this was not the case, and more than 90,000 persons were killed by it. Here we have a clear proof of the value of preventive measures. Sardinia was saved because the king refused the admission of the ship into the port of Cagliari; Marseilles was ravaged because a like precaution was not taken.

## THE REPTILES AT THE ZOOLOGICAL GARDENS.

From Naturalists' Note Book.

The reptile house in the Gardens at Regent's Park, London, is apt somewhat to disappoint the ordinary observer. Its occupants in many instances are stowed away comfortably beneath the blankets with which they are generally provided; and those which are visible are lying motionless on the gravel, or reposing in the branches of a tree. Very little motion is to be seen, unless it be among the lizards, which are more active than the serpents, but of whom the larger kinds are in the habit of standing in apparently the most uneasy attitudes for a considerable time. In this, and many other respects, they resemble the serpents, and there are indeed species which seem to form connecting links between the two orders.

The *Ophidia* are, however, seen to much greater advantage at their feeding time, which occurs once a week; not that they are all fed so often, for many will take sufficient food at a meal for several weeks, and some (in particular the pythons) have been known to fast for months together. Having been present lately on the occasion these of creatures receiving their usual allowance, we purpose to give a short account, from careful observation, of the manner in which they seized and killed their prey.

If we disregard the scientific divisions of the order which comprises these animals, we may divide them into three classes: firstly, those which seize their prey with their teeth, and crush it in their folds; secondly, those which seize and swallow it alive, after the manner of lizards; and thirdly, those which bite, or rather strike it with poisonous fangs. Of the first, the finest examples are the pythons and boas, besides which there are the yellow snakes of the West Indies, and others. Those of the second are fewer in number; they include the red snake of Bengal, viperine snake, English snake, etc. The present specimens of the third class include rattlesnakes, and Indian and Egyptian cobras, water vipers, etc.

These divisions are not strictly scientific, as some of the poisonous serpents have a structure closing resembling that of the boas, and are classed with them, but they will serve our present purpose better.

The constricting serpents, as we may term them, are kept in large cases, the entrance to which is either by a glass door in the front, which opens by a sliding up, or by a similar contrivance at the back, in the wooden partition. The colubrine snakes are in some of these cases generally, and indeed are so harmless that little precaution is needed. The venomous serpents have no opening but a small one on the lid of the case, about two or three inches square. Through this their food is introduced; and all necessary operations for the cleanliness and order of the interior are performed with a rod of stout wire, to the evident disgust of the occupants, who, if new comers, strike at it vigorously with their fangs. The first to be fed were the yellow snakes, and other species in the same case. The keeper, having uncermoniously removed the blanket, beneath which most of the occupants of the compartments were huddled together, as usual, quickly introduced under the glass door about a dozen sparrows, and one or two Guinea pigs. The former immediately retired to the darkest corners, seeming, however, to be quite unconcerned as to the presence of the snakes, as in some cases they stood on the bodies of the latter, which for the most part remained motionless. The Guinea pigs were more restless, moving slowly about as if in search of food. They seemed to be preferred by the snakes to the sparrows; and presently one of the reptiles, waiting his opportunity, seized a Guinea pig by the neck, and, jerking it nearer, threw two or three folds round it, killing it in a few seconds.

The other snakes rapidly dispatched the sparrows in the same way, when seized; but they were apparently in no hurry, as there were a number of the birds in one corner for more than an hour, which had not been touched during that time. It may be well to remark that there is nothing revolting in the spectacle of a serpent taking its food. Its victim suffers neither the mental or bodily torture ordinarily supposed. When seized, it is killed without delay, especially if it struggles to escape; and before its seizure it is never conscious of danger. Not only is this well known to those in charge of the creatures, but we can verify it from actual and careful observation. A rabbit will approach a snake out of mere curiosity, and, after sniffing at its head, and even being touched by its tongue, will start to another part of the inclosure, and resume its composure, returning again in the course of its explorations to the same snake without the

least uneasiness, except what arises from a want of cabbage leaves, and the indigestibility of the gravel flooring. Guinea pigs show even less concern, and are not so easily startled by any moving object.

The snakes which had seized the sparrows, etc., waited till their prey was quite dead before they uncoiled and began slowly to prepare for swallowing it. The pythons, which occupy an adjoining case, and are the largest serpents in the collection, were next supplied with two or three ducks. The largest python instantly seized one, and threw one folded round it. He then remained perfectly motionless, appearing to be satisfied with having secured the bird, and did not at once kill it. The duck did not seem at first much concerned at such unusual treatment, but soon became restless, on which the python tightened the fold, and in about a minute had quite destroyed it. Having waited some minutes, as if to make sure that life was extinct, he slowly unwound his coil from the body, and touched it with his muzzle, moving it about till it had found the head. The idea of lubrication with saliva, now quite exploded, evidently arose from this habit of feeling over the body with the mouth. Having taken the head into his mouth, he began to swallow the carcass, his jaws stretching to an immense extent to allow of its passage. When he found any difficulty, he used the part of his body which lay nearest to it to push it gently, and considering the apparent difficulty, was not long in completing his meal. The supply of food is never stinted, and we believe that it not uncommon for a python to devour six or eight ducks and rabbits on one day. Of course a full meal takes a long period to digest, as is the case in all reptiles.

The colubrine snakes might with propriety be termed legless lizards, as, with the exception of the want of limbs, they are in most respects similar in structure to the saurians. A fine lively specimen of the Bengal rat-snake was fed with half a dozen frogs, which he pursued with great speed round the inclosure, and, driving them one by one into a corner, seized and swallowed them, in spite of their struggles.

We will now turn to the venomous serpents, and in particular the rattlesnakes. The keeper having put two young Guinea pigs into the case, one of the snakes instantly struck at that nearest to him. The action of a venomous serpent in wounding an animal cannot strictly be called a bite, as, though the fangs undoubtedly represent teeth, the jaws are not closed upon the object struck, which is simply punctured, the snake in most cases retiring immediately. The Guinea pig almost immediately showed signs of giddiness, but its body did not appear to swell; it seemed to be thrown into violent convulsions, and in about a minute fell helplessly on its side, with no other sign of life than occassional spasmodic motion of the jaws. A larger animal would not have been so soon killed; but as the snakes, being confined, have not often occasion to use their venom, it is probably more powerful than when they are in a wild state.

There are a large number of puff-adders in one case; and a Guinea pig being introduced began sniffing about as usual: but though he was touching one of the reptiles, it did not seemed disposed to strike, when suddenly another puff-adder darted at full length from an opposite corner, and, striking the creature, remained with its fangs apparently buried in its flesh, contrary, we believe, to the usual habit of the reptile. His intention was perhaps to prevent any of the others from devouring it.

There are specimens of the two species of cobras, the Indian and Egyptian: perhaps the most interesting of all serpents; but, on account of their excitable nature, it has been found necessary to hide them partially from view by filling the lower half of the case front with ground glass, so that it is not easy to observe them.

The appearance of the cobra when about to give the fatal stroke is graceful, and yet terrible to see. The inflated hood, the waving motion of the head, and the peculiar expression of the eye, combine to impress the observer of its consciousness of the deadly power which it possesses, and with which it threatens any living creature that dares appproach it. Venomous serpents can generally be distinguished by the broad head and stumpy tail which they possess; but this rule does not always hold good, some of them, for example the cobras, having a structure closely resembling that of the colubrines, with the exception of the fangs and organs pertaining to them. There are in this house some young alligators, which are kept with the water tortoises. They seem to pass their time generally in sleep, but when feeding time comes are extremely alert. On some mice being thrown into the water the alligators pursued them, swimming with the mouth raised out of the water. Having seized the unfortunate mice, they held them under the surface till drowned, and then tossing them into the gullet, bolted them whole. The tortoises are not fed with live animals, but with raw meat, which they tear in mouthfuls under the water. Considering the number of species which exist, the collection seems deficient in the *Chelonia;* but with regard to the *Sauria* and *Ophidia* it is probably unequaled.

## RAIN AND RAIN DOCTORS.

There are rain doctors in all countries; some further removed than others from science, but doctors still. The looking out for omens (a habit more general than we are in the habit of supposing) is a residuum of a belief that was almost universal in old days. The signs or symptoms connected with the movements of animals may, in many instances, be worthy of attention; but they are mixed up with the strangest absurdities. Of the rain prognostics accepted two or three centuries ago, there was a pretty extensive variety. If ducks and drakes flutter their wings unusually when they rise; if young horses rub their backs against the ground; if sheep begin to bleat and skip about; if swine are seen to carry hay and straw to hiding places; if oxen lick themselves the wrong way of the hair; if a lamp or candle sputter; if a great deal of soot falls down the chimney; if frogs croak more than usual; if swallows fly low; if hogs run home loudly grunting and squeaking; if cattle and donkeys prick up their ears; if ants come out of their hills, and moles and worms out of the ground; if crows assemble in crowds and ravens croak; if water fowl come to land; if (as an old writer describes it) "beastes move here and there, makynge a noyse, and brethyng up the ayr with open nostrels;" if the down fly off from the dandelion and the thistle when there is no wind; if church bells be heard further than usual; in all such cases, we are told to expect rain. Gay, in his *Pastorals*, tells us that when a heifer sticks her tail bolt upright, or when our corns prick, it is an omen of approaching rain; whereas fine weather is foreshadowed by the high flying of swallows. *Poor Robin's Almanack*, about a century and a half ago, announced that when the hedgehog builds a nest with the opening in one direction, the next rain and wind will come from the opposite direction. Another writer asked:

Why doth a cow, about half an hour
Before there comes a hasty shower,
Clap her tail against a hedge?

The question is, does she? And the next question would be, is it one peculiarly constituted cow which does so, or do cows generally so conduct themselves?

Rain-doctors and rain prophets are two different classes. The latter wish to know whence and when rain is coming, but with fair good sense lay aside any claim to the power of producing it. Not so the medicine men of North America, who (if the exceedingly troublesome Red Man still retain his ancient characteristics) are looked to as potent influences in times of unwonted dry weather. Arabia can say something of the same kind. When Karsten Niebuhr was in that country, he stopped sometimes in the province of Nedjeram, which was under the rule of a sheikh named Mecrami. Of this sheikh, Niebuhr said: "He honors Mohammed as the prophet of God, but looks with little respect upon his successors and commentators. Some of the more sensible Arabs say that the sheikh has found means to avail himself of heaven even in this life; for (to use their expression) he sells Paradise by the yard, and assigns more or less favorable places in that mansion according to the sums paid him. Simple superstitious persons actually purchase assignments upon heaven from him and his procurators, and hope to profit thereby. A Persian of the Province of Kerman, too, has lately begun to issue similar bills upon heaven, and has gained considerable by the traffic." Niebuhr dryly remarks upon this: "The people of the East appear to approach daily nearer to the ingenious inventions of the Europeans in these matters." He then proceeds: "The knowledge of many secrets, and among others of one for obtaining rain when he pleases, is likewise ascribed to the sheikh. When the country suffers from drought he appoints a fast, and thereafter a public procession, in which all must assist, with an air of humility, without their turbans, and in a garb suitably mean. Some Arabs of distinction assured me that this never fails to procure an immediate fall of rain."

The women in some parts of India adopt a peculiar method of their own to produce rain. The *Bengal Hurkaru*, a newspaper published in Calcutta, had the following paragraph, less than five years ago, in relation to a drought which affected a large portion of India: "The pundits and moulvies were called into the service, and muntras and beits (prayers) were read with intense but unavailing fervor. Finding the efforts of the priests fail them, the ryots (peasants) next had recourse to an ancient and somewhat singular custom. At night all the women of many of the villages walked naked to some neighboring tank or stream, and there, with song and invocations, sought to propitiate the offended heavens, and to induce the gods to send them rain. This device was also without immediate effect."

But while the medicine men and weather doctors try to bring rain where there is none, what are we to say of a semi, or demi-semi, scientific man who attempts to drive away rain when he doesn't want it, and make it fall somewhere else?

One M. Otto, of Leipzic, has not only broached this problem, but has actually had his scheme brought before the Academie des Sciences at Paris. He proposes a machine, called a pluvifuge, or rain expeller, to be hoisted on a very elevated platform. The machine is to consist of an enormous pair of bellows worked by steam power; and its purpose is to blow away any rainy clouds that may be accumulating. If many of these were placed at equal intervals in a large city, they might perchance insure a continuance of fair weather. What the learned Academie thougat of this is not recorded; perhaps they preserved a polite silence; but a very knotty question presents itself. If (an enormous mouthful to swallow, in all conscience) the pluvifuge could really do this work, how about other localities? As dirty little boys when driven away by a policeman from one place, will certainly re-assemble in another, so would the rain, driven away by the pluvifuge from one locality, make its presence sensibly felt in another. And suppose that other locality does not want it? It has been very cogently asked: "Would not an action for damages lie against the workers of the machine in town A, in case of towns B and C suffering from the undue quantity of rain which would be liable to fall to their share, if town A succeeded in puffing it all away from itself? For the vapor blown from some place must needs be blown to some other place. Or say that towns B and C, and even D and E, were as sharp-witted as town A, and were to set up equally efficacious machines, there surely ought to be some redress for town F, in case of its being altogether submerged as might very possibly happen under such circumstances." A case is supposed of an open-air fete at Smithville, to celebrate the coming of age of the heir of the Smiths. At Brownsville a pluvifuge happens unluckily to be at work, and blows the rain to the very lawn at which the fete champetre is being held. If a case (Smith *vs.* Brown) were instituted, would not the plaintiff be entitled to damages for the injury done by the rain to the ladies' dresses, and for doctors' bills arising out of colds and catarrhs caught on the occasion?

There are sometimes real showers of very unreal rain. It is stated by an old writer that in Lapland and Finmark, about a century ago, mice of a particular kind were known to fall from the sky, and that such an event was sure to be followed by a good year for foxes. A shower of frogs fell near Toulouse in 1804. A prodigious number of black insects, about an inch in length, descended in a snow storm at Pakroff, in Russia, in 1827. On one occasion, in Norway peasants were astonished to find a shower of rats pelting down on their heads. Showers of fishes have been numerous. At Stanstead, in Kent, in 1666, a pasture field was found one morning covered plentifully with fish, although there is neither sea nor river, lake nor fish-pond near. At Allahabad, in 1839, an English officer saw a good smart downpour of fish; and soon afterward thousands of small dead fish were found upon the ground. Scotland has had many of these showers of fish; as in Ross-shire, in 1828, when quantities of herring-fry covered the ground; at Islay, in 1830, when a large number of herrings were found strewed over a field after a heavy gusty rain; at Wick, much more recently, when herrings were found in large quantities in a field half a mile from the beach. In all these, and numerous other cases, when a liberal allowance has been made for exaggeration, the remainder can be explained by well understood causes. Stray wind blowing from a sea or river; a water-spout licking up the fish out of the water; a whirlwind sending them hither and thither; all these are intelligible. The rat-shower in Norway was an extraordinary one; thousands of rats were taking their annual excursion from a hilly region to the lowlands, when a whirlwind overtook them, whisked them up, and deposited them in a field at some distance; doubtless much to the astonishment of such of the rats as came down alive.

The so-called showers of blood have had their day of terror and marvel, and have disappeared. Not that any one ever saw such a shower actually fall; but red spots have occasionally been seen on walls and stones, much to the popular dismay. Swammerdam, the naturalist, told the people of the Hague two centuries ago that these red spots were connected with some phenomena of insect life; but they would not believe him, and insisted that the spots were real blood, and were portents of evil times to come. Other naturalists have since confirmed the scientific opinion.—"*All the Year Round.*"

### Forms for Telegraphic Messages.

The British Post Office authorities have prepared for the use of the public forms for telegraphic messages, to be used when the whole system of inland telegraphs is acquired by the government. The form is very simple and complete, and differs in one or two important respects from those hitherto employed by the companies—the novelties, it may be added, being decided improvements. The principal of these refers to the arrangement of the words that make up the message. A separate space in lines is allotted to each word, and the corresponding charge is printed clearly on the margin, so that the sender can see at a glance how much he has to pay, and the receiving clerk need be at no trouble in calculating how much he has to charge. Each of the forms thus divided into spaces is prepared for a message of fifty words, which is assumed to be sufficient in the majority of instances. In the right hand upper corner of the page, a blank space is left for the stamps, which will probably be almost exclusively used to cover the charges of transmission. Attached to the form are directions for the guidance of the sender, with a tariff of charges, and full information as to the arrangements for porterage.

MOTION.—"There is a definite store of energy in the universe, and every natural change or technical work is produced by a part only of this store, the store itself being eternal and unchangeable." What the learned Helmholtz teaches by these few words is important for us all to know, and it is this: Every force or power, that is, energy, that man exerts himself, or that he sees exerted by other animals, or any power or force exerted by natural phenomena—such as by the wind, the waves, or falling water, or what we may term artificial power or force, as exhibited in a steam engine, or a wound-up clock—is derived from the store of force-energy already existing in things of the earth. There is, in fact, never at any time any new creation of force, but merely a release of it, for the time being, from a state of rest. Hence, force, or energy, merely passes from one thing to another, and it is during this transmission that it becomes apparent under the form of motion.—*Septimus Piesse.*

NEW WAY OF MAKING TIN-LINED LEAD PIPES.—A new method of making tin-lined lead pipes recently invented in England, is as follows: A "muff" is formed, coated with tin on the inside, by pouring in the tin while the lead is still in a state of fusion. In order to prevent the metals from mixing the mold is rapidly revolved, the centrifugal force generated keeping the heavier metal—lead—on the exterior after the mass is cooled the pipes are drawn in the usual way. A perfect junction of the metal is thus attained. The method is an ingenious application of the well known principle of centrifugal action in the separation of bodies of different densities.

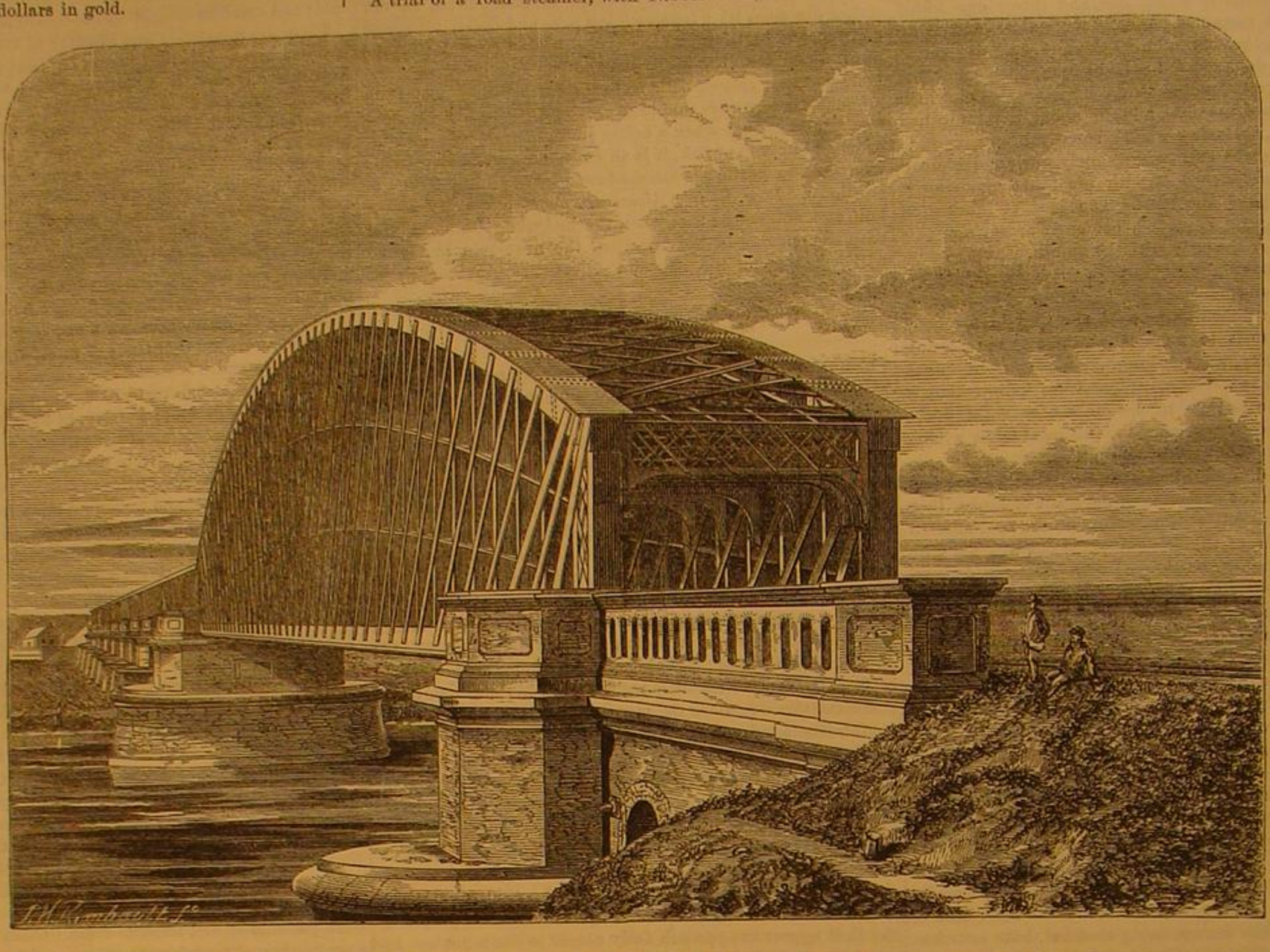
### The Kuilemberg Viaduct.

The great railway viaduct in Holland, crossing the Lek, one of the branches of the Rhine, which empties itself into the North Sea, has just been completed under the superintendence of the engineer-in-chief, Mr. N. T. Michaëlis. Messrs. Harkort & Co., a well-known Dutch firm, obtained the contract early in 1866, for the sum of one hundred and fifty-three thousand pounds sterling, or about seven hundred and sixty-five thousand dollars in gold.

We illustrate, this week, from the *Building News*, the main span, which has a clear opening of 492 ft. Besides this, there are eight other spans, one of 262 ft. 6 in., and seven of 187 ft. each. Of the stone piers the largest is 23 feet wide, one is 16·40 ft. in width, and the remaining six are each 13ft. wide. The total length of the viaduct between the end abutments is 2,181 ft. The main opening of 492 ft. is spanned by a girder with a parabolic upper member.

The depth in the center is 35·6 ft., and at the end 26·24 feet. The girders are placed 30 ft. 4 in. apart from center to center, leaving a clear width of roadway of 26 ft. 3 in. The vertical struts in this girder are placed 13 feet 1½ inches apart, from center to center, and are braced with wrought-iron diagonal bracing. The cross girders are 26 feet 10½ in. long and 2 ft. 11½ in. deep.

The total amount of iron and steel which has been employed in the construction of the Kuilemburg viaduct is as follows: The 492 ft. opening, 2,123·94 tuns; the 262 ft. 6 in. span, 673·80 tuns; the seven smaller bridges, 2,192·4 tuns: total 4,990·14



VIADUCT OVER THE RIVER LEK, AT KUILEMBERG, HOLLAND.

### Siamese Paper.

The material employed, according to the *Journal of Applied Chemistry*, in the manufacture of this paper, is the root of a tree called the ton koy, four or five feet in length, and sold in bundles of 10,000 pieces for 25 cents. The roots are first soaked in fresh water and then transferred to tanks with lime water, where they are left for several days. They are then boiled in peculiarly constructed pans, the lower part of which, exposed to the fire, is made of sheet iron, while the upper part is of basket work. After being well steamed in these vessels it is taken out in small quantities and thoroughly hammered on a table. After this process a bundle of the fiber is thoroughly agitated in water until small feathery clumps swim about in the tub. The contents of the tub are poured through a sieve, and the fiber caught on the meshes in tolerably uniform thickness. This uniformity is further aided by rolling bamboo over it, and the sieve is then exposed to the sun until the mass is thoroughly dry. The sheets of paper prepared in this way depend in size upon the sieves. They are sometime half a yard wide and two and a half yards long. Two workmen can make twenty sheets in a day. No sizing is used, as the gelatin of the root is sufficient for that purpose.

A better sort of paper is sold in sheets twelve to eighteen inches long and four to five inches wide. Writing is done with charcoal or with pencils prepared of coal and lime.

The manufacture of paper is usually conducted in canals that empty into rivers, and is chiefly carried on by women.

### Road Steamers in Paris.

A trial of a road steamer, with rubber tires, has recently been made in Paris. The tractile power was sufficient to draw a heavy omnibus with fifty passengers.

*Engineering* states that on the report of the French Government engineers, leave has been granted to the road steamer to ply over two routes, several miles in length, and including some busy parts of Paris. The engineers report it more handy and manageable than horses, and in no way dangerous to the public. The huge india-rubber tires save the machinery from jolting and the roads from ruts. The speed is that of a fast omnibus; it went up the paved street beside the Trocadero, of which the gradients are 1 in 11, and even 1 in 9, without the least difficulty, and came down again without any brake. In a wet grass field it was curious to observe how little the wheels sank into the saturated soil; in fact, it obliterated, on retracing its circle, the deep ruts of the omnibus wheels. This circumstance has drawn the attention of artillery officers present at the experiment, suggesting to them an inquiry whether the system might not be advantageously applied to military transport in campaigning.

### Utilizing Solar Heat--New Safety-apparatus for Mines.

This method is due to Mr. Delaurier, of Paris: A truncated cone, open at both ends, is silver-plated on the inner surface, and highly polished. The solar rays enter the large end, and, because of the equality of the angles of incidence and reflection, converge at the small end. As the length of the cone is increased, the area of the smaller opening may be diminished, and the concentration of heat becomes greater. This simple contrivance, in the opinion of the inventor, may work out an industrial revolution, especially in Africa. We quote from the inventor's description:

"Heretofore we have made use of concave mirrors and lenses to concentrate solar rays. Everybody knows the difficulties attendant upon the use of large metallic mirrors having but one focus, and the great loss of heat caused by reflection.

"Lenses are not only a very bad means for concentrating radiant heat, being but little diathermic when thick, and, moreover, impossible of construction when one attempts to make them in sections.

"The process described has a further advantage in the fact that rays incident upon the surface at a small angle lose little by reflection; so that in this case almost all substances can be made good reflectors. But the chief advantage is cheapness and facility of construction. A common wooden box of the right shape, lined with tin, will be sufficient. If it is wished to get a greater concentration of rays let this pyramid be made long.

"Is it not possible, by this means, to obtain heat enough for ordinary purposes, especially for irrigation, by furnishing steam to engines suitably modified?"

M. Delaurier has also devised a means to prevent explosion of fire-damp, by a continual firing of the gas as soon as it is generated in small quantities in different parts of the mine. A wire runs through the mine from a Ruhmkorff coil which is kept constantly charged. This wire is cut at intervals deemed sufficient, and the ends are separated about four tenths of an inch. With a coil giving a spark of two and four tenths inches in length, he cuts the wire in say 10 places in the highest parts of the mine, where the gas first collects. There is no need of a return-wire, the earth serving

as well. By this means the explosive compound of air and gas is set on fire as fast as the gas is generated, and the consequence is nothing more dangerous than a series of slight explosions. This is not very expensive; and the expense can be reduced by applying the process for a few minutes each day before the miners begin their work.—*Van Nostrand's Magazine.*

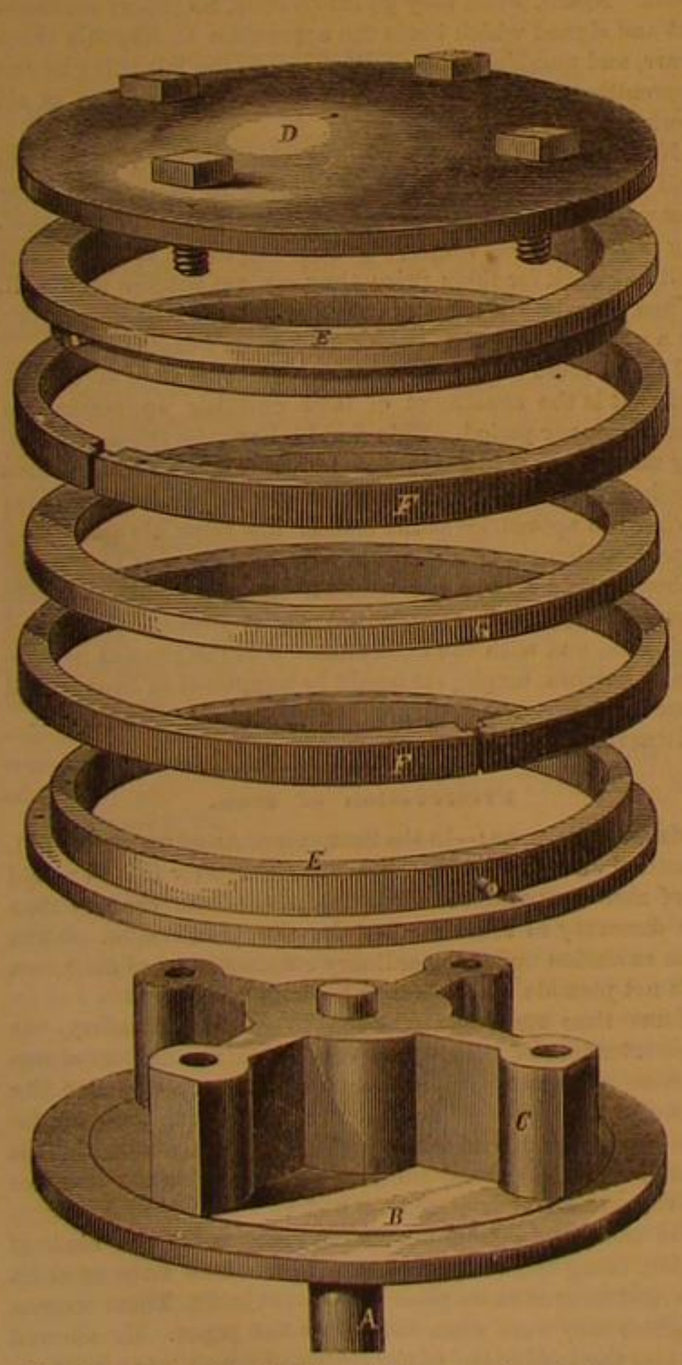
## IMPROVED PACKING FOR THE PISTONS OF STEAM ENGINES.

It would be a waste of ink to go into a discussion of the importance of well fitted pistons in steam engines, and in the present state of engineering knowledge, it is almost superfluous to remark that a well fitted piston means something more than a piston which does not leak. A large number of devices, among which may be included the class which depends upon the expansive force of steam, absorb too much power in friction, are liable to wear and cut, and therefore are not favored in good practice.

The packing, the details of which are shown in our engraving, gives a tight-fitting piston with minimum friction and wear, and it is claimed, is very much more durable than any form of packing hitherto used; while the wear is distributed equally on all parts of the cylinder, thus tending to keep it true. The parts of the device will be understood by reference to the engraving. The piston rod, A, is attached to a plate, B, upon which is cast a spider, C. To this spider is bolted a counter plate, D. The ends of the four radial arms of the spider, B, are turned to a true circle, the center of which is in the axis of the piston rod. Between the plate, B, and the counter plate, D, and over the ends of the spider arms are placed the rings, E, F, G, in the order shown. The rings, E, have an L-shaped section, and over their vertical projections the cut rings, F, fit, a pin on each of the rings, E, fitting into a recess in each of the cut rings, F, so as to keep the cuts in a constant position to break joints.

The rings and plates fit so tightly together that no steam enters the spider, and the cut rings being elastic, expand to fit the surface of the cylinder without exciting so great force thereon as to give rise to friction and cutting.

We are informed that this packing is in use on the Delaware, Lackawanna and Western Railroad, Cayuga division, where it has been tried for three years with the most satisfactory results. It is stated that it has been put to the severest tests, ascending grades of 100 feet to the mile with 120 pounds pressure of steam, and has never shown any leakage. Of course it is as well adapted to stationary engines as to locomotives, and it seems worthy the attention of practical engine builders. It can be applied to any engine without alteration of the piston head.



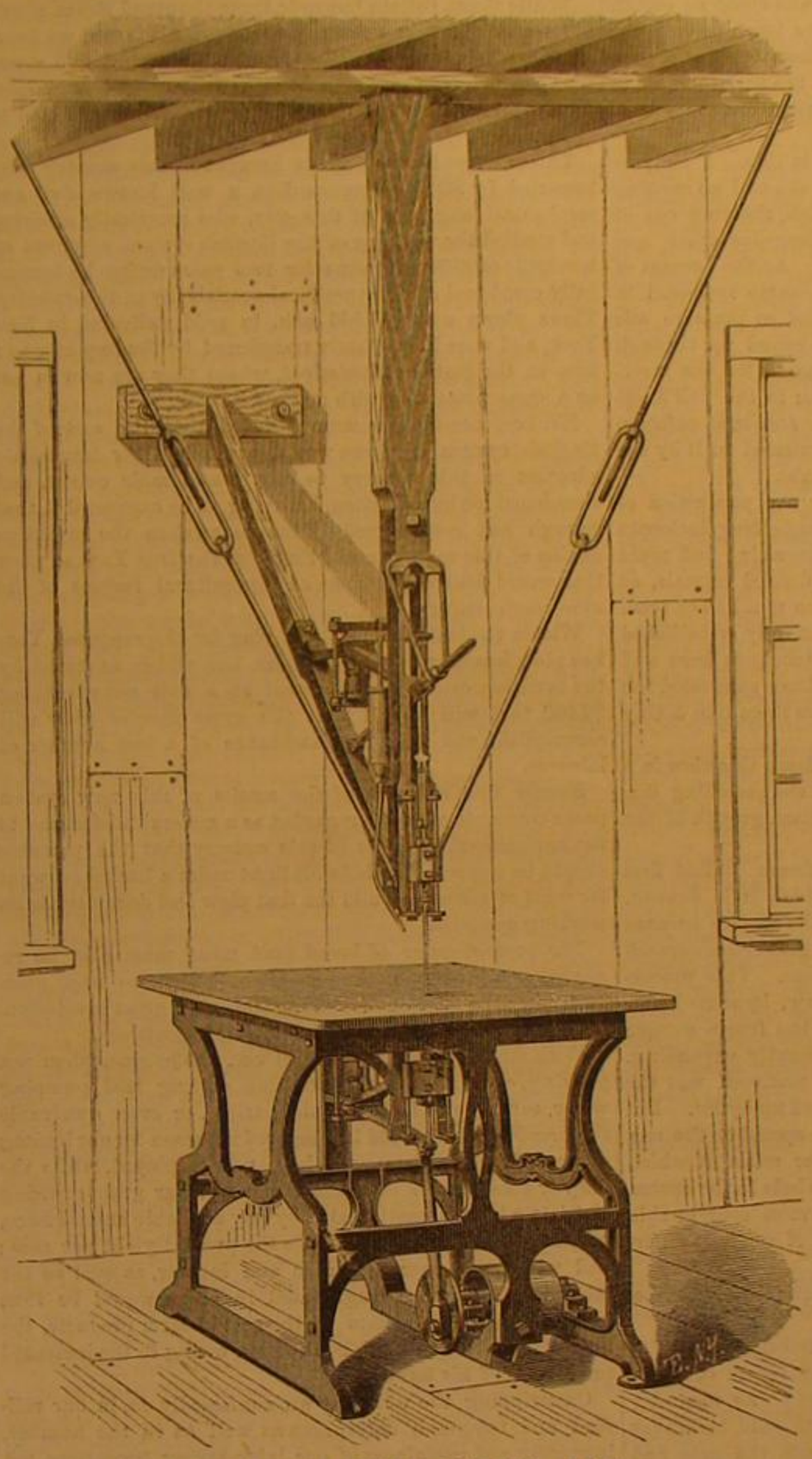

The inventor will sell railroad, State, or shop rights.

Patented through the Scientific American Patent Agency, Jan. 5, 1869, by Francis A. Brown, of Ithaca, N. Y. (P.O. Box 484), who may be addressed for further information.

CUTTING AND POLISHING AGATES.—We are in receipt of numerous letters asking for instructions in the art of cutting and polishing agates and other stones. This art can never be learned from written directions. It is one eminently requiring manual skill and artistic feeling. It can no more be learned from books than landscape painting. We must henceforth leave these inquiries unanswered.

### Improved Scroll Saw.

Undoubtedly one of the chief essentials to a perfect working scroll saw is perfect and uniform tension at all points of the stroke. Other important essentials are a table free from incumbrances to impede the free movement in any desired direction of the wood (or technically the "stuff") by the operator, durability and stability, lightness of the moving parts so that high speed is attainable with immunity from breakage, and freedom from lateral movement. It should



MOYERS' PATENT SCROLL SAW.

also be capable of adjustment for different lengths of stroke and various lengths of saws.

In the saw herewith illustrated these desirable qualities are fully secured as we can personally vouch, having seen it in full operation.

It will be observed that the table is perfectly clear and that the work may be turned in any way required. The saw is guided by hardwood cross-heads running in steel rods and, it is stated, may be run with a five inch stroke at the rate of one thousand revolutions per minute without jar or noise. The speed recommended is six hundred revolutions, at which the best quality as well as the greatest quantity of work is performed.

The distinguishing characteristic of this saw is the method of hanging. The saw is hooked to the cross-heads in the usual manner and each crosshead is connected by a link or rod to the end of a lever which is so adjusted as to compress a powerful hard rubber spring. The two springs acting against each other of course neutralize the resistance either would separately exert to a reciprocating motion while they give the required tension to the saw.

The table is adjustable to the "rake" of the saw, and a lever is provided which receiving the force of the springs enables the saw to be unhooked or hooked on in an instant. The fast and loose pulleys are seven and one half inches by three inches face.

The saw is capable of doing good work and a great deal of it. The manufacturers offer to guarantee it to do double the amount of ordinary work performed by ordinary scroll saws, and of a better quality.

This invention was patented April 21, 1868, and is now manufactured by C. Edward Copeland, successor to Hampson & Copeland, 42 Cortlandt Street, New York, whom address for further particulars.

### Prints and Their Production.

An interesting collection of prints, produced by various processes, and recently brought together at the house of the Society of Arts, in London, is of an historical character. In arranging it, the object has been to illustrate the results attained by each of the processes employed, rather than to point attention to the works of any particular masters of schools of art. The series begins with examples of prints from wood or metal blocks, either simple or compound, and of plain as well as colored impressions obtained by their means, but by a single operation of the printing press.

A London paper, noticing this collection says:

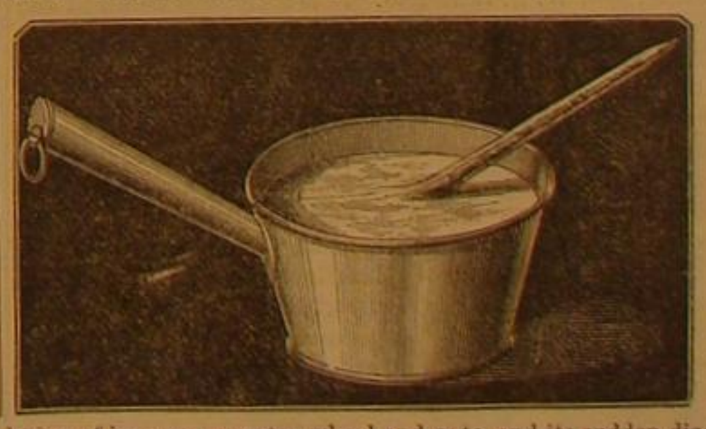
"A set of impressions from the blocks cut by Bewick illustrate the degree of perfection to which wood engravings was advanced at the close of the last century, and examples of split prints from the pages of the *Illustrated News* show the means which have been employed to aid collectors in completing their series from the pages of periodicals and the literature of our own times. Prints from engraved copper plates follow, and they illustrate the results attained by simply cutting away portions of the surface of the metal plate by the graver; the action of acids, as applied in the production of etchings; and the result of a combination of etching and engraving, as those arts were practiced at the period when Hogarth begun his career.

"The next set illustrates engraving upon steel and lithography. Following the lithographic example is a large series of prints in carbon obtained by a variety of photographic processes. It is curious to remark that the past, the present, and the future of our print-producing powers have each been based upon entirely distinct principles. As greater facilities for producing prints have been demanded, a weaker and apparently less durable source of production has been, and appears, in the future, to be still more resorted to. Thus, in the past period, engravings were executed and prints obtained from copper and steel plates. At present wood blocks and lithographic stones are employed; but the future of our art producing power appears likely to rest on what are apparently still less durable, viz.: gums, resins, and gelatin.

"The series is brought to a close by juxtaposing the works of Doo, Cousins, Landseer, and others, engravers of our own times, as published by Mr. Graves, with the series of carbon prints obtained by means of gelatin, as in the photo-galvanographic processs of Herr Paul Pretsch; prints in gelatin by Mr. Swan, of Newcastle, the Autotype Company, of London, and Woodbury's process; and prints from gelatin as seen in the examples by M. Tessie du Motay, of Paris, and Herr Albert, of Munich. The collection consists of about three hundred examples, and presents a sort of panoramic view of prints and reproductive art during the past century and a half, and it is interesting as showing the direction in which we must look in the future."

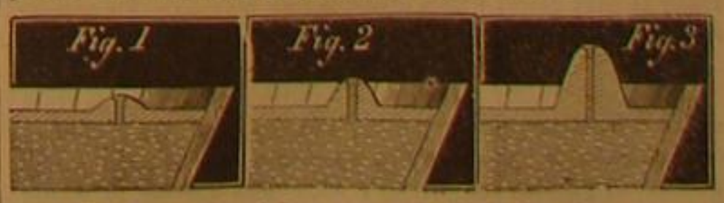
## CURIOUS ICE FORMATIONS.

Our readers will recollect some correspondence recently published in this journal in regard to two singular ice formations. The first described a sudden and singular accumu-



lation of ice upon a water wheel and gate, and its sudden disappearance under peculiar circumstances; the second gave an account of a singular prismatic column of ice forming in a bucket of water which had frozen over night, an engraving of which, prepared from a photograph, we laid before our readers.

We this week give an engraving of a still more singular formation which made its appearance in Burlington, Vt. Mr. Frank R. Rathburn, of Auburn, N. Y., sends us a drawing of the formation—an engraving of which we have prepared—and writes us as follows, in regard to it:




"Upon the night of Jan. 23d–24th, 1858, the thermometer ranged from 10° to 15°; and a dipper having been carelessly left nearly filled with water, upon a table, was discovered in

the morning, solidly frozen, with this icicle projecting from the ice surface, as seen in the sketch. A drawing was immediately made of the same, to exhibit more as a curiosity than for any other purpose, of which I submit for your consideration a correct copy."

W. Woodbridge, M. D., of Brooklyn, Conn., writes in regard to these formations that he has three or four times seen similar phenomena. He says:

"In every instance that came under my observation, the ice-prism was triangular, hollow, with walls about an eighth of an inch thick, filled with water to the top, of about the same dimensions as your correspondent describes, but always at an angle (I should say about 60°) with the surface of ice in the pail. The production of the formation was every time in severely cold weather.

"My explanation of the occurrence is this. I suppose that when the sheet of ice first formed in the pail, an opening was left bounded by the ice crystals, which, shooting out at their normal angle of 60°, inclosed a triangular space, and thus determined the shape of the prism. As the process of freezing went on, the ice in the pail of course increased in bulk faster than the water diminished; and so pressure was made upon the water which was thereby forced up through the commencing prism, and supplied materials for the structure; the continuing pressure on the water in the pail keeping the tube full as it grew. Some water remained unfrozen in the prism because of the heat communicated to it by the freezing process which was forming the tube.

"Some of the necessary conditions for the production of these curious formations seem to be an unyielding inclosure of moderate dimensions for the water to freeze in; and rapid freezing, which produces large and well defined crystals, as I noticed in the instances of prism-formation that I have seen. The whole ice surface in the pail was beautifully embellished with the outlines of crystals; and the triangles here and there formed by the intersection of these lines suggested the shape of the little ice pillar that rose above them like a tiny Tower of Pisa."

H. Wiegand, a chemist of this city, confirms this view in a letter upon this subject, accompanied by the preceding diagrams, numbered in the order of the supposed growth of the formation. He writes as follows:

"Before the water in the pail began to freeze, it had first to be cooled down to 4° C, the point at which it is densest. Then a thin film of ice began to form on the surface because now by becoming colder still the water on the surface expanded and could remain on the top until it froze. This process goes on whenever water freezes. But now, by some cause there must have been left a small hole in the frozen surface from which the water was driven by constantly expanding. This constant pressure and the motion it produced was the cause that this little hole could not be filled up by ice. But as soon as the water which was forced out spread on the surface it froze and formed a kind of crater the walls of which grow by a supply of water through the hole in the center. This, I think, is an explanation which is most conformable with the laws of nature and the properties of water at different temperatures."

In regard to the second phenomena mentioned, Mr. Wiegand remarks:

"Water may be cooled down below the freezing point if it is kept in motion all the time. (The temperature of water in the channel should have been ascertained.) As soon now as this motion is diminished by friction with solid bodies (as was the case in the contact of the water with the gate and sides of the channel) it crystallizes all at once."

Mr. Floyd Hamilton writes in regard to this phenomenon that "similar occurrences are very frequent on the St. Lawrence, attributable to 'anchor ice,' which forms on the rocks in the bottom of the stream where the water runs swift and presents the appearance described by your correspondent from Maine, Rev. W. H. Littlefield. It is sometimes detached and rises as fast as it forms, making the water thick and sluggish and often retarding powerful wheels and sometimes stopping them altogether, although very little ice is perceptible in the water. At other times the ice does not rise until it has accumulated to a considerable depth, when it appears to loose its hold and rise in large masses, sometimes damming up large channels as well as 'flumes.' This ice always forms on the bottom of the stream hence its name "anchor ice,"

We have no doubt the explanations given by Dr. Woodbridge and Mr. Wiegand are correct; if so it seems possible to verify their opinions by experiment. Should any of our readers act upon this hint we shall be pleased to learn whether these formations can be induced by the formation of artificial openings in, or by the formation of a bubble underneath a sheet of growing ice.

A CORRECTION.—The *Chicago Railway Review* calls our attention to the fact that an article of great value, published on page 26, current volume, entitled "A Step in the Right Direction," was wrongly credited to another cotemporary, whereas it originally appeared in the *Railway Review*. We endeavor to give proper credit for all articles copied from other journals, but mistakes sometimes occur. The *Chicago Railway Review* being one of our best exchanges and always ready to give credit where credit is due, we make this *amende* all the more cheerfully.

HOISTING PULLEY.—Since the publication of the diagram of the "hoisting pulley wanted," on page 2, we have had several answers, accompanied by diagrams. Unfortunately we did not publish the writer's name and address, to whom all communications should be referred. If he will call upon us we shall be happy to show him the plans which have been submitted.

## Correspondence.

*The Editors are not responsible for the Opinions expressed by their Correspondents.*

### Steam Plowing and the Bread Supply.

MESSRS. EDITORS:—It is a proposition confidently asserted and believed by all men of observation, especially those who have given some attention to agricultural engineering, that this country is now ripe for the steam plow.

While Great Britain has over three thousand steam plows successfully at work on comparatively small farms, we have, in the whole extent of the United States, but five steam plows in use, four of which have been imported from England, while one is the Standish plow now being tested in California.

The first two English plows brought to this country were imported by Mr. Wellington Lee, a well known civil and mechanical engineer of this city, who practically observed and studied the working of the English system of plows on hundreds of different farms for two years before he became fully convinced of their practical availability in this country. These plows cost $10,000 each, in gold, delivered in New York, and were immediately transferred by the importer to a firm in the State of Mississippi, where they are now in use on a sugar plantation with marked success.

Mr. Lee, however, became satisfied that the cost of the English system of plows would preclude their immediate adoption in this country to any considerable extent, and abandoned his importations, believing, as he expressed it, that enough had been already done to awaken the inventive genius of this country and bring out the true Yankee plow that would doubtless become an agricultural feature of the nineteenth century.

Within the last few months a plan for the supposed Yankee plow has been submitted to Mr. Lee, which, as stated by the inventor, can be manufactured at a cost not exceeding $2,000, that will do all that the great Fowler plow will accomplish, and with the assistance of a less number of laborers.

Should this estimate of the merits of this new system prove correct it must be regarded as a general misfortune to the agricultural interests of this country that the patentee should be compelled to hide his light under a bushel for want for want of means to build the first plow and demonstrate its working qualities.

The present price of bread (and meat must also be regarded as a product of the plow), would seem to urge upon capitalists the wisdom of looking into this great revolutionary project as an enterprise of inviting importance.

With steam plows in general use, the engine, when not plowing, can be used for thrashing, cutting feed, pumping water, sawing wood, etc., double, triple, or even quadruple the breadth of soil could be prepared in season for our leading crops with the same manual help now employed, while the deep or subsoil work of steam in most of our grain-growing districts which is unattainable by any available animal force, would almost, if not quite double the present yield per acre; and while the poor mechanic and laborer, as well as the masses of humanity congregated in cities, would be thus benefited by the reduction in the cost of farm products, the farmer himself would not be the loser owing to the increased production of his farm.

Outstripping the world, as we confessedly do, in our railroad and telegraph enterprises as well as in the number, ingenuity and usefulness of our labor-saving inventions, yet we quietly allow England to distance us in the great work of agriculture—the very science that gives bread and life to our people—owing partly to the indifference and short-sighted policy of capitalists in that direction, and partly to the skeptical tendency of the press as to the necessity and possible success of steam cultivation in this country.

I am glad to see the subject revived in your columns, and attention called to the fact that the country is now ready for this great agricultural revolution; for it is a fact that cannot be gainsaid that our wheat, or at least the bulk of it, comes every year further from the westward as it seeks new soil that has not been impoverished by the "skinning" process so unavoidable with animal force. The farms in New York and Pennsylvania which, twenty-five years ago, yielded thirty-five and forty bushels of wheat to the acre have, every average year, yielded less and less, till now fifteen bushels are considered a good turnout, and the farmer many times considers himself fairly paid if he gets ten; while the English farms, almost abandoned for their unproductiveness under the old system, are yielding, under steam cultivation, twenty to thirty bushels of wheat to the acre and with a regular increase, both in quantity and quality.

If these are facts—and they are clearly demonstrable—it is painful to see the impoverishing process go on when the remedy is so palpable and self-evident. Let inventors hurry forward the Yankee plow. A. W. HALL.

New York city.

### A Physiological Problem.

MESSRS. EDITORS:—Will some of your scientific correspondents please philosophize upon and give the causes of this—to me—strange phenomena?

During last March I became paralyzed—wholly—at the age of 19. I was not stricken, but taken gradually. When my arms became so weak that I could not raise either of them separately to my face, by connecting or joining them, I could raise them very easily for a day, until I became too badly paralyzed. And when I began to mend I could raised my hands, joined, many days before I could raise either separately. Why was this? SILAS M. HISSEM.

Shiloh, W. Va.

### Filing and Setting Mill Saws.

MESSRS. EDITORS:—Your recent Alabama correspondent on the dress of sash and rotary saws seems to think the bevel or shear dress the best without swaging or upsetting, and gives as a reason in part the economy in dressing when there is no upsetting.

In my twenty years' practice and extensive observations, I find the square and upset dress the best on the sash, muley, and circular mill, and give as a reason that such dressed saw can be run and not touch, except when it can and will cut; and it will present an edge that will cut at the same time with as little, if not less power than the shear dress or bevel tooth. The upset tooth will carry more feed than the non-upset tooth, for the reason that the cross-grained wood that makes the side of the kerf rough in proportion to the feed or amount of wood cut by each tooth, cannot touch the side of the tooth to drive it out of line and cause friction on the side of the tooth when there is no cutting edge, as is the case with the shear dress or non-upset tooth.

While I set or bend the tooth a little to regulate the set, I upset or swage every day. I file the under or inside of the tooth altogether, never changing the back of the teeth by filing if they have the proper clearance. I keep circular saws strictly round, file square, and all from one side, and can saw any kind of wood with such teeth without any trouble. The inserted tooth saw is being introduced where the sawyers are in favor of shear dress, yet they can't use any other than square dress, and have to upset for a clearance, as they cannot bend the teeth at all. I believe the dress has much to do with their introduction, but I am not in favor of swaging for clearance altogether with the common saw.

I have seen and practiced much between the Allegheny Mountains and the Gulf of Mexico, and I have always found the square and upset dress doing the best work, and the same kind of dress for sash and muley saws.

Hopkinsville, Ky. WASHINGTON MILLER.

### A Primary Cause of Strikes.

MESSRS. EDITORS:—I would like to give you my opinion in regard to strikes. I wish to discuss the subject only as related to my own trade—that of machinist. I consider the lax manner in which apprentices are taken into shops as the primary cause of strikes. Let me explain.

It is the custom of shops at the present time to keep a large number of apprentices. They are taken for three years, and, at the end of that time, are turned out finished mechanics, or supposed to be. As a general thing the first year they are kept doing the drudgery of the shop, and sometimes longer. Their time for learning the trade is therefore reduced to two years. Again, when they go into a shop, no papers are made out and signed which binds the apprentice to stay his three years, and also binds the employer to do the fair thing by the apprentice, who is just hired in like a helper or man of all work; in fact he is nothing else.

Now what is the consequence of this method? The boys half learn the trade, and when hunting for work engage for less wages than a first class mechanic will. Employers, knowing this, reduce the wages, also knowing that if first class men will not work for their price they can get botches who will. When this state of things become unbearable the men strike. As a general thing the strike ends for the worse.

I think there is only one remedy for this state of things, and that is the enactment of laws obliging apprentices to work a longer period. This would have the effect of deterring many from going into the trade. Papers or indentures binding the employer as well as the apprentice, and also giving the apprentice at the end of his term his qualifying papers, without which it would be a misdemeanor to work in a shop, should also be required. If this were done it would prevent many from entering a trade at present overstocked with men, and with the extermination of the present generation of botches, employers would be compelled to treat skilled labor more fairly. MECHANIC.

Titusville, Pa.

### Preservation of Iron.

MESSRS. EDITORS:—In the SCIENTIFIC AMERICAN, of Jan. 1, I noticed an article with the above title. Few things would be of more importance to the business of the country than the discovery of some method for the preservation of iron from oxidation under the ordinary circumstances of daily use. Is it not possible that this may be done by-and-by?

Some time ago I had occasion to call at a foundery, the superintendent of which was curious in all matters of mechanics; and knowing my taste in the same direction, he spoke of this subject—the preservation of iron from oxidation—to which his attention had been recently called. This was in the winter, and his little boat, used in the summer for recreation and exercise, was laid up for the season.

He took down from its resting place an oar, the blade of which, being split, was wound with a narrow strip of sheet zinc, and secured in its place with carpet tacks. These were as brightas they were when taken from the paper. He showed me also the rudder, one of the pintles of which was a little too large for the thickness of the rudder. This had been remedied by putting over its edge two or three thicknesses of sheet zinc, and then the rudder iron was driven on and secured through all with three rivets of iron, the ends of which had been finished by the file. The surfaces made bright in that way were untouched by oxidation, though they had been in salt water through the spring, summer, and fall.

NEAL DOW.

[The preservation of iron by placing small pieces of zinc in contact with it, has long been well known. Sir Humphry Davy proposed to protect copper bottoms of ships in this way, and it was tried with success so far as preservation from

oxidation was concerned; but bottoms thus protected speedily became loaded with barnacles, and this caused the abandonment of the method. Small iron implements liable to rust may be protected by zinc rivets.—EDS.

### Standard Time.

MESSRS. EDITORS:—About a year ago you published an article entitled "Standard Time," suggesting that the local time of some point, say Greenwich, be fixed as the standard for the whole world.

I have meditated upon the idea sufficiently to convince myself that it would be a capital thing for everybody in a hundred ways. It would be a constant regulator for the local time for every town or city, whereas we have at present an institution here and there which occasionally takes true time from some fixed star; but from one taking to another the clock may vary considerably. There is scarcely one place in a hundred which is governed by its own true local time, or anything near it. The "regulators" of the different railways not only govern the business of such railways, but for considerable distances they govern the watches and clocks of the people. For instance, the clock at Altoona, Pa., governs the trains for a hundred miles or so east or west of it, leaving a discrepancy of about 6 minutes for every 100 miles of east and west lines to be gotten over in a very queer manner, yet it is done, and matters seem to get along somehow, something like this: Suppose a train running on Altoona time reaches the westward limit governed by that time at twelve o'clock, noon, 100 miles west from the clock. The true time (local) at that point would be about 11·54 A.M. Locomotives are changed, and in a moment that train is running under a regulator which pointed at 11·48 when the Altoona hands stood at 12 noon. Passengers cannot tell whether the train is on time or not unless they regulate their watches as they go along; and if they scan the matter closely they will be surprised to find their train leaving a station 12 minutes before it arrived there.

Now that we have trains constantly threading their way from New York to San Francisco and back, how satisfactory it would be to have but one clock to go by; doing away with three or four hours' discrepancy in time between these points.

The telegraph could furnish the exact time every day, first by cable and thence throughout the country. All men would soon know the difference between standard and their own local time, and as a matter of necessity everybody's clock and everyone's watch would always be right; for every jeweler would take a pride in taking and keeping the standard time of the world; and the local astronomers would have a fine opportunity to show their learning by informing the public how much ahead or behind their local time should stand.

OLD FOGY.

Oil City, Pa.

### Prevention of Boiler Explosions.

MESSRS. EDITORS:—My attention was called a few days ago to an account of an explosion of a locomotive on the Baltimore Railroad, while the engine was at rest, which killed the engineer. Paticulars of the accident (?) state that locomotives carry from 90 to 120 pounds of steam, and that this one had never been fully tested before being used.

Leaving it to those "who know" to reprimand, I send the annexed Regulations as enforced in France, and recommend their application in this country.

No boiler is to be used unless it has been proved by an hydraulic press, worked under a pressure of at least three times the effective pressure, n–1. The same applies to cylinders.

No boiler is to be delivered from any shop unless it has been fully tried by the maker, according to Regulations made by the Ingénieurs des Mines. There are three circumstances under which a boiler may be proved a second time, at the place of delivery, namely: 1st. On the requisition of the owner. 2d. If any damage has occurred to it during transportation from shop to destination. 3d. If any change has been made in it since leaving the shop.

If these regulations were enforced in this country, there were would be fewer accidents and consequently less loss of life.

ERNEST TURNER, C. E.

Germantown, Pa.

### Oil in Steam Boilers.

MESSRS. EDITORS:—In your answer to J. H. G., of Tenn., you say oil put in a boiler will cause much foaming. I have seen it repeatedly stated in the SCIENTIFIC AMERICAN that oil in a steam boiler will cause forming; to prove this is not always the case, I will give you my experience. I own two seven-horse upright hoisting engines, they are precisely alike, and by the same makers, one never foams and the other does. I tried a great many expedients to stop the foaming; none did any good.

A boiler maker of this city advised me to put a little oil in the boiler, which I did, and it proved a complete cure. Now when there are signs of foaming one tablespoonful of oil pumped in with the water will stop it; doing this twice a day is sufficient. I will add that the boiler alluded to was a very bad case, so much so that I got no work out of the engine until after oil had been pumped into the boiler.

J. MCCLAY.

Hartford, Conn.

### Latent Heat of Metals.

MESSRS. EDITORS:—If the author of an article with this heading, in the SCIENTIFIC AMERICAN of Jan. 8, signed J. P., containing some animadversions upon the old theory of latent heat, as stated in "Pynchon's Chemical Forces," had had an opportunity to read that book, he would have discovered that the new theory was also fully explained a little further on, in language very similar to that which he has himself employed. The old theory is stated first, as being easier to understand, and as preparing the way for the more intelligent comprehension of the new. * * *.

## ON THE NATURE OF THE INTERPLANETARY MEDIUM.

BY PROF. VANDER WEYDE, M. D.

The latest investigations with the spectroscope have revealed to us not only the nature of the matter constituting sun, stars, and celestial nebulæ, but promise also to teach us something about the nature of that much-spoken-of, contested, mysterious, hypothetical, and, withal, surely existing medium, which fills the interplanetary and interstellar spaces.

The observations of Angström, in Europe, corroborated by Winder, of Toronto, Canada, and by Peirce, of Cambridge, Mass.—show that at the hight of from ten to four hundred miles a medium exists not identical with any of the known simple or compound gases, while Angström recognized the same medium to exist in the zone of the zodiacal light, which, as is well known, occupies the space of a belt around the sun in the plane of the ecliptic, inside the earth's orbit. It is probable that this material medium fills the whole planetary space, but becomes only visible if illuminated by some cause, such as electric currents in the case of the aurora polaris, an unknown agency as in the case of the zodiacal light, or chemical action as in the case of the comets' tails—according to Tyndall's theory.

The nucleus of some comets have been proved to consist chiefly of carbon—a fact as startling as the other, also revealed by the spectroscope, that many nebulæ consist of incandescent hydrogen. And, by the way, let us here correct a common error committed by many scientific papers, which, when speaking of this fact, call it *burning hydrogen*. The hydrogen in the nebulæ is *not burning*, but simply in an incandescent state, which means at a temperature so high that it becomes luminous like a piece of red-hot, or white-hot, metal, undergoing no other change but that of a slow cooling process, which, in the case of the nebulæ in question, is probably more than counteracted by the mutual gravitation of its mass, and its consequent contraction and condensation.

I am not aware that the tails of comets have already been submitted to spectroscopic investigation; it will be indeed an interesting point to compare the spectral lines of these tails with those of the aurora and zodiacal light, because—if Tyndall's theory of the formation of these tails be correct—we will have a third way in which this interplanetary material medium is made visible. Tyndall supposes it to be a chemical action of the sunlight (after it has passed through the head of the comet) on the interplanetary matter, separating from it particles like a fog, which become temporarily visible, and afterward are dissipated again by the direct sunbeam. Spectral analysis will show the lines peculiar to the material particles deposited, which form this fog, and so teach us more concerning the chemical nature of the interplanetary substance.

To imagine such a very attenuated ponderable matter as fills the interplanetary space, takes no larger stretch of the imagination than conceiving a difference in density with the lightest bodies we know on the surface of our earth, just as we know these to differ from the heaviest. Hydrogen gas is 250,000 times lighter than iridium, the heaviest body known, and we may easily rarefy hydrogen some 400 times, so as to make it 100,000,000 times lighter than iridium and still be sure that we have hydrogen in the vessel, and prove its presence by recondensation or otherwise. If now we imagine a medium 100,000,000 times lighter than such hydrogen it is all we want, it may be beyond our actual verification; but so is the existence of hydrogen for uncivilized man, and was even to our race before Cavendish had described it only one century ago. It is, indeed, difficult to conceive the existence of hydrogen without having seen the experiments proving its properties; and undoubtedly we labor under a similar difficulty in regard to the clear conception of the interplanetary substance, as the ignorant do in regard to the conception of hydrogen gas.

For several reasons I avoid giving this substance a peculiar name, as nothing is gained by this. I consider it as ponderable, but of so light a weight that its expansive elasticity is far greater than its gravitating power.

Prof. W. A. Norton, of New Haven, according to the latest number of the *London and Edinburgh Philosophical Magazine*, in a defense of his "Principles of Molecular Physics," maintains still the simultaneous existence of two mediums, which he calls electric and luminiferous ether; the first for the explanation of electric, the second for that of the luminous and electric phenomena. The first hypothesis of an electric ether has become entirely unnecessary and must be considered obsolete, since it has lately been practically proved that electricity cannot possibly be transmitted through a real vacuum, and therefore is a mode of motion of ponderable matter. The doctrine of heat cannot exhibit such a striking and conclusive experiment against the hypothesis of a caloric fluid, as this. We cannot possibly make a vacuum through which heat and light will not pass. Notwithstanding this, heat is now considered as a mere mode of motion of matter, and only its transmission through space necessitates the conception of a transmitting medium which fills that space. We have much more reason to abandon the hypothesis of an electric fluid or ether, than that of a caloric fluid.

It is not a little remarkable that it appears that we are able with our modern contrivances to make here below, on the surface of our earth, a vacuum more perfect than that existing in the super-atmospheric space—in which a medium appears to exist, which transmits electricity—namely, in case the luminosity produced in this medium during the aurora borealis is caused by electricity; this appears really to be the fact, and the only rational explanation, by reason of its action on the compass needle, which is perfectly identical with that of an electric current.

As the aurora extends from the upper strata of our atmosphere to a hight of some 400 or 500 miles, it appears that this—the electricity-conducting and ponderable medium—extends to that hight, and that above this the rest of the planetary space is filled with the same substance still more rarefied and less ponderable, so that it no more conducts the electricity, but only light and heat, and is there similar to our perfect vacuum, which also conducts only the latter, but not the electric currents; that this medium is, however, still dense and material enough to become visible under certain circumstances, is probable from the comets' tails and the zodiacal light.

Perhaps the atmosphere in which we move is the type of a more extended and more subtile atmosphere around the sun, extending through the planetary space and in which the planets move; this atmosphere must be more rarefied at its limits, and rotate with the planets, as our terrestrial atmosphere rotates with the earth; this planetary medium, more condensed in the interplanetary space, is less so beyond; but still as a medium in the interstellar space, adapted to the transmission of light and heat, as these agents reach us, even from the fixed stars, of which the distances surpass that of the sun many million times. As the amount of heat reaching us from the stars has even been measured, and as the so-called radiating heat is simply the result of the transmission of vibrations by means of an elastic medium (like as air transmits sounds), we are compelled to admit that, at least as far as we can penetrate, there exists no empty space anywhere, and that matter is diffused through the whole universe not only in a very variable degree in regard to quality, but much more still in regard to quantity.

To recapitulate. I deny the existence of so-called imponderable matter, and sustain the definition that all which has weight is matter, and *vice versa*, that the so-called imponderable forces have no separate existence, but are simply different modes of molecular motions of ponderable matter, which fills the whole universe, only very much rarefied in the supposed empty spaces, and that this exceedingly rarefied ponderable matter is the medium which transmits heat, light, and electricity, like as air transmits sound; I maintain that it is as absurd to accept the existence of a separate caloric or electric fluid, to explain the caloric and electric phenomena, as it would be, to accept a separate sonorous fluid in order to explain the acoustic phenomena; and, finally, that as the extremely light but still ponderable air is a sufficient vehicle for sound, without recourse to any other hypothesis so the more extremely light but still ponderable matter in the universe, is the sufficient vehicle for light, heat, electricity, etc., without recourse to any other hypothesis of inconceivable imponderable agencies.

## MANUFACTURE OF THE POINTS OF NEEDLES AND PINS BY ELECTRICITY.

BY C. WIDEMANN.

A recent discovery has been made by M. Caudery, telegraph inspector on the Western Swiss railroad, and is now applied with success at Aix la Chapelle (Belgium), whence needles and pins are shipped to all parts of the world.

In establishing an electrical current by means of a small Bunsen battery, and by passing a metallic wire (brass, copper, iron, or steel), corresponding with the negative pole, through the bottom of a glass tube, closed in such a way as to contain an acidulated liquid, in leading the other wire of the positive pole through the superior opening of the glass tube, closed in such a way as to allow the positive wire to plunge into this acidulated liquid, taking care to leave a small interval between the extremities of the wires; the electric current thus established through the acidulated fluid as a conductor, produces the following phenomena.

Very soon the extremity of the positive wire takes a conical point of more or less sharpness, depending on the free distance existing between the two wires plunging into the acidulated liquid.

During this phenomenon, which takes from 5 to 15 minutes, according to the acid used, its strength, the composition of the wire, its degree of thickness, and also the intensity of the electric current, very fine sections of the wire are seen to separate from the wire.

Water, acidulated with sulphuric acid, appears to be more efficacious, especially for iron and steel wires.

Nitric acid is used in preference for brass and copper wires.

The same effect will take place if to the positive pole (superior) an indefinite number of wires are tied together and dipped in the acidulated water, instead of the single wire, care being always taken to keep this positive wire at a little distance from the negative wire.

I have seen a hundred brass wires after having been submitted to this operation, present points as sharp as the best English pins, although the electric current was produced by a very small Bunsen battery.

It appears to me very desirable that this new method should receive proper encouragement, and every thing should be tried to bring it into general use. The operation of making the point of needles and pins in their manufacture is a dangerous and costly one. Medical men in large manufacturing cities have long recognized the dangerous effects produced by the fine metallic dust resulting from it, on the health of the workmen.

The remedies for this evil are very imperfect, little used, and very impracticable; inhaling apparatus communicating with the outside air has been tried, but every danger would be suppressed by the method above described.

### Improved Laundry Machinery.

In no department of domestic work, is the labor more severe than in the laundry, when washing of clothing is made a purely manual operation, in conjunction with the detergent action of soap and water. There has, therefore, been a great demand for devices calculated to lessen such labor. Most of the inventions made to meet this want have been mechanical, and many chemical compositions have also been employed to advantage, but many kinds are objectionable as they injure the fabric. There is still room for the application of chemicals in many kinds of laundry work where machinery cannot supply the place of manual labor; but the upshot of the numerous experiments in this field is the conclusion, that with the aid of good machinery, good soap and soft water kept hot by steam, are ample for all ordinary laundry purposes. Other chemical substances may be necessary in the cleansing of clothing soiled by paint, tar, and other substances not readily soluble in soap suds; but soap and water in conjunction with super-heated steam will cleanse and even disinfect articles used as dressings for wounds in hospitals, or which have been worn by diseased persons; and where a proper temperature can be maintained, there are few substances with which clothing is likely to be soiled that these simple means will not thoroughly remove from textile fabrics.

Of mechanical inventions designed to lessen the labor of washing there have been no end, and, though many have failed to secure popularity, some have been very successful.

Much cause of failure has arisen from the fact that the most of these mechanical appliances have been designed to employ manual labor, and as this was only a substitution of one kind of manual labor for another, it is plain that unless such machines demonstrate on trial that the work necessary to propel them is less, for a given amount of clothing cleansed, than hand rubbing, they stand no chance of permanent success, though the general desire on the part of the public to secure such an aid in the laundry, is sufficient to secure a sale for almost any machine of this kind that can make a plausible showing of results. We have in mind a man who now rides in his carriage, goes clothed in purple and fine linen, and fares sumptuously every day on the profits of the sale of a washing-machine, which, if it can be now found in existence, lies among old lumber in back garrets.

Many machines now abandoned as failures would have given economical results on a large scale when driven by some cheap motive power, other than human. Their fault was, not that washing could not by their use be satisfactorily performed, but that they rather added to, than diminished the amount of work. Such a slight increase of labor as they entailed, would have been of no consequence in case this labor had been thrown upon a steam engine. Hence the adoption of machinery in large laundries is becoming more and more general. Many small machines designed for general use in families have also shown themselves truly worthy of adoption, and have therefore secured large sales solely on their merits.

We this week illustrate an excellent power laundry washing machine and mangle, which combine many advantages.

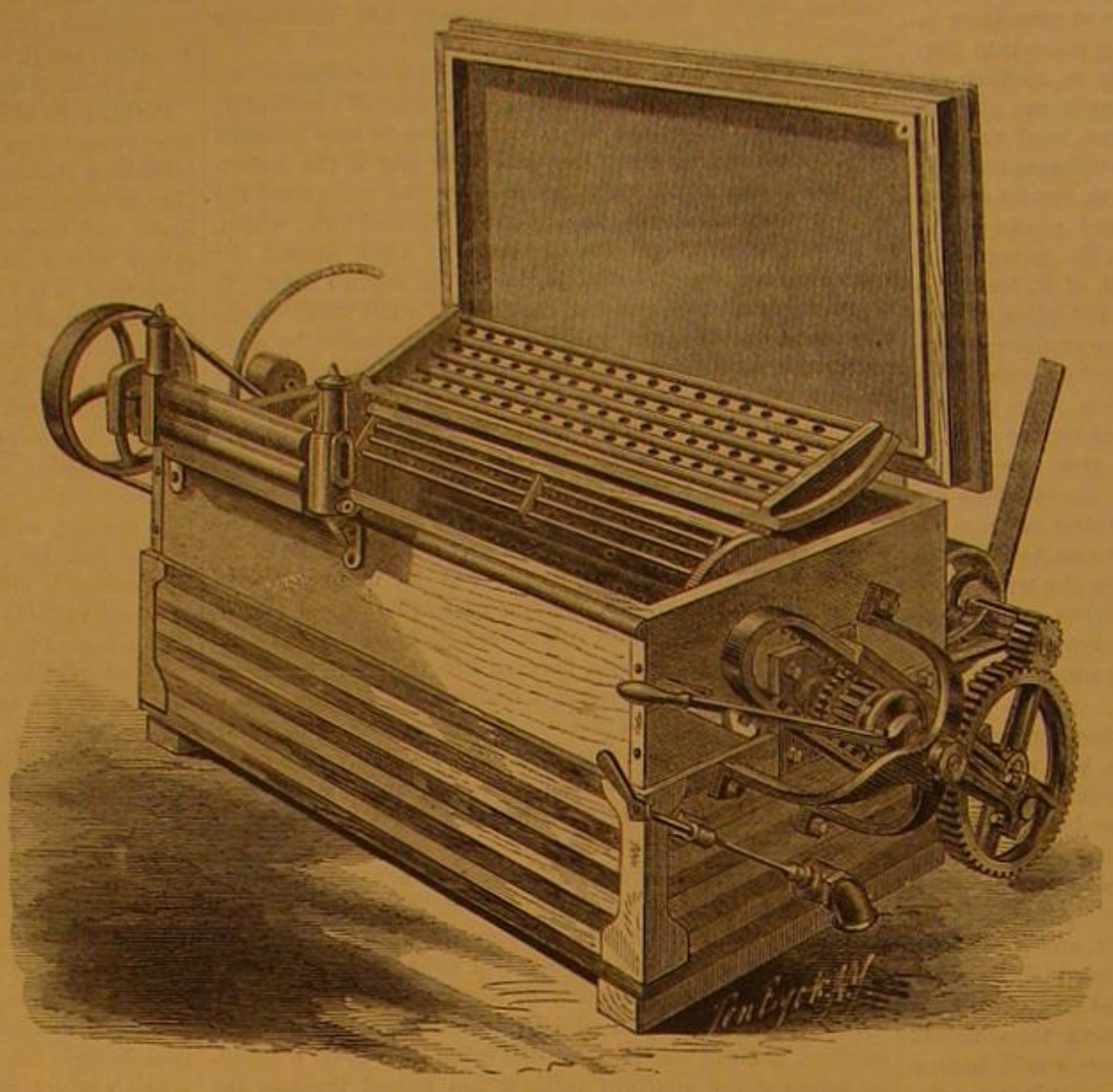
In the washing machine the principle of rubbing has been rejected as injurious to fabrics and unnecessary. Reliance is placed upon the power of very hot suds to loosen and dissolve the various extraneous matters which it is desired to remove, and their discharge from the fiber of the tissues is effected by the mechanical action of the hot suds flowing through and through the texture.

A large perforated cylinder placed within a tight steam chest receives the soiled goods. On the interior of this cylinder are placed at frequent intervals longitudinal ribs, the object of which is to keep the goods from hugging the shell. Three wings, one of which is shown in the engraving, also project from the interior of the cylinder and divide the inner surface into segments, which alternately receive the clothing when the machine is in motion. These wings are made of a system of rods not attached rigidly to the cylinder, but with springs, so that they yield somewhat under the weight of the goods, as they fall from one division to another while the cylinder is revolving, and also by their action completely turn over the mass so as to constantly expose all portions to detergent action.

In operation the hinged segment of the perforated cylinder is closed and fastened. The external chest being filled to the proper hight with hot suds, and its lid, which closes steam-tight, being shut, the contents may be, when necessary, kept at a boiling temperature by the admission of steam. Motion is then imparted to the inner cylinder by a double rack actuating two pinions, which act upon the cylinder shaft through ratchets and pawls. The double rack has a reciprocating motion imparted to it through a crank actuated by a system of gearing. By these means the cylinder is alternately rotated in opposite directions, and its contents violently agitated, but without severe friction upon the textures, so that the finest lace curtains, and most delicate textures are uninjured by its operation while they are thoroughly cleansed.

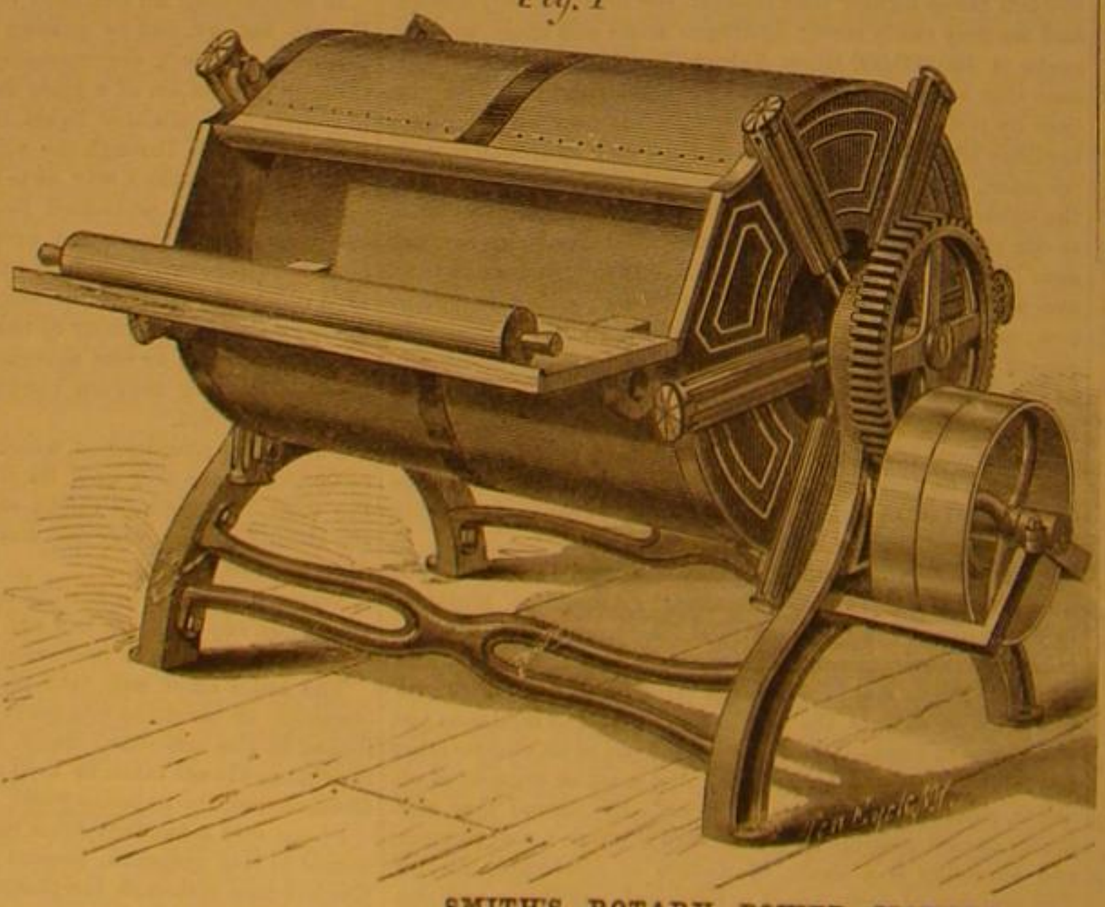
A power wringer is attached to the machine, the rubber rollers of which are made to act when wanted by tightening a loose belt.

This machine, besides being well adapted to use in all large laundries for hotels, hospitals, barracks, prisons, alms-houses, etc., is also well adapted to cleansing wools, and general cleansing purposes in bleacheries, dye-houses, and manufactories.



SMITH'S POWER WASHING MACHINE.

Fig. 1



SMITH'S ROTARY POWER MANGLE.

The mangle is constructed on an entirely new principle, developed by the results of long experience in the construction of such machinery. It consists of a revolving cylinder, rotated by a wheel and pinion, surrounded by a drum, which, when the machine is not at work, stands concentric to the revolving cylinder. The external drum does not revolve, but acts in a manner which will be understood by reference to the diagram, Fig. 2. A series of radial standards and springs permit the external drum to recede from the revolving cylinder, at the same time exerting through it a powerful pressure upon the roll of goods. This roll is formed by rolling the goods upon a wooden roller upon the feed table of the machine, Fig. 1, which is then fed into the machine, the angle of the feed table being rounded at the entrance, as shown in Fig. 2.

A constant parallelism being maintained between the revolving cylinder and the external drum, compels a corresponding parallelism in the roll of goods as it passes around between the cylinder and the drum, and subjects all portions of it to an equal pressure. Thus wrinkled parts are gently extended to smoothness, and a uniform and beautiful appearance is imparted to the textures. The roll after having made the circuit of the cylinder and drum, drops out upon the feed table, and another, prepared while the first was making its circuit, is fed in, and so the work proceeds.

This washing machine is the result of a great variety of inventions for which patents have been taken through the Scientific American Patent Agency. The mangle is the subject of a patent granted through the same Agency, October, 1869. All of these are the inventions of Hamilton E. Smith, the inventor of the well-known hydraulic clothes washer, who has secured patents in foreign countries through this office. These machines were awarded the first premium—medal and diploma—at the recent Fair of the American Institute. A large number of the best hotels and public institutions in the country have these power machines in successful operation. The inventor has made arrangements with the firm of Bolen & Crane, whose manufactory is located at 29 Plane street, near the Morris & Essex Railroad depot, at Newark, N. J., to furnish these improved washing machines and mangles adapted for both dwellings and laundries. An office is also located in the north-east corner of the American Express Building, Nos. 55 to 61 Hudson street, New York, where any communications or orders may be addressed.

### Another California Flying Machine.

According to the San Francisco *Bulletin*, one G. M. Montandon has invented a new aerial machine, which he is confident can be made to navigate the air successfully against all currents of air, taking as its guide the compass and sun. There are two chambers for gas, conformable in size and shape with that of the main body or passenger saloon. It has an oblong shape, each end sharp, to offer as little resistance as possible to the air. It is to be propelled by a continuous blast of compressed air. Openings are left for the air, which, after having forced ahead, can escape without causing any counter force.

In the center of the apparatus stands a sort of capstan, which holds in the grooves of a top and lower wheel, the transversal and longitudinal beams of the center of this capstan being forced from right to left, or left to right, will steer the apparatus, causing it to pivot on its center. It can be helped or done away with by applying compressed air to the fore and rear, on the two opposite sides. That is to say, on the right side forward lift, backward, and *vice versa*; in this manner, the forces being opposed, the apparatus must naturally pivot on its center. The cap or gas chamber, being inflated, causes the ascension, and moderates and lets it down, when the gas is allowed to escape by the valves placed at the two extremities. It is supplied with gas by two tubes placed forward, which receive it from the generator, which is placed in a room forward of the apparatus, in the top of the instrument, by which the compressed air is applied, and which overreaches the apparatus, and so keeps the top chambers from head winds. A tube starts from the lower gas chamber, through the passenger room, meets the top chamber, from which another pipe starts and meets the cap, giving thus the power in case of dilation, to diminish the expansive strength of the gas, and by that the top chamber is the receiver and dispenser of the force of ascent and descent.

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## PROGRESS IN MECHANICAL AND ENGINEERING SCIENCE AND INVENTION IN 1869.

While, without any very conspicuous or startling discoveries, progress in the physical sciences during the past year has been steady and marked, the mechanical arts and engineering science have been no whit behind in their onward march, and, in these fields, some very brilliant achievements have been accomplished.

### CIVIL ENGINEERING.

Much progress has been made in the art of concrete building, and its applicability to large and heavy structures has been demonstrated by the erection of large warehouses in Southwark, England. It has, also, been employed to a great extent in the construction of docks, piers, etc., and the method is, without doubt, destined to be more extensively employed in the future. Ransome's artificial stone, and induration process, are worthy of mention in this connection. They have achieved a great success in England, and, although an attempt, made by licensees, to introduce them into this country, has not been so successful, it is, doubtless, the fact, that whatever of failure has been met with, is the result of too meager knowledge. As soon as the proper skill is attained, we feel assured the Ransome process will repeat its successes in America.

Shaw's gunpowder pile driver has been introduced and received with marked favor. Its operation is based upon sound scientific principles, and the results attained have shown it to be more efficient than any method of pile driving heretofore devised, while it is, at the same time, economical.

The construction, in England, and the successful towing of an iron floating dock, of unprecedented size to the Bermudas form one of the triumphs of the year.

The commencement of the enormous suspension bridge, which will cross the East River between New York and Brooklyn, is also an event of great engineering importance. When completed it will be a fitting monument to the extraordinary genius of its gifted projector, John A. Roebling, who, in his devotion to the work, exposed himself to injuries resulting in his death.

The Broadway Tunnel, for Pneumatic Transit, has been commenced under Broadway, New York, and, when completed, will be the largest experiment of the kind yet undertaken. Everything in the natural qualities of the earth penetrated is favorable to the rapid progress of the work, and those familiar with the success which has attended similar works in London, predict a triumphant success for the New York Tunnel. The advantages of this system are too important not to merit more specific remark in this connection. It is well known that the running of heavy locomotives and tenders underneath the surface, in the proximity of buildings upon the surface, entails an enormous expense in construction, in order that safety for the superimposed structures may be secured. What pneumatic transit proposes to secure is perfect immunity from all danger to buildings underneath or near to which it passes, and to provide at once the lightest possible motive power in the smallest space, thereby decreasing the expense of construction until it bears no comparison to the vast outlay required for steam transit; and at the same time, eliminating from the problem all necessity for the consideration of the evils of smoke or impure air. The system fully developed would not only enhance the price of real estate in the city, but, by providing a quick, comfortable passage to the suburbs, or to the neighboring cities, by tubes passing underneath the rivers, remove the greatest inconveniences of metropolitan life, namely, forced dependence upon horse cars and ferries.

But the crowning triumphs of the year, in civil engineering, are three. One of these may be claimed exclusively by the New World. One has shed its luster upon the Old World, and the other serves to bind the Continents in closer union. The Pacific Railway, the Suez Canal, the French Atlantic Cable. Surely if nothing else had been accomplished, here were glory enough for one year.

Yet in ocean telegraphy there has been enormous growth. Numerous shorter cables have been laid or projected, and even now the *Great Eastern*, which, like an enormous silk worm has spun out so many threads, is on her way from England around the Cape of Good Hope with two thousand miles of cable in her belly to be paid out from Bombay to Aden and Suez, preparatory to a direct communication between England and her great empire in the East.

### STEAM ENGINEERING.

In this department of engineering the two most prominent features of progress for the year are the extended use of the Chatelier Compression Brake, and Morton's Ejector Condenser. Although the invention of the improvement of M. Chatelier does not bear date in the year 1869, yet, within this year, its use has been not only greatly extended, but the peculiar features of the system, with their advantages, have become widely known and appreciated through the publication of M. Chatelier's treatise upon the subject.

Morton's Ejector Condenser does not properly belong to the year under review; but, although previously introduced, it has been made the subject of careful study by the most able engineering talent of Europe and America, the results of which study and experiment sufficiently demonstrate the importance of the improvement.

Warsop's experiments in Aero-steam Engines have been announced this year, but their value has not yet been so fully demonstrated as to warrant final judgment upon their merits.

### INVENTIONS.

There have been no inventions during the year which are are calculated to produce any great and marked change in the character of the industries of the period; but the year has been prolific in minor improvements, and much gradual progress has been made. A great many useful improvements have been made, and many of them have secured a well-deserved popularity. The year has also witnessed the extensive introduction of some important inventions, the most prominent of which, as well as the most unique and revolutionary in character is the Positive Motion Loom, first brought to public notice in the latter part of 1868, but which has, during the past year, achieved a world-wide reputation, ranking it among the most remarkable inventions of the period.

The number of applications for patents filed in the U. S. Patent Office, for 1869, have been 19,271. The number of patents issued have been 13,986. The number of caveats filed have been 3,624. There has, therefore, been a decrease of 1,174 in the number of applications as compared with those of 1868, while there has been an increase of 1,027 in the number of patents issued.

There is nothing to be ashamed of in this record of progress. It would be difficult to select any year in the history of the world in which more solid and enduring work has been done. Years there have been, made illustrious by great and even startling discoveries, rendered of supreme importance to mankind by subsequent developments; but it has been reserved for the year 1869, to witness the time for circumnavigating the earth reduced to two months by the connecting iron link between the Atlantic and Pacific Ocean, and the joining of the Mediterranean and Red Seas by the Suez Canal.

With such a retrospect, we may look forward hopefully to the events of the year which lies before us.

## NATURE OF DESIGN PATENTS.

It is evident on referring to the Statute that the distinguishing feature in this class of patents is merely one of ornament or of form or configuration of a specific thing either useful, ornamental in itself, or both combined. Hence a new improvement might be the subject matter of two quite distinct classes of patents, one being for the ornament or form or configuration, and the other for the thing containing such ornament, new shape, or configuration, as the specific thing itself may be a new article of manufacture or a number of elements or members never before combined or arranged together in a particular way.

A trade mark is ornamental, and in a certain sense useful in itself, and comes within the statute clearly, as it is necessarily attached to or indicates some article of manufacture, when use is made of it.

Such supplemental patents also, it may be stated, add to the security of invention by shutting out more avenues of infringement. Be it understood that "designs" do not cover the article or things themselves. An impression that they do tends to confusion, and arises from their nature being more abstract than that of any other class of patents. Such may also lead us into the error of supposing that the "design" may not only be ornamental but may partake of the useful, forgetting that in itself it can have neither attribute of the thing or article to which it is attached, or ornaments, or gives form to; while the article bearing the ornament, or form, or configuration may have either, and when it is of the latter can be patented, as is usual with inventions combining both novelty and utility.

The law requires the "design" *to be* originated for a manufacture, etc.; or to be a design *for a* bust, statue, *bas-relief*, composition in alto or basso relievo; or to be of any new and original impression or ornament; or such design *to be placed* on an article of manufacture, etc., same being formed in marble or other material; or to be any new and useful pattern or print or picture to be either worked into or worked on, or printed, or painted, or cast, or otherwise fixed on any article of manufacture; or any new and original shape or configuration of any article of manufacture.

The above may be considered a fair analysis of the statute referring to the subject. In nearly every one of the cases will appear the distinction made as respects the "design" or abstract thing itself and the article of manufacture or thing to which the "design" is to be added in some known way.

As to whether there can be "claims" to such patents which will be broad enough to cover all but substantial or radical changes, like other classes of patents, appears to be settled, so far as the Courts have gone, in the affirmative.

No doubt but the application of a certain ornament, configuration or form to anything either of ornament or utility, ought at least to be protected in all colorable evasions, as are trade marks at present in our Courts, namely: to the extent where people of fair or ordinary judgment might be deceived by the attempted colorable change. Anything that would appear to be in substance the same ornament, form, or configuration, and by reason of which persons in the community would purchase the articles to which the "design" patented is intended to have more direct reference, ought to be held as an infringement. To treat these patents as patents of inventions, by invoking the state of the art to show formal or substantial changes, would open up a vast field of litigation wholly unnecessary in this class of patents; which were no doubt intended for but simple and practical purposes, namely, for more effectually securing the makers and venders of articles of manufacture in their specific originality as respects ornament or form.

Let us at least preserve this class of patents in their simplicity and entirety; and they should be granted freely, as they were designed mainly to protect more effectually what the law did not at once *prima facie* protect, namely, the use of a trade mark. Then the burden was on the party owning the trade mark to show a title, that is, to aver and prove an exclusive right, *now* under the statute, by a patent the trade mark is a *prima facie* title and it is for the infringer to displace it.

It also very clearly appears by the statute that "designs" ornamental of or controlling the form of an article of manufacture are to be protected as well as trade marks; and whether this extend to the outline or contour of a particular combination of machinery is a question. This may be answered in the negative if it is considered that nearly every clause of the section of the statute under consideration has reference to a "design" in connection with an "article of manufacture;" and such phrase in other portions of the patent acts is spoken of as different from and not in any sense as a machine.

## THE CARELESS USE OF LUCIFER MATCHES.

We believe that many of the fires announced in the journals as believed to be the work of an incendiary, have their real cause in the careless use of matches; and we propose to point out some of the ways in which property is thus endangered. We feel quite confident that in many instances risk is incurred from want of knowledge.

There are several kinds of matches in popular use. Of these probably the safest are those in which sulphur forms a considerable portion of the compound used for tipping. Such matches require considerable friction to ignite them, and unless some deflagrating substance like chlorate of potash, and kindred salts, is used, they do not detonate when ignited.

Some matches in quite popular use are so explosive that they detonate almost like a percussion cap; and when they chance to be tipped too profusely, the burning material will scatter to some distance by the sheer force of the explosion. We have seen the fused burning compound from such a match fly from one to two feet. The material thus scattered, would, in many cases, do no harm; but in a comparatively few instances it might kindle a disastrous conflagration. Falling into loose cotton, inflammable liquids, fine shavings, etc., it would be quite likely to ignite them, but as in such cases the fire is generally at once discovered, and is smothered out by the hand or the foot, the cases in which fires thus caused now become disastrous, are still fewer than those in which they might become so were the persons who use matches always heedless, or worse, intoxicated. Unfortunately, there are occasionally heedless and tipsy people, and so far as we are aware, they are not prohibited the use of matches; hence it may be fairly inferred that occasional fires do occur by the use of matches which violently detonate, when with a safer kind of match no harm would accrue.

In the hands of such people, the fuses used for cigar lighting, and which hold fire for a considerable time, are exceedingly dangerous. Thrown down often before the fire is extinguished, a glowing hot coal, they are, of course, liable to ignite almost any highly combustible substance with which they come in contact.

The writer once extinguished a fire in a wooden box of saw dust, used as a spittoon, caused by a fusee cast away by an intoxicated person, and which would, doubtless, but for its timely discovery, have done immense damage.

The dropping of a book once ignited a bunch of detonating matches lying on our table. Such an accident occurring at night, through the agency of some inquisitive cat, might well pass into the papers as the work of an incendiary.

Such matches are often dropped upon floors by persons too careless to pick them up, and are subsequently ignited by stepping upon them. Others who would stoop to pick up a whole match, would not think it worth their while to attend to a broken piece, although the latter, perhaps, is the tipped end, and just as dangerous as the whole match would be should it chance to be stepped upon.

We have tried some experiments to ascertain the liability of such matches to set fire to buildings, and have found that shavings, cotton waste, and even carpet with cotton warp may be ignited in this way.

Not to dwell too long upon what may seem to some a simple matter, we may sum up as follows:

The careless use of matches, is, in our opinion, the most fruitful of all the causes of fires of mysterious origin.

There are kinds of matches extensively used in offices, factories, and dwellings, which ignite so easily as to be dangerous, and which the insurance companies ought to include in the list of prohibitions in buildings insured by them, and which proprietors should refuse to allow on their premises.

Those matches are safest which require considerable friction to light them, and which, when lighted, only furnish sufficient heat to ignite the small dry splints which constitute their bulk.

Finally, all matches ought to be kept in a tightly closed box or safe, the best material for a match safe being tinplate; and a wholesome appreciation of the danger of carelessness in their use, should be early instilled into the minds of children. Servants, proverbially careless, will probably continue careless in spite of instruction and reproof; and the only thing that can be done with them is to allow them only the use of matches as safe as can be purchased.

## THE MILD WINTER.

Where be those prophets now who warned us last autumn of the coming "cold term?" Shade of the departed Meriam, what a mess those prophets have made of it! What premature shiverings they caused us by their statements about the extraordinary thickness of the new bark on trees; the voluminous wrappings provided by sagacious nature to prevent the ears of maize from being touched with the inevitable hard frosts; and the vast stores of provisions the squirrels—supposed to know all about the weather beforehand—had put in to meet the impending emergency. How disappointed the squirrels must be, and how they must regret that they had not played instead of working during the brief beauties of the last Indian Summer!

We trust no one will suspect us of attempting a pun when we say that all attempts to prophecy what kind of weather may be expected for any particular time longer than a day or two, are unprofitable, and likely to bring discredit upon those who attempt it.

We are not very sanguine of the existence of any law or combination of laws which acts with sufficient uniformity to enable predictions to be made, even if all the elements which influence weather were perfectly known to us.

We may count the bits of glass in a kaleidoscope and may compute mathematically the number of possible figures they can combine to form, but we never can tell which of the possible figures will show itself at the next turn of the instrument. There appears to us to be about the same difficulty in foretelling the state of the weather. The elements of variation are so many in number and so variable in time and degree, that their combinations are infinitely various, and follow no regular order of succession.

Such signs as we have alluded to above we regard as utterly unreliable; we have seen them all fail oftener than they have coincided with the conditions they are supposed to indicate.

But while we deem it impossible to predict with even tolerable accuracy future states of weather, at specified times, we believe the modern idea of giving warning to distant localities of approaching storms by means of electric telegraphs is destined eventually to prove of immense benefit to the world; and the suggestion that announcements be made to large agricultural districts by artillery signals prearranged to indicate the intensity, rapidity and direction, as well as the other peculiarities of approaching storms, seems to us to be very practical and promising. This system would save crops from destruction, vessels from shipwreck, and much sacrifice of human life.

## SCIENTIFIC INTELLIGENCE.

A French chemist, M. Nadie, has been making a thorough examination of the salt water of different oceans, especially in reference to the amount of chloride of sodium contained in them. He obtained the following results:

The Mediterranean Sea contains of salt, 2·719 per cent; the Atlantic Ocean, 2·789 per cent; the English Channel, 2·595 per cent; the Pacific Ocean, 2·587 per cent; the Lake Ormiah Persia), 19·05 per cent.

The specific gravity of the water was found to range from 1·029 to 1·030 per cent.

### A NEW CHLORIDE OF GOLD.

M. Debray announces the discovery of a new chloride of gold that is not decomposed by heat but is volatile at 572°, about the boiling point of mercury. Its other properties are not defined.

### ACTION OF LIGHT ON GLASS.

The famous optical glass manufacturer, Bontemps, attributes the greenish yellow coloration of glass to the free sulphur resulting from the decomposition of the sulphate of soda used in the frit. The researches in this direction have become so refined that the constituents of glass will soon be determined by the uses to which it is proposed to be applied. Manganese will have to be omitted from glass designed for the sky-lights of photographers, as it turns red and thus cuts off chemical light, and the sulphate of soda must be dispensed with for the same reason. We shall presently have glass made to order and exactly adapted to its proposed uses.

### HYDRATE OF CHLORAL.

This new sedative can be prepared by passing dry chlorine gas through absolute alcohol, but the actual manipulation is attended with a good deal of difficulty. M. Thomsen, of Copenhagen suggests that the alcohol should be put into a roomy flask, and that the Liebig's condenser should be arranged perpendicularly over it so that the condensed vapors can run back into the flask. Chlorine gas is passed through the absolute alcohol until the liquid becomes yellow and absorbs no more gas. The content of the flask is then boiled to expel all the free hydrochloric acid, and is neutralized with chalk. The neutralized liquid is transferred to a retort and subjected to a fractional distillation. The portion going over between 230° and 240° Fah., is kept by itself. The more volatile portions must be redistilled. All traces of water can be removed by further distillation from chloride of calcium.

The boiling point of hydrate of chloral is 240° Fah.; it solidifies at 104° Fah. A slight amount of water will vary the degree of solification considerably.

By employing absolute alcohol and observing all the above precautions, a perfectly pure crystalline hydrate of chloral can be obtained.

This new medicine is employed to produce sleep. It is given in solution in sweetened water, is agreeable to the taste, and produces gentle sleep with no nausea or bad after consequences. It has been successfully tried in cases of delirium tremens, in insanity, in acute gout, and bids fair to become a most valuable contribution to the pharmacopœia. It can hardly be called an æsthetic agent, although it does produce insensibility, and is not likely to come into competition with chloroform or ether. As an hypnotic agent it appears to exceed any of the narcotics, and bids fair to be largely employed, hence the necessity for great caution in its preparation.

## ON COTTON SEED AND COTTON SEED OIL.

BY C. WIDEMANN, CHEMIST, PARIS, FRANCE.

No. I.

This series of papers is intended as a resume of nearly all that has been said or written on cotton seed and cotton seed oil, with the addition of what I have been able to learn of it through my own experience in analyzing cotton seed oil, and examining the different processes now used in its production from the seed, and in refining and bleaching the same.

In Europe, as long ago as 1785, a prize was offered by the London Society for the Encouragement of Arts and Commerce, for the manufacture of cotton seed oil from the Egyptian seed.

The first sample that was ever produced of refined cotton seed oil was made by De Geminy, of Marseilles (France), exhibited at the Great Exhibition of Edinburgh, but in the United States this industry is more recent, and I shall only speak of its manufacture with reference to this country and its interests.

It is not long since the cotton seed was left to decay in large heaps on plantations. It was sometimes used as manure, and found to be very beneficial to the soil, and it is still hard to induce old farmers to sell their seed and deprive themselves of this fertilizer.

### THE SEED.

The seed comes principally from Texas, Alabama, and Louisiana; and the yield of cotton is about one third of the seed. It has been found necessary to manufacture oils from it here, as many trials made to ship the seed from this country to France or England have failed on account of the great tendency of the seed to ferment, and as on this account when worked abroad it produces but very inferior qualities of oil. Many unsuccessful trials have been made, but to prevent this alteration of the seed and stop the fermentation, it was first attempted to decorticate the seed and send the kernels; second, to grind them, and heat the meal to coagulate the albumen and legumin contained in the seed, but all this proved of no avail.

The cotton seed is mostly manufactured in this country from the seed of the Gossypium Barbadense, or upland seed, though some mills have tried to use the Sea Island seed as yielding a larger quantity of oil, and also as not requiring to be decorticated, this seed being clean and free from cotton fibers; but at first these manufacturers found some difficulty in selling their cakes in England, where nearly all this article goes, as for a short period there was a prejudice in that country against the black cakes as being injurious to cattle, but this prejudice is dying out, as it has been proved to have been entirely unfounded.

The only way that has been found at present to prevent the fermentation of the seed is due to M. Robert, of Marseilles, France, who uses immense iron air-tight cases, into which the seed is introduced, the air exhausted, and sulphurous gas introduced. In this way the seed may be shipped any distance without alteration.

It has been observed that the first seed of the season, being green, is very watery, and hence is ginned and decorticated with great difficulty, as it packs in the gins and hullers. The oil obtained contains a large quantity of water and resinous substance, is cloudy, settles slowly, and is more apt to become rancid. The more the season advances the better the seed is, and the cold weather also stops the fermentation. The seed needs great care in shipping, as the dampness and heat of the southern climates tend greatly to cause fermentation.

It is shipped from the plantations in gunny bags sent for this purpose by the oil manufacturers to the planter. The purchase of these bags necessitates the use of a large part of the capital invested in the oil business, as sometimes 400,000 bags are required, and the loss yearly in carelessness, fire, decay, and robbery is enormous. In France they boil the bags in tannin water, as the fishermen do with their nets, to prevent their decay.

The seed is sold in New Orleans at about $15 per tun; the average freight, per steamer, to New York, is $10 per tun, which increases the price to $25, and reckoning the bags, insurance, wear and tear, at $3, the average price of seed at New York is $28. It is thought, however, that the price of seed at New Orleans will not be maintained higher than $13 per tun.

The bags contain, on an average, 92 pounds; one bushel of seed weighing 43 to 45 pounds; so it requires nearly 22 bags to a tun of seed.

The relative proportion of shell or husk in 100 parts is 37·45 husks to 62·55 kernels.

The cotton seed arriving at New Orleans from all parts of the Mississippi is not very well ginned, and parties have found it very profitable to gin it again there with very perfect machines before they send it to the mills, the yield of cotton per bag being from 1¼ to 2 pounds, worth from 18 to 23 cents per pound, or 21 pounds of cotton per tun. In this way the oil manufacturers are deprived of an important source of profit.

### THE HUSKS.

The husks of the carefully-ginned and decorticated seeds do not sensibly yield any thing soluble in alcohol, ether, sulphide of carbon, benzene, benzole, or water; and they are mostly used in the oil mills as fuel, the fire under the boilers being first made with wood or coal and then kept up with the husks or hulls; but in New Orleans the husks are sold to dairy men for their cows, as they eat it with great avidity mixed with cotton seed meal, and the quantity of milk is largely increased by this food.

A full load of these husks sells for $10 or $12, and I think it would replace, with great advantages, the slops from distilleries as food for milch cows. The husks have been also used as manure, containing, according to Liebig's analysis, 1 per cent of ammonia, some gardeners buy them to protect their strawberry beds from the cold. They are also used to pack glassware, porcelain, and other fragile objects; and quite lately a Philadelphia paper house has used them very successfully in the manufacture of paper. The negroes in in Virginia make tea of it as a preventive of the fever and ague.

### THE KERNELS.

The seed to be sound must be hard and dry, and crack under the teeth when pressed. The almond, or kernel, must be well shaped, of a fine white color, on the surface, and of a light yellow in the interior, and have a sweet flavor. In examining a section of the kernel, small, dark-colored specks are seen dispersed over and through the yellowish white mass of the kernel, which specks impart to the oil its peculiar color. In examining these specks under a powerful microscope they are observed to be filled with a dark, pink colored, resino-fatty substance, soluble in ether, benzine, sulphide of carbon, and also in weak alkalies, and undergoing a change with the latter solvents.

In crushing the carefully-decorticated kernels in a mortar, a light, yellow green fluid is at once observed; this is the oil. But very soon the atmospheric air changes the original green to a color reddish brown. To convince myself of this I have placed some carefully-decorticated husks in alcohol in a closed vial, which I placed under the receiver of an air pump, over sulphuric acid, and after having exhausted the air and alcohol, I obtained the oil with its original color, which is yellowish green.

## Peculiar Appearance Shown by the Flame of Burning Hydrogen.

Dr. Seelhorst has repeated Barett's well-known experiments of holding in the flame of burning hydrogen gas very well cleaned glass rods, metals recently cleaned by filing them just previous to the holding in the flame, and has observed the same blue coloration as M. Barett did. But the author is not at all inclined to ascribe this coloration to the effect of burning sulphur, which should be so generally spread about in the shape of some sulphate, as to produce this coloration. The author, though abstaining from stating any precise cause at all, inclines to the belief that the cooling effect of the cold body held in the flame has something to do with this phenomenon. Perfectly pure hydrogen, burning from a platinum burner, as well as from iron or glass burners, exhibited the phenomenon, when cold bodies, just after having been cleansed by scraping or filing, were held in that flame. These experiments were conducted in a laboratory, repeated in a lecture hall, and in the tap-room of a *café* with the same result.—*Chem. News.*

## California Silk.

The *Journal of the Franklin Institute* has received from Mr William J. Horstman a beautiful specimen of raw silk raised in California by Mr. D. Provost, of San José, and reeled on a machine invented by Mr. Joseph Neuman, of the same place.

This material is of an excellent character and in perfect condition, forming a solid hank of the beautiful golden color peculiar to the best raw silk. We learn that much is being done in California by the gentleman on whose estate this sample was produced, as well as by others, and it will evidently be of great advantage, if an industry which represents, yearly, a sum of $214,900,000 can receive such encouragement that it may be fairly established in our country, where so large a demand for its products does and always must exist.

The same journal states that the removal of gum from silk may be more easily and cheaply obtained by the use of ammonia than by the usual method of boiling with soap.

## MICHAEL FARADAY.

BY PROFESSOR JOSEPH LOVERING IN "OLD AND NEW."

Michael Faraday was born September 20, 1791; the son of a blacksmith in Newington Butts, Surrey, England. He died in the apartments in Hampton Court Palace, which the Queen had assigned to him, on August 25, 1867; and with him went out the brightest light which had radiated through the chemical and physical sciences for forty years.

In 1804, at the age of thirteen, and with a scanty education, Faraday was sent to a bookbinder, with whom he served an apprenticeship of eight years. But he was not toiling these many years merely upon the *outside* of books. He felt through his whole life his indebtedness to the works of Mrs. Marcet, and he says: "Whenever I presented her with a copy of my memoirs, I took care to add that I sent them to her as a testimony of my gratitude to my first instructress." A copy of the "Encyclopedia Brittannica," sent to be bound, riveted Faraday's attention; particularly the article on electricity. Out of an old bottle he constructed his first electrical machine, and out of a medicine phial a Leyden jar, and, thus equipped, he began to experiment. It is to be observed, however, that a great many other boys have done the same thing without growing up to be Faradays. But with them it was play, with him it was work. Faraday, himself, in later years, attached considerable importance to the habit which he acquired in early life of repeating, as far as he was able, the experiments of which he read in chemistry and electricity. And when, afterwards, the brilliant lecturer enchanted both young and old, he treated his audiences as he had treated himself. He did not suppose them to know, or require them to believe in any physical law, however familiar, unless he had shown it to them; not even that a stone would drop to the earth, without dropping it first before their eyes on to the floor of the lecture-room.

In 1812 Faraday was invited to the Royal Institution, to hear Sir Humphry Davy lecture. He took notes at these lectures which he afterwards sent to Davy, asking at the same time his assistance to escape from trade and dedicate himself to science. Davy, who was then at the zenith of his transcendent popularity, had the time and the disposition to encourage the youthful aspirant, and in March, 1813, Faraday became chemical assistant in the laboratory of the Royal Institution. Mr. Gilbert Davies, who had himself detected the genius of Davy in the obscure home of a Cornish carver at Penzance, has said of the illustrious Davy that the greatest of all his discoveries was the discovery of Faraday. In a few months after Faraday's installation at the Royal Institution, Davy started upon his prolonged visit to the Continent, and Faraday accompanied him as secretary and chemical assistant. His own modest merits were not altogether overshadowed by the shining fame of his companion, and he formed friendships in Paris, Geneva, and Italy which were only broken by death.

Faraday began his career of original investigation in 1816, with a successful analysis of a specimen of caustic lime from Tuscany. Since that time, his contributions to science flowed on in a steady stream, so broad and so deep that every province in chemistry and physics has felt the reviving influence. In acoustics, we recall his researches on the sand figures and lycopodium heaps of vibrating plates, on musical flames and Trevelyan's experiment with a heated metal; in optics, we are reminded of his papers on aërial perspective, on ocular deceptions produced by rotating wheels, on the relation of gold and other metals to light, on the borosilicate of lead or heavy glass; and of his services on the committee to which he was appointed in 1824, with Herschel and Dolland, by the Royal Society, to suggest improvements in the manufacture of glass for telescopes, and his valuable report upon the methods of manufacturing glass; in general and molecular physics, we remember his labors and discoveries on the limit to evaporation, on the temperature of vapors, and their solidification, on their passage through capillary tubes, on the pneumatic paradox of Clement Desormes, on vegetation; in practical science, we are indebted to him for suggestions, experiments, inventions, or discoveries on ventilation, illumination, fumigation, gunnery, on india-rubber and the alloys of steel, on the prevention of explosions in collieries, on the extinguishment of blazing houses, on sustaining a prolonged breath in a dangerous atmosphere, and on the false pretensions of spirit-rappings and table-turnings.

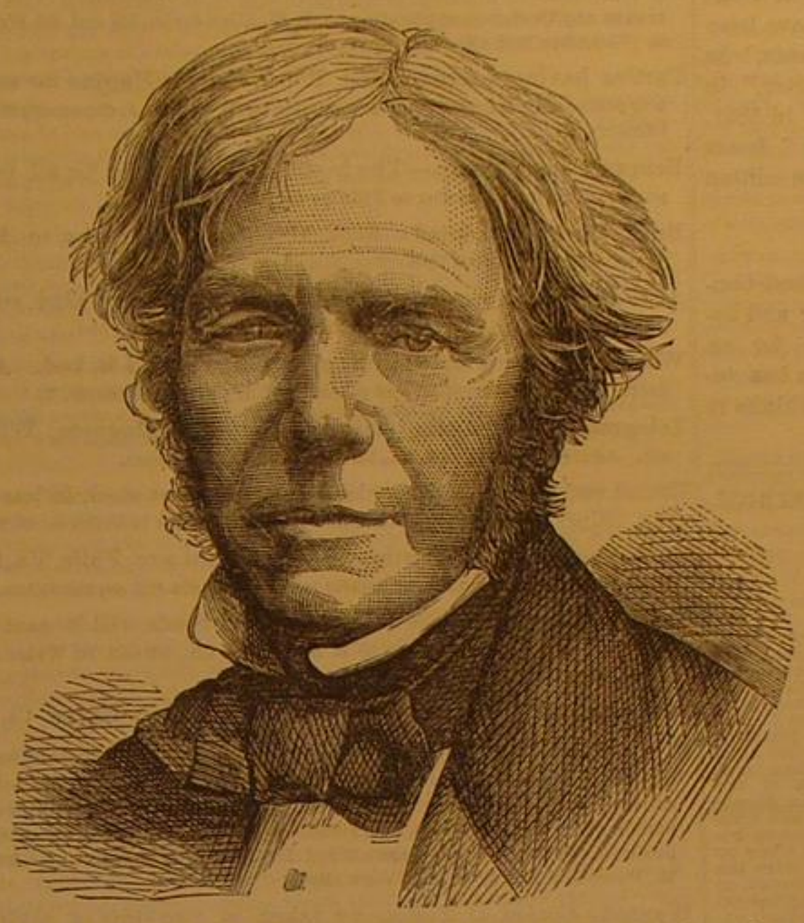
This meager enumeration, in which years of intellectual activity are registered in as many lines, indicates the exceeding great versatility of Faraday's genius. Nevertheless, chemistry and electricity were his favorite if not his absorbing pursuits, from the beginning to the end of the half century which his discoveries have made so brilliant. And of these two chemistry served him, but electricity commanded him. It is impossible in this place to specify, much less to analyze, the varied researches of Faraday in chemistry and electricity.

In 1820 he described two new compounds of chlorine and carbon. "The discovery of these two compounds," to adopt the words of De la Rive, "filled up an important gap in the history of chemistry." In 1825 Faraday discovered benzole, to which, says Hoffman, "we virtually owe our supply of aniline, with all its magnificent progeny of colors."

In 1820 Oersted set up one of those milestones, which stand forever in the history of science, by his inauguration of electro-magnetism. Many pressed into the ranks to pursue the new discovery to its consequences, and Faraday among the foremost. He adapted the reaction between the current of electricity in the conductor and the magnet to the production of a continuous revolution—a stupendous novelty then, without a parallel in mechanics nearer than the heavenly bodies. Even Ampére's sweeping generalization of the electro-dynamic action had not anticipated such a result, although it was afterwards able to explain it.

In 1831 the scientific interest which had been monopolized by electro-magnetism was transferred to a younger sister, magneto-electricity. Magneto-electricity was a corollary from Faraday's new discovery of voltaic induction, when the latter was viewed in the light of Ampére's theory of magnetism. Science had been in possession of voltaic electricity for forty years, its most powerful instruments had been wielded by Davy, Hare, and Silliman, statical induction was a familiar fact; but it was reserved for Faraday first to see with his own eyes the external influence of current electricity. Henry's induced currents of the higher orders; Page's devices for exalting the intensity of induced currents, and their application to therapeutics; Ruhmkorff's coil, and its various adaptations to blasting, lighting, etc.—all these had their origin in Faraday's discovery of voltaic induction.

On the 20th of November, 1845, Faraday read to the Royal Society of London, his startling discovery of the "Magnetization of Light and the Illumination of Magnetic Lines of Force." This discovery, from its delicacy and novelty, deserves to take rank as Faraday's greatest, standing, as Tyndall describes it, among his other discoveries, and overtopping them all, like the "Weisshorn among mountains—high, beautiful, and alone."



It really means, however, less than the language in which it was announced would convey to most minds. More than thirty years before, Seebeck and Brewster had succeeded in imparting to common glass, by pressure or heat, the depolarizing structure of crystals. It was reserved for Faraday to imitate, partially, the quartz-like structure of oil of turpentine, and its strange power of circular polarization, by subjecting his heavy glass, and even water, to the influence of strong magnets. This discovery was followed by others, in rapid succession, extending over a period of five years; all of which are included in his comprehensive classification of substances into magnetics and diamagnetics. A compass needle made out of a diamagnetic would point east and west, where an ordinary compass needle would point north and south. As oxygen is powerfully magnetic, Faraday labored hard to show that it was superfluous to seek for the cause of terrestrial magnetism, or at least of its fluctuations, outside of the earth's atmosphere. The antagonistic properties of magnetism and diamagnetism are influenced by crystallization. Faraday proved this for bismuth, antimony, and arsenic, as Plücker did for the optical axes of crystals. Faraday could have had little expectation in 1825, when he was melting the borosilicate of lead, that this heavy glass, which proved a failure for optical purposes, on account of its deep color, would, after standing on the shelf for thirty years, become the instrument of his grandest discovery.

Nor should we forget how much Faraday did to establish the identity of electricity, from whatever source it is derived, to prove the definiteness of its action, to unveil the process of electrolysis, to bring under one general law conduction and insulation, to assert the dependence of electrical and magnetic induction on the molecular agency of intervening media, and to deal a vigorous and mortal blow to the contact-theory of galvanism. Faraday was not destined, either by early associations, education, or mental constitution, to discuss successfully high schemes of speculative philosophy or mathematical science, such as the nature and conservation of force, or the essence of matter, though he has written a few papers upon these subjects. Nevertheless, he contributed more largely, perhaps, than any of his cotemporaries to that vast scientific capital, from which Grove has freely borrowed in the establishment of his theory of the Correlation of the Physical Forces, and the convertibility of one manifestation of force into another, as so many varieties of motion.

In 1854, as Faraday was approaching the close of his long period of active service, he delivered a lecture at the Royal Institution, under extraordinary circumstances, on Mental Education. This lecture deserves special commemoration, inasmuch as Faraday regarded the views expressed in it both as cause and consequence of his own experimental life. We here see that faith, humility, patience, labor of thought, mental discipline, well-educated senses, had all conspired to make him a fit high-priest of science. But he says that "this education has, for its first and its last step, humility."

After Faraday returned from his tour with Davy upon the Continent, he pursued the even tenor of his way at the laboratory of the Royal Institution with little interruption; not allowing himself to be distracted from the chosen work of his life by pleasure or profit or applause. Though by following out his researches to their practical application he might have amassed a large fortune, Faraday rejected the glittering bribe when it was already within his grasp, saying, "I felt I was not sent into the world for this purpose." If Faraday was sent into the world for the discovery of truth, then most certainly he accomplished his destiny. For was he not what Tyndall calls him, "the greatest experimental philosopher the world has ever seen"? Though Faraday would not desert his high vocation for emolument, he often did it at the call of his government, of humanity, of civilization, of science. Nothing could have been more distasteful to him than to leave, even for one hour, his quiet walk with Nature, which never cheated however she might elude him, and sit with table-movers and other pretended interpreters of her secrets. After describing the apparatus, which, with great experimental tact, he had devised for exposing the trickery or self-deception of his associates, he writes, "I am a little ashamed of it, for I think, in the present age, and in this part of the world, it ought not to have been required." And again he says, "I think the system of education that could leave the mental condition of the public body in the state in which this subject has found it must have been greatly deficient in some very important principle."

Many scientific men in Great Britain have surpassed Faraday in the clearness, elegance, and eloquence of their writings. But no one, unless it were Davy, possessed to such a degree Faraday's gift of imparting to others, in the lecture-room, what he had discovered for himself. If, as De la Rive said of him, he was never caught in a mistake in his laboratory, "the hand marvelously seconding the resolves of the brain," we may add that he seldom disheartened his audience by the miscarriage of an experiment, destroying the spell by which he had hitherto bound them. Though he was less dramatic, we might almost say less theatrical, in his style of address than Davy, he never failed to attract an admiring crowd, not only of the thoughtful and the educated, but of the gay and the high-born. He was equally at home with the juvenile audiences which listened to him during the Christmas holidays.

For fifty years Davy and Faraday together had sustained the glory of the Royal Institution as with the brightness of a whole Academy; each of them of unchallenged greatness, not only as discoverers of physical truths, but as expositors also. In Davy was found a rare combination of poetry and science. Coleridge, it was said, frequented his lectures "to increase his stock of metaphors." Davy preferred the blazing battery of the Royal Institution to the chemist's balance. His generalizations were bold and dazzling. Quality and not quantity excited his mind. In ten years he stood on the pinnacle of fame. He was knighted; he was courted; and then his position at the Royal Institution was almost honorary. Faraday relied less on his imagination and more on his experiments. Brilliant as were his triumphs, they were won by hard work. His whole scientific life was one protracted campaign, and that was a war of posts and not a succession of brilliant charges. He prized the recognition of academies and universities, but not the insignia of rank. Without leisure for fashionable society, he enjoyed preaching to the humble sect of Christians to which he belonged as much as lecturing before princes and nobles, either of birth or of intellect, at the Royal Institution.

It is little to say of such a man that he was made a Fellow of the Royal Society of London in 1824, a Corresponding Member of the French Academy of Sciences in 1823, a Foreign Associate of the American Academy in 1844; that his name was eagerly sought to adorn the list of honor of all other Academies in Europe and America; that he received from the Royal Society of London the Rumford, Copley, and Royal medals; that his simple life was made independent by a pension of £300, conferred upon him in 1835; that Napoleon the exile was instructed by his lectures, and Napoleon the Emperor acknowledged the obligation by naming him Commander of the Legion of Honor.

It is much to say of him that he declined all honors and rewards which were foreign to his scientific character; that, when he might have amassed a fortune of £150,000 by applying old discoveries to commercial uses, he preferred to concentrate his whole mind on the discovery of new truth, dying poor and leaving a widow dependent on a small pension, which, in noble imitation of his example, she refused to have increased; that he ruled a strong nature so as to be always gentle, and only impatient of those who unnecessarily wasted his time; that he was as much exalted above others in modesty as in intellectual greatness; that he made science honorable and attractive; that he ruled with imperial sway the hearts no less than the intellects of his generation, and that his final departure from the laboratory in the Royal Institution of Great Britain on the 20th of June, 1862, was followed by one universal pang of grief throughout the world of

science. Long and loudly and perseveringly had Faraday knocked at the secret gates of nature, and most encouraging were the responses which, from time to time, he had received. Nevertheless, he finds it in his heart to say, "I have never seen anything incompatible between these things of man which can be known by the spirit of man which is within him and those higher things concerning his future which he cannot know by that spirit."

Faraday, with a wise precaution which consulted the convenience of others no less than his own reputation, made a timely collection of his scattered publications, and placed them in a compact and permanent form suited to the private library of the student of science. His "Series of Experimental Researches upon Electricity," amounted to thirty; all but one of which are now contained in three volumes, published successively in 1839, 1844, and 1855. These Researches are illustrated by other papers upon the same subject originally printed in the "Philosophical Magazine," or in the "Journal and Proceedings of the Royal Institution," as the Researches themselves were in the "Philosophical Transactions." Faraday's "Experimental Researches in Chemistry and Physics" fill a fourth volume which appeared in 1859. Also, under his sanction and partly from his notes, have been printed, "Six Lectures on the Non-metallic Elements," in 1852; "Six Lectures on the Various Forces of Matter," in 1860; and "Six Lectures on the History of a Candle," in 1861.

The first edition of the "Chemical Manipulation" bears the date of 1827. This was followed by an American edition in 1831, and a second English edition in 1842.

PRESIDENT Grant has vetoed the bill which passed Congress allowing the Commissioner of Patents to hear and decide upon the merits of the case of Rollin S. White for an extension of his patent on revolvers. The patentee has received a royalty of $71,000, which the President thinks is enough. This is his first veto.

## UNITED STATES CIRCUIT COURT---SOUTHERN DISTRICT. BEFORE JUDGE BLATCHFORD.

RIVAL SEWING MACHINES—INJUNCTION.

*The Florence Sewing Machine Company* vs. *The Singer Manufacturing Company*.—BLATCHFORD, J.—Without passing, in a plenary manner, upon any of the various questions of law and fact raised and discussed on the motion for an injunction made in this case, I am of a opinion that a due regard for the rights and interests of both parties demands that the injunction, asked for in the bill, should be issued provisionally, subject to conditions—conditions which, in substance, are self-imposed by the plaintiffs in their bill.

An order will therefore be entered, directing that an injunction issue restraining the defendants from giving notice to the plaintiffs of the option, or purpose, or election of the defendants to terminate the license to the plaintiffs, dated February 20, 1868, referred to in the bill, and from attempting to collect from the plaintiff's license fees or patent rent to become due or accrue thereunder, such injunction to continue in force so long, and only so long as the plaintiffs shall continue to deposit with the clerk of this Court all such sums as the patent rent under said license, at the rate of $5 for each machine not exported, and $2 for each machine exported would amount to, for each and every quarter year which shall expire during the continuance of said license and the pendency of this suit, at the several times when the same would fall due by the terms of said license; and further directing that the said clerk shall deposit all sums which shall be so received by him with the United States Trust Company in the city of New York on interest to the credit of this suit, and that such sums shall be subject to the order of the Court to be made in this suit.

E. R. Hoar and A. L. Soule for the plaintiffs; E. W. Stoughton and G. Gifford for the defendants.

## NEW BOOKS AND PUBLICATIONS.

A PRACTICAL TREATISE ON METALLURGY. Adapted from the last German Edition of Professor Kerl's Metallurgy. By William Crookes, F. R. S., etc., and Ernst Rohrig, Ph.D., M.E. In three volumes. Vol. III. Steel, Fuel, Supplement. Illustrated with Wood Engravings. New York: John Wiley & Son, 2 Clinton Hall, Astor Place.

This is the third volume of the most extensive and complete work on metallurgy now existing in the English language, previous volumes of which have been noticed in these columns as they have appeared. To give even a list of the subjects treated would make too great demands upon our space. The three large octavo volumes which compose the entire work, contain a mass of practical information upon metallurgical subjects which entitle the work to be called literally an exhaustive treatise. The volume before us contains one hundred and forty-five wood engravings, and the work is brought down to the most recent processes, which are described with a profuseness of detail and thoroughness of treatment never excelled in any work of a similar character ever brought to our notice

THE ARCHITECTURAL REVIEW AND AMERICAN BUILDERS' JOURNAL. Edited by Samuel Sloan, Architect, and published by Claxton Remsen & Haffelfinger, 819 and 821 Market street, Philadelphia.

This is the leading American periodical devoted to architecture. It is beautifully printed, and edited with singular ability. Every number contains, besides able editorials and art miscellany, original designs for buildings of various styles, and engravings of beautiful structures, which cannot fail to elevate the architectural and artistic taste of the country.

THE WORKSHOP

is one of the most beautifully illustrated journals devoted to industrial art published in Europe or America. The publisher, E. Steiger, 22 and 24 Frankfort street, New York, has prepared and published "The Workshop Album," being a selection of engravings from the back volumes of "The Workshop," for the years 1863 to 1867 inclusive, containing the cream of the designs published during three years and forming a valuable addition to any art collection. Price of "Album," $3·00; to yearly subscribers to "The Workshop," $2·00.

GOOD WORDS, for January.

This magazine opens with the first two chapters of a new story, entitled 'Carlino." Rev. Charles Kingsley contributes a short sketch under the title of "The Air-Mothers," and Dr. McLeod the editor, the first of a series of papers on "Days in North India." The latter article is profusely illustrated, as also is "A Visit to the Country of the Vaudois," by Samuel Smiles. The most noticeable article in the present number is that by Dean Alford, on 'The Christianity of the Present and of the Future. "Good Words" is, in our judgment, the best magazine now published for the home circle. J. B. Lippincott & Co., Philadelphia, publisher. Terms, $2·75 a year.

THE SCIENTIFIC PRESS,

Published by Dewey & Co., San Francisco, Cal., is an eminently popular and useful weekly, devoted to the interests of mining, farming, and the mechanic arts. Its contents are always varied and interesting.

WE are in receipt of the Report of the Department of Agriculture from the Hon. Horace Capron, United States Commissioner of Agriculture. It is replete with valuable statistics and information, upon which we shall draw liberally for the benefit of our readers. Commissioner Capron will please accept our thanks.

A NEW candidate for public favor to which the publishers, H. O. Houghton & Co., 135 Washington street, New York, and Hurd & Houghton, 459 Broome street, New York, have given the name of "Old and New," ranks among the first of American monthlies in point of literary excellence, and must, we think, inevitably secure a large share of popular favor. The contents of the first number are diversified, and contributed by eminent authors. One of them, a biographical sketch of Michael Faraday, by Prof. Joseph Lovering, we republish in another column, accompanied by a life-like portrait of that eminent physicist.

BY the courtesy of Mr. William H. Clarke, Principal Assistant City Engineer, Chicago, who will please accept our thanks, we are in receipt of the Eighth Annual Report of the Board of Public Works of that city, which is a very interesting and instructive document.

"THE NATION" as a critical, political, and literary journal, stands at the head of the weekly press. We consider it in all respects one of the most high-toned and able journals on our exchange list.

## Business and Personal.

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

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, $4·00 a year. Advertisements 17c. a line.

Agricultural Implements.—Our new List of Discounts will be sent to any Dealer on application to R. H. Allen & Co., 189 and 191 Water st. (Postoffice Box 376), New York.

Parties having a second-hand Roper Caloric Engine for sale, will please address, with price and particulars. George J. Capewell, West Cheshire, Conn.

Eclipse Steam Pump.—The best Pump in use for for all purposes. Send for a circular to Phillips & Cluleys.

Brick Machine Wanted.—Send Circular, with prices, to McPherson Wright, Lott's Postoffice, Edgefield county, S. C.

All Editors of Newspapers and Periodicals of every kind, send specimen copy to L. W. Frederick, Gosport, Owen county, Ind.

Wanted—A Screw-cutting Engine Lathe, 3 or 4 ft. bed. Address, with full description and price, H. M. H., Prickly Pear, M. T.

Telegraph Instruments, Galvanic Batteries, Magnets, Wire, etc. Address C. Williams, Jr., 109 Court st., Boston, Mass.

Round and Square decarbonized bar and sheet steel, in lots to suit, 11c. per pound. Philip S. Justice, 42 Cliff st., N.Y.; 14 N. 5th st., Phil'a.

G. W. Lord's Boiler Powder, 107 W. Girard ave. Phila, Pa., for the removal of scale in steam boilers is reliable. We sell on condition.

Reliable Seeds.—Our New Trade List of Seeds will be sent to the Trade only on application to R. H. Allen & Co., 189 and 191 Water st., (Postoffice Box 376), New York.

Peck's patent drop press. Milo Peck & Co., New Haven, Ct.

A Profitable Investment—For a Company to Manufacture a well-known material now manifoldly applied in the arts. The Factory, consisting of several lots of ground, situated opposite this city, with steam engine and other apparatus, all in full operation. Also, goodwill of the business connected with it, are offered for sale on cash terms. Address M., Postoffice Box 3,948, New York city.

Wanted—Copies of Testimony taken in two suits of equity, brought by the American Wood Paper Co., in 1867. 1st. Against Heft & Co., in the Eastern District of Pa. 2d. Against the Fiber Disintegrating Co., in the Eastern District of New York. Address, stating price, Compiler, 423 Main st., Cincinnati, Ohio.

For Sale—A valuable Patent. J. G. Redline, Lanark, Ill.

Manufacturers, Attention.—Responsible Manufacturers about to remove to the vicinity of New York, would do well to address George S. Bell, South Norwalk, Conn.

Henry F. Piaget, author of "The Watch," dealer in fine watches, watch repairer, etc., late of 119 Fulton st., has removed to 86 Nassau st.

Reliable Seeds.—Our new Seed Catalogue, with descriptions, illustrations, and prices, will soon be issued. Send for one to R. H. Allen & Co., 189 and 191 Water st., (Postoffice Box 376), New York.

For Sale—Or exchange for Western Lands, the whole or one half interest in a 1-set Woolen Mill. Address O. Barnard, Bloomington, Ill.

Aneroid Barometers made to order, repaired, rated, for sale and exchange, by C. Grieshaber, 107 Clinton st., New York.

The Babcock & Wilcox Steam Engine received the First Premium for the Most Perfect Automatic Expansion Valve Gear, at the late Exhibition of the American Institute. Babcock, Wilcox & Co., 44 Cortlandt st., New York.

For best quality Gray Iron Small Castings, plain and fancy Apply to the Whitneyville Foundery, near New Haven, Conn.

Keuffel & Esser, 71 Nassau st., N.Y., the best place to get 1st-class Drawing Materials, Swiss Instruments, and Rubber Triangles and Curves

Foot Lathes—E. P. Ryder's improved—220 Center st., N. Y.

Those wanting latest improved Hub and Spoke Machinery, address Kettenring, Strong & Lauster, Defiance, Ohio.

For tinmans' tools, presses, etc., apply to Mays & Bliss, Brooklyn, N. Y.

Mill-stone dressing diamond machine, simple, effective, durable. Also, Glazier's diamonds. John Dickinson, 64 Nassau st., New York.

Send 3-cent stamp for a circular on the uses of Soluble Glass, or Silicates of Soda and Potash. Manufactured by L. & J. W. Feuchtwanger, Chemists and Drug Importers, 55 Cedar st., New York.

Glynn's Anti-Incrustator for Steam Boiler—The only reliable preventative. No foaming, and does not attack metals of boiler. Liberal terms to Agents. C. D. Fredricks, 587 Broadway, New York.

For solid wrought-iron beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Machinists, boiler makers, tinners, and workers of sheet metals read advertisement of the Parker Power Presses.

Diamond carbon, formed into wedge or other shapes for pointing and edging tools or cutters for drilling and working stone, etc. Send stamp for circular. John Dickinson, 64 Nassau st., New York.

To ascertain where there will be a demand for new machinery or manufacturers' supplies read Boston Commercial Bulletin's manufacturing news of the United States. Terms $4·00 a year.

Agricultural Implements—Descriptive and Priced Circulars of any Implement, Machine, or Small Tool needed on a Farm, Garden, or Plantation; will be sent on application, accompanied by stamp, to R. H. Allen & Co., 189 and 191 Water st., (Postoffice Box 376), New York.

Winans' boiler powder, 11 Wall st., N. Y., removes Incrustations without injury or foaming; 13 years in use. Beware of Imitations.

### The Architectural Review

And Builder's Journal—the First and Best Periodical of the kind in the country, with practical details to the Builder and Architect, and much useful information to the general public. Profusely illustrated. Terms $6 per annum. SLOAN & GOODRICH, Editors, etc., Philadelphia. Sold by publishers and news agents everywhere.

THE NEW YORK TIMES has some severe but true remarks, from which we quote: "Another illustration of the indifference to improvement is shown in the practice of Gas Companies in lighting street lamps. The lamps of European cities are lighted by a Torch, the operation being, literally, quick as a flash. Here labor is far dearer than in Europe, and yet the Manhattan Co. has but recently begun to use the Torch. Other Companies still send round a man with a ladder, with which he climbs the posts, turns on the gas, then takes a match from his pocket, scratches it upon the post and lights the gas, the process taking about three times as long as the new one, carrying all who see it back almost to the middle ages." "This improved method of lighting street lamps, referred to by the *Times*, is the same to which we have called the attention of those interested in lighting street lamps, as being not only a great improvement, but the best, of which the full particulars may be obtained from Mr. J. W. Bartlett, of 589 Broadway, New York, who is proprietor of the Patents."—[EDS. GAS LIGHT JOURNAL.

## Answers to Correspondents.

*CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; besides, as sometimes happens, we may prefer to address correspondents by mail.*

*SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisemets at $1·00 a line, under the head of "Business and Personal."*

*All reference to back numbers should be by volume and page.*

J. W. S., of Miss.—All other things being equal, the power of a screw is increased or lessened as the pitch is increased or lessened and in the same proportion. The ordinary formula given in text books for computing the powers of screws does not take friction into account. Friction in a screw is, however, greatly influenced by the abruptness of the incline of the thread, and this, of course, depends upon the ratio of the pitch to the diameter. Screws, to work well, should have their diameters properly proportioned to their pitch, but this subject can not be discussed in the limits of an answer to a query.

J. G. E., of N. Y.—You may give a gold color to cast iron by gilding, bronzing, or—first coating with tin—by the use of a suitable lacker. The cheapest way for large articles is to use bronze or mosaic gold. The castings are first to be heated hotter than the hand can bear but not so hot as to burn the varnish, and coated with German gold (Mosaic gold) mixed with a small quantity of alcohol varnish. If the iron is polished, it must first be heated and rubbed over with a rag dipped in vinegar.

H. B. R., of Ill.—If a boiler makes dry steam, there is, in our opinion, no economy in superheating. To construct a brick flue over a horizontal boiler of the kind you describe, with a view to superheating the steam thereby, would, in our opinion, result only in loss. If the boiler is exposed so that the loss by radiation is great, you will find it economy to clothe it with felt. Bricking-in a boiler will, of course, prevent radiation to a considerable extent, but to attempt to superheat steam in that way proposed would prove unprofitable.

L. W. E., of Pa.—The explosion of the oil still which you describe as occurring five hours after the still had been stopped running and the manhole opened, is without doubt correctly attributed by you to the firing of gas generated therein mixed with air. The cause of ignition seems involved in mystery, and with the data you furnish we are unable to come to a conclusion in regard to it.

G. A., of Ind.—There should be no difficulty in making a good, practically water-tight cellar by the use of good water cement, and any mason worthy of the name ought to know how to do it. Of course if water gets under a cement bottom, it may break it up by its upward pressure, but this could not occur in ordinary cases.

J. W. W., of Conn.—The coloring of oak timber steamed in iron tanks, is probably due, as you suppose, to the formation of tannate or gallate of iron. A remedy would be to coat the interior thoroughly with asphaltum, or to substitute wooden steam boxes for the iron.

H. K. B., of Va.—Soapstone is valuable and useful for lining stoves and furnaces, and stoves are made composed almost wholly of it. It is also employed for making certain cooking utensils, slate pencils, etc. A quarry of good soapstone is good property if easily accessible.

W. S., of Wis.—The power on your windlass being exactly one half the weight (not taking into account the weight of suspending chain), the length of lever required to balance power and weight will be twice the distance from the center of the windlass to the circumference.

G. W. Clarke.—We do not know of any thing we can recommend for general use better than good oil paint for external application to brick walls of buildings, to obviate the ill effects of moisture upon them.

A. D., of Ind.—We do not desire at present to renew the discussion upon force and resistance. We must be the judges of what will best suit our readers.

H. M. R., of N. Y.—The reason why your article was not published, was that we did not wish to continue an unprofitable discussion.

W. M. H., of Ohio.—The recipe for recutting old files with acids may be found on page 122, volume XVIII, of the SCIENTIFIC AMERICAN.

J. C. G., of Pa.—Scrap steel may be melted over in crucibles and recast into ingots without alteration.

## Recent American and Foreign Patents.

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

WATCH.—S. D. Engle, Hazleton, Pa.—This invention consists in a protecting ring or band around the watch movement, and attached thereto.

BITSTOCK.—R. S. Hildreth, South Adams, Mass.—This invention relates to new and useful improvements in bitstocks or braces, for holding and operating boring bits.

SASH AND DOOR CLAMP.—G. H. Hall and Lorenzo D. Farra, Germantown, Pa.—This invention relates to a new and useful improvement in clamps for putting together sashes and doors, and for other purposes, whereby the operation is greatly facilitated.

CAR-AXLE LUBRICATOR.—T. J. Meoers, Blossburg, Pa.—This invention relates to improvements in devices for lubricating the axles whereon the wheels run loosely, and consists of a valve arrangement applied within the reservoir on the wheel hub, for keeping the supply passage always closed by action of a spring, and under an arrangement whereby it may be readily opened to fill the reservoir. The invention also consists in an arrangement of the absorbent material for supplying oil between the ends of the whee and the collars, as well as to the axle.

VELOCIPEDE SLEIGH.—D. M. Anderson, Twinsburg, Ohio.—This invention relates to improvements in means for propelling and guiding sleighs by the rider, and consists in the application of a spike wheel, foot crank shaft, driving wheels, and belts, for propelling, and guiding shoes, under an improved arrangement whereby the rider may propel the spike wheel with his feet, and thereby draw the sleigh along over the ice, or swerve and guide it at the same time with his hands.

FEATHER DUSTER.—M. A. Goodenough, New York city.—This invention consists in the manner in which the flexible connection between the center and the base of the brush is formed.

WASHING MACHINE.—A. J. Wilcox, Fall River, Mass.—This invention relates to a new and useful improvement in machines for washing clothes.

CARD HOLDER.—Charles F. Wilson, Brooklyn, N. Y.—This invention relates to a new and useful improvement in a device for holding cards, whereby durability, cheapness, and simplicity are combined, while the position of the card is secured in the most effective manner.

ROTARY ENGINE.—S. M. Snyder, Brady, Pa.—This invention consists in combining with the hollow revolving piston of a rotary steam engine two or more diametrical sliding valves, placed at right angles to each other said valves being made bulging at the central parts which are within the cylinder.

GUN LOCK.—N. C. Lock, Salem, Mass.—This invention relates to a new and useful improvement in locks for firearms, whereby they are made safer to carry and to handle than when furnished with the ordinary lock.

LOCOMOTIVE WATER PIPE.—Frank Gerrard, Kansas City, Mo.—This invention relates to a new and useful improvement in the construction and arrangement of feed water pipes for locomotives at railroad watering stations.

CLAY CRUSHER.—Alfred Hall, Perth Amboy, N.J.—This invention relates to a new and useful improvement in machines for crushing clay and other similar substances, and consists in two cogged and grooved cylinders which are rotated so as to engage with each other, and in combination therewith a series of cleaning bars or scrapers.

CAR COUPLING.—Jerome B. Vedder, Gloversville, N. Y.—This invention relates to a new car coupling, which is so constructed that it will be readily operated without being liable of becoming spontaneously disengaged.

MEAT CHOPPER.—Leopold Steigert, Cincinnati, Ohio.—This invention relates to improvements in that class of meat choppers, wherein a meat-chopping block, revolving on a vertical axis, and reciprocating cutters working in vertical planes, upon the top of the said block are used, and it consists in an improved arrangement in connection with the same of guard plates, to prevent the knives from scattering the meat which adheres to them more or less about the floor or table whereon the machine rests.

SEAT CUSHION.—Richard A. Kendall, Mineral Point, Wis.—This invention relates to improvements in seat cushions for churches, halls, and other places, and consists in providing the same with spring hooks for attachment to the benches in a simple way, and so that they may be readily detached, the said spring hooks being attached to the under, or back sides of the cushions, so as to hook over the front edge of the seat or the top of the back.

SCREWS AND SCREWDRIVERS.—Peter Nelson Jacobus, Flatbrookville, N.J.—This invention relates to an improved screwdriver and screw, whereby a screw may be attached to and held by the screwdriver by means of jaws or clamps, so that the screw may be screwed into a piece of wood, without being held by the hand, or having the hand applied directly to it. The screwdriver is also provided with a countersink cutter, so that the countersink to receive the screw head will be made in the wood simultaneously with the screwing in of the screw. The head of the screw is also made with notches or their equivalents, so that the screwdriver may grasp or hold the screw head firmly while the screw is being screwed into the wood.

FOLDING CHAIR.—C. O. Collignon and N. Collignon, Closter, N. J.—This invention relates to a new method of constructing folding chairs for domestic use, and for other purposes, the object being to so arrange the parts of which the chair is composed that while the structural strength is secured, the chair will admit of being folded up into a very small compass when not in use.

WATER CLOSET.—J. Keane, New York city, and G. H. Brown, Washington Hollow, N. Y.—This invention relates to an improved automatic apparatus for regulating the flow of water to the basins of water closets. The invention consists in adapting to the supply cock a pinion which is caused to turn and open the cock by means of a sector rack on one end of a lever, which has its fulcrum on a central standard.

FERMENTING SUBSTANCES AND GERMINATING GRAIN AND SEEDS.—Rudolph d'Heureuse, San Francisco, Cal.—This invention relates to a mode of improving fermentation and germination, by the introduction of air of proper temperature and moisture into the substance to be acted on, at or near the bottom of the vessel containing the same.

WASHING MACHINE.—H. E. Smith, New York city.—This invention relates to a new washing machine in which the articles to be washed are thoroughly stirred or kept in motion in hot water or steam, without requiring the use of friction, so as to preserve the articles to be washed in good order and condition.

GEARING FOR MULTIPLYING THE MOTION ON A SINGLE SHAFT.—L. S. Fithian, Brooklyn, N. Y.—This invention relates to a new and useful combination of cog wheels, whereby motion may be increased on a single shaft, thereby greatly simplifying the methods in common use for that purpose.

MANUFACTURE OF SIRUP AND SUGAR.—Narcisse Pigeon, Brooklyn, N. Y.—This invention relates to a new process of making a pure syrup and crystallizable sugar sirup from substances whether extracted from indian corn, cereals, or other analogous vegetable product having a chemical formula of $C^{12}$, $H^{10}$, $O^{10}$, or closely allied thereto. It also relates to a process for making a hard crystallized sugar from such sirups. Starch and cellulose in a nearly solid state are the ordinary substances from which it is proposed to make the pure sirup and the crystallizable sugar sirup.

STEAM GENERATORS AND FURNACES.—S. Lloyd Wiegand, Philadelphia, Pa. This invention consists in forming boilers with double tubes in several separable sections, and in combining with boilers so formed, certain devices for promoting the activity of the circulation of water therein contained, and thus promoting the cleanliness, efficiency, and durability thereof, and further in the improvement of the furnace, which is so adapted and applied to said boilers that very great economy of fuel together with perfect facility of inspection and repairs are cheaply secured.

SELF-ACTING SPINNING NEEDLE.—S. D. Paul and S. S. Cook, Woonsocket R. I.—These improvements are mainly designed for spinning woolen yarn, but some of them are applicable to spinning cotton, and the invention consists in the general construction and arrangement of a self-actor spinning mule, to produce the movements common to such machines by new arrangements of the operating parts.

MACHINERY FOR BUBBING AND MIXING PAINTS, CHEMICALS, FERTILIZERS, AND OTHER SUBSTANCES.—Robert Poole, Baltimore, Md.—The machine which is the subject of this invention has for its object mainly the mixing of paints and chemicals, but may be used for mixing or rubbing any soft, pasty, gummy, glutinous, or resinous substances; and the invention consists, first, in combining with a pan, tub, or other suitable holding vessel revolving horizontally on its support a rubbing or mixing apparatus that turns about its support within or over said pan, tub, or other holder, so that the united movements of the pan or holder, and of the rubbers or mixers shall form or resemble a series of circular lines that cut or cross each other after the manner of "chased" or "lathework," as it is termed. And the invention further consists in combining with a revolving pan, tub, or other suitable revolving holding vessel, and the rubbing or mixing apparatus, a guide or scraper for turning and directing the material that is being rubbed or mixed out of the path of the rubbers or mixers when desired.

STEAM GOVERNORS AND VALVES.—Francis Johnston Nutz, Philip Estes' De Forrest Fairchild, and Edward Payson Willson, Leavenworth City, Kansas.—These improvements relate to centrifugal ball governors for regulating the motion of steam engines, water wheels, and otherwise, and they consist, first, in a device for controlling the action of ordinary ball governors, so that they shall more perfectly perform their function as regulators of machinery to make the motion uniform and steady; secondly, in a device to be applied to governors for the purpose of preventing the joints and valves from gumming or becoming rough and dirty with scale and oil, causing them to work stiff. This improvement consists in stepping the governor spindle in the valve stem in such manner as to produce a "bobbing" or saltatory motion which keeps all the parts moving continuously, and thereby always in good working condition.

COMPOUND FOR TANNING LEATHER.—Louis Henry Dennis and Otho Richard Brown, Stafford Springs, Conn.—The object of this invention is to produce a tanning compound by which the leather can be completely and satisfactorily tanned without requiring the use of the ordinary bark extract now used. The invention consists in a combination of catechu, commonly known under the name of cutch, with common lye, in various proportions.

SUBMARINE TELESCOPIC LANTERN.—Henry Thompson, Mobile, Ala.—This invention relates to improvements in submarine lanterns, the object of which is to provide a more useful lantern than any now employed for the same purpose. It consists in the application to a lantern of an improved means for supplying air for the support of combustion, and also for the protection of the lamp. Also of an improved means for supplying the lamp with gas from a reservoir above the surface of the water. Also in the application of a telescopic attachment for the better observance of the objects to be inspected.

STEREOSCOPE.—John Francis Adams, New York city.—This invention relates to new and important improvements in instruments used in viewing stereoscopic or photographic pictures, and consists mainly in the use of magnets for receiving and holding the pictures in the proper position for being viewed.

CORN PLANTER AND CULTIVATOR.—Nathan Breed, Jeffersonville, Ind.—This invention has for its object to improve the construction of the improved corn planter, patented by the same inventor, April 6, 1869, and numbered 88,604, so as to make it more convenient, satisfactory, and effective in use.

ORGAN.—John R. Mortimer, New York city.—This invention has for its object to improve the construction of the action mechanism of organs, so that the palate may be operated to make the pipes speak by the pressure of the wind in the wind chest, thus greatly lessening the labor of playing the organ.

DOOR REST.—Frederick W. Gammell, Spring Valley, Iowa.—This invention has for its object to support the door when closed, and also when swinging open and shut, so as to prevent the hinges from being worn and the door from sagging or warping, and which shall be simple in construction and easily applied to the door.

POTATO PLANTER.—S. T. Godfrey, Seaville, N. J.—This invention has for its object to furnish a simple, convenient, and effective machine for planting potatoes, and which shall be so constructed and arranged as to drop a portion of some suitable fertilizer upon the seed before it is covered.

SPOKE TENONING MACHINE.—J. P. Crutchfield and C. T. Whitten, Longmire's Store, S. C.—This invention has for its object to furnish a simple and convenient machine, by means of which the spokes of wheels may have the tenons formed upon their outer ends easily and accurately.

TIME REGISTER FOR VELOCIPEDES, ETC.—Auguste Courvoisier, Denver, Colorado.—This invention has for its object to furnish an improved time register, for use in velocipede schools, livery stables, pleasure boats, billiard rooms, and other places where articles are rented by the hour, and which shall be so constructed and arranged that the party holding the key can easily know by reference to the register how long it has been in his possession.

PORTABLE FENCE.—Jacob Fox, Bucyrus, Ohio.—This invention has for its object to furnish an improved portable fence, which shall be so constructed and arranged that it may be easily erected, taken down, and moved from place to place, which will stand equally firm upon uneven or hilly or level ground, and which may be easily adjusted for use as a flood gate.

RAILROAD CAR TRUCK.—Isaac Dripps, Fort Wayne, Ind.—This invention has for its object to furnish an improved railroad car truck, which shall be simple in construction, strong, and durable, cannot be knocked out of square, and will be sufficiently flexible to allow each side of the truck frame to accommodate itself to inequalities of track, thereby relieving the wheels from any undue shocks from bad joints, or other unevenness of the rails.

WATER WHEEL.—Edward M. Buckley, Amenia Union, N. Y.—This invention has for its object to furnish an improved water wheel, simple in construction and effective in operation, utilizing a larger per cent of the power of the water and running with a less head of water than the wheels constructed in the ordinary manner.

CHAIR.—Charles R. Long, Louisville, Ky.—This invention has for its object to furnish a simple, strong, durable, and cheap chair, which shall be so constructed and arranged that it may be transported by any conveyance in the "knock-down state," and to which the detached seats can be easily and conveniently attached when desired.

COAL SCUTTLE.—Frank L. Blair, Allegheny, Pa.—This invention has for its object to improve the construction of coal scuttles, hods, or buckets, so as to make them much more durable without materially increasing the cost of manufacture.

GRASS AND GRAIN HARVESTER.—J. F. Crawford, New York Mills, N. Y. This improvement relates to a new method of connecting a finger bar with the main frame of a harvester, with the the object of admitting of its being turned from one side of the machine to the other, so that it will mow equally well on either side of the machine.

UMBRELLA LOCK.—Hiram Plumb, Frankford, Pa.—The object of this invention is to devise a simple lock by which the runner of an umbrella, when the same is closed can be locked to the handle, so that unauthorized persons may be prevented from using the umbrella. A simple key will readily open the umbrella and admit of its removal.

WIRE CRADLE.—L. Chevallier, Williamsburgh, N. Y., and R. Brass, Waterbury, Conn.—This invention relates to a new cradle, which is made of wire netting, for the purpose of being at all times well ventilated, light, strong, and not very costly. The wire basket, or body of the cradle, is placed upon a rocker frame which can be of suitable material.

CRYSTAL GRINDER.—J. S. Warner, Ogdensburgh, N. Y.—This invention relates to an improved chuck, to be used for grinding crystals for watches, either on the edges to reduce the diameters, or on the sides of the edges, and consists of a cup-shaped chuck, fitted to be attached to the lathe mandrel at the base, and provided with a face plate capable of being readily attached to the edge or the part resembling the top of the cup, or detached therefrom. The face of the crystal is ground against the side of this plate, using emery and oil, and holding it by first attaching it to a stick by sealing wax or otherwise, and when the face is sufficiently ground the plate is removed and the edge finished inside the cup-shaped part.

LETTERING BLOCK.—Edward J. Griffin, Hart's Falls, N. Y.—This invention relates to improvements in "blocks" used by marble cutters and others in laying out letters previous to cutting or painting them, and consists in the combination with such blocks of certain devices, by which to guide the pencil in marking all the different straight lines required, whether horizontal, vertical, or inclined, and adapted for pyramidal, rectangular, or other formed stones; also adapted for spacing and for adjustment readily to the different conditions required.

BARREL STAVE CLAMP.—Edmund Doremus, Rondout, N. Y.—This invention relates to a new device for holding barrel staves while the same are being cut for jointing, and has for its object to make the apparatus adjustable for barrels of various shapes and sizes.

PAPER ENGINE.—Ebenezer Hawkins, Islip, N. Y.—This invention relates to certain improvements in the "beating engine" used for the treatment of "half stuff," and has for its object to provide more rapid and continuous action than could be obtained in the ordinary oval vat single cylinder The invention consists in the arrangement and use of an annular vat or cistern, together with two or more beating cylinders, all arranged so as to produce continuous and rapid action.

LOOM.—Rudolph Webendorfer, New York city.—This invention has for its object to construct a positive motion loom in which the shuttle is not pushed ahead, and at the same time to do away with the belt, chain, or other constant connection with the shuttle.

REVOLVER-CYLINDER.—B. R. Hill, Cranston, R. I.—The object of this invention is to so construct the cylinders of revolving fire-arms, that the same may be placed with either end against the stock, so that they can be fired from either end. The invention consists chiefly in providing ratchets or their equivalents on both ends of the cylinders, so that the rotating mechanism may act upon them at either end. The invention consists also in the arrangement of conical apertures through such cylinders, which are so distributed that the cylinder may at once contain two sets of cartridges, one set being put in from either end.

SAFETY VALVE.—T. S. La France, Elmira, N. Y.—This invention relates to a new safety valve for steam boilers, and has for its object to adapt the valve to any desired degree of steam pressure, so that it will be opened by the steam whenever the same will reach the said degree of pressure, and that it can also be raised off the seat by a separate apparatus whenever steam is to be blown off.

PERAMBULATOR.—J. A. Crandall, Brooklyn, N. Y.—This invention has for its object to so improve the children's carriages, known as perampulators, that the same can be readily steered by the person pushing the same forward. Heretofore these vehicles had the front axles fixed or hung so that they could not be swung for steering, and the hubs of the front wheels were consequently chafed and injured, whenever curves were described. In order to overcome this inconvenience, the front axle is pivoted at the middle to the frame, and connected with the rear handle, so that by means of such rear handle the vehicle may be readily steered.

APPARATUS FOR PRODUCING MOTIVE POWER.—Wm. C. Stiles, Nevada City, Cal.—This invention consists in arranging a series of hydraulic bellows around the perimeter of a vertical wheel, and operating them by means of cams on the spindle upon which the wheel runs, so as to force the water from one bellows into another at certain points of the wheel's revolution. The weight of the water thus transferred from one point of the perimeter to another rotates the wheel and furnishes the motive power.

HOTEL COMMUNICATOR.—N. A. Patterson, Nashville, Tenn.—This invention relates to improvements in apparatus for use in hotels, business houses, steamboats, depots and the like, for communicating the wants of the occupants of the rooms to the clerk, at headquarters, in a way to save the time and labor now required, in answer to the bell calls from the rooms, of a journey to the rooms by the servants afterwards, to be told by the occupants what is wanted.

BRIDGE.—H. S. McDowell, Columbus, Texas.—The object of this invention is to provide certain improvements in the construction of bridges, whereby the parts thereof of wood may be readily removed for the substitution of others when decayed or broken, without interfering with the use of the bridge or weakening it. The invention also has for its object to provide certain improved arrangements of the parts calculated to simplify the construction and increase the efficiency of the same.

# Official List of Patents.

## Issued by the United States Patent Office.

FOR THE WEEK ENDING JAN. 11, 1870.

*Reported Officially for the Scientific American*

SCHEDULE OF PATENT OFFICE FEES:

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| On each caveat | $10 |
| On filing each application for a Patent (seventeen years) | $15 |
| On issuing each original Patent | $20 |
| On appeal to Commissioner of Patents | $20 |
| On application for Reissue | $30 |
| On application for Extension of Patent | $50 |
| On granting the Extension | $50 |
| On filing a Disclaimer | $10 |
| On an application for Design (three and a half years) | $10 |
| On an application for Design (seven years) | $15 |
| On an application for Design (fourteen years) | $30 |

In addition to which there are some small revenue-stamp taxes. Residents of Canada and Nova Scotia pay $500 on application.

*For copy of Claim of any Patent issued within 30 years* ..... $1
*A sketch from the model or drawing, relating to such portion of a machine as the Claim covers, from* ..... $1
*upward, but usually at the price above-named.*
*The full Specification of any patent issued since Nov. 20, 1866, at which time the Patent Office commenced printing them* ..... $1'25
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98,656.—SCREW AND NUT FOR CLAMPS, ETC.—John Adt (assignor to the Judd Manufacturing Company), New Haven, Conn.
98,657.—VELOCIPEDE-SLEIGH.—D. M. Anderson, Twinsburg, Ohio.
98,658.—PROCESS OF CLEANING COTTON WASTE AND OTHER FIBERS FROM OIL, ETC.—H. M. Baker, Washington, D. C.
98,659.—STOVEPIPE ELBOW.—P. J. Biesenbach, Rochester, N. Y.
98,660.—RETAINER FOR NECKTIE.—J. B. Bishop, New Haven, Conn.
98,661.—COAL-SCUTTLE.—F. L. Blair, Allegheny, Pa.
98,662.—REFLECTOR.—E. C. Blakeslee (assignor to the Benedict & Burnham Manufacturing Company), Waterbury, Conn.
98,663.—CORN PLANTER AND CORN CULTIVATOR.—Nathan Breed, Jeffersonville, Ind.
98,664.—CANE AND WHIP COMBINED.—C. L. Bushnell, Jefferson, Ohio.
98,665.—TURBINE WATER-WHEEL.—H. A. Chadwick, Burnet, Texas. Antedated Dec. 29, 1869.
98,666.—MACHINERY FOR CUTTING BARREL HEADS.—Philander Chase, Peoria, Ill.
98,667.—LIQUOR METER.—W. F. Class and Wilhelm Napp, Cleveland, Ohio.
98,668.—ICE CREEPER.—W. B. Coates (assignor, for one half, to Joseph Leeds), Philadelphia, Pa.
98,669.—TIME REGISTER FOR HIRING PURPOSES.—Auguste Courvoisier, Denver, Colorado Territory.
98,670.—CHILDREN'S CARRIAGE.—J. A. Crandall, Brooklyn, N. Y.
98,671.—HARVESTER.—J. F. Crawford, New York Mills, N. Y.
98,672.—RAILWAY CAR SPRING.—D. G. Daniels, Chicago, Ill.
98,673.—MOLD FOR CASTING METALS.—Henry Davies, Covington, Ky.
98,674.—ADJUSTABLE ATTACHMENT OF PUMP BARRELS TO THEIR BASES.—J. W. Douglas (assignor to W. & B. Douglas), Middletown, Conn.
98,675.—RAILWAY CAR TRUCK.—Isaac Dripps, Fort Wayne, Ind.
98,676.—ANCHOR FOR SECURING CORES IN MOLDS.—Zabina Ellis, Philadelphia, Pa.
98,677.—DUST RING FOR WATCH FRAMES.—S. D. Engle, Hazleton, Pa.
98,678.—PROGRAMME CLOCK.—S. F. Estell, Richmond, Ind
98,679.—WASH BOILER.—Thomas Evans, Newark, N. J.
98,680.—VAPOR BURNER.—J. E. Finley, Memphis, Tenn.
98,681.—RAILWAY CAR AXLE COUPLING.—D. F. Fetter, New York city.
98,682.—FENCE.—Jacob Fox, Bucyrus, Ohio.
98,683.—RAILROAD PUSHING JACK.—Alfred Freeman, Peoria, Ill.
98,684.—LATCH.—F. W. Gammell, Spring Valley, Iowa.

98,685.—WATER SUPPLY PIPE FOR LOCOMOTIVES.—Frank Gerrard, Kansas City, Mo.
98,686.—WATER METER.—Othniel Gilmore, Raynham, Mass.
98,687.—POTATO PLANTER.—S. T. Godfrey, Seaville, N. J.
98,688.—GLOBE VALVE.—E. J. Gould, Milwaukee, Wis.
98,689.—DROPPING DEVICE FOR HARVESTERS.—O. C. Green, Dublin, Ind.
98,690.—MEDICAL COMPOUND.—H. H. Grigg, Philadelphia, Pa.
98,691.—PAPER ENGINE.—Ebenezer Hawkins, Islip, N. Y.
98,692.—RAG CUTTER.—J. W. Barbour, Winooski Falls, Vt. Antedated Dec. 29, 1869.
98,693.—SICKLE GRINDER.—A. B. Jones, Lowell, Wis.
98,694.—WINDOW BUTTON.—Morton Judd and A. D. Judd, New Haven, Conn.
98,695.—SAW SWAGE.—Simon Kinney, Bignellville, N. Y.
98,696.—MACHINE FOR DRESSING FELLOES.—Henry Kurtz, Washington, D. C.
98,697.—SAFETY VALVE.—T. S. La France, Elmira, N. Y.
98,698.—WRENCH.—A. B. Lipsey, New York city.
98,699.—BRIDGE.—H. S. McDowell, Columbus, Texas.
98,700.—HARVESTER.—Christina J. Miller, administratrix of Charles G. Miller, deceased, and Benj. Kersting, Springfield, Ohio, assignors, for one half, to G. W. Heglin and S. D. Graffin.
98,701.—CAR AXLE LUBRICATOR.—T. J. Mooers, Blossburg, Pa.
98,702.—COMBINED PRESS FOR CHEESE, ETC.—C. C. Musselman, Somerset, Pa.
98,703.—CHURN.—J. P. Nichols, New Richmond, Ohio.
98,704.—PICKER FOR WOOL.—S. R. Parkhurst (assignor to E. R. Parkhurst and W. H. Holt), Mont Clair, N. J.
98,705.—COTTON GIN.—Stephen R. Parkhurst (assignor to Emily R. Parkhurst and Warren H. Holt), Mont Clair, N. J.
98,706.—MACHINE FOR MAKING WIRE HEDDLES.—Peter Philip and Franklin Philip, Stockport, N. Y.
98,707.—MACHINE FOR FORGING NAILS FOR HORSESHOES.—Silas S. Putnam, Dorchester, Mass.
98,708.—CORN PLOW.—William B. Raper, Carthage, Ill.
98,709.—SPRING HINGE.—David Renshaw, Brooklyn, N. Y., assignor to Edward P. Bray, Elizabeth, N.Y. Antedated January 8, 1870.
98,710.—RULING DEVICE.—E. H. Robinson, Janesville, Wis. Antedated January 3, 1870.
98,711.—HAY FORK.—Luman Rogers, Pittsburgh, Pa.
98,712.—MODE OF TREATING VEGETABLES TO OBTAIN FIBER FOR PAPER, ETC.—Julius Augustus Rothe, Philadelphia, Pa.
98,713.—SAWING MACHINE.—Cyrus W. Saladee, Circleville, Ohio.
98,714.—CONSTRUCTION OF SAFES, VAULTS, OR DOORS.—James Sargent, Rochester, N. Y.
98,715.—DEVICE FOR CONTROLLING HORSES.—Norman P. Slade, Franklin Grove, Ill. Antedated January 5, 1870.
98,716.—RAILWAY CAR BRAKE.—Erastus Slater, Girard, Pa.
98,717.—PIPE COUPLING.—Edmund Smith, Hamburg, Germany.
98,718.—APPARATUS FOR FEEDING SWINE.—Nathan Stockwell, Ossquaga, N. Y. Antedated December 30, 1869.
98,719.—BEARING FOR RUDDER HEADS.—Retire C. Sturges, Boston, Mass.
98,720.—ADDING MACHINE.—Edward Augustus Swain, New York city.
98,721.—CARRIAGE SEAT.—Samuel Toomey, Wilmot, Ohio.
98,722.—HORSE COLLAR.—J. L. Van Wert, Tolland, Mass.
98,723.—RAILWAY CAR COUPLING.—Jerome B. Vedder, Gloversville, N. Y.
98,724.—CUT-OFF VALVE GEAR.—Charles W. Wailey, New Orleans, La., assignor to New Orleans Pneumatic Propelling Company.
98,725.—MODE OF OPERATING VALVES IN STEAM ENGINES.—George I. Washburn, Worcester, Mass.
98,726.—STEAM GENERATOR.—Francis William Webb, Bolton, England.
98,727.—COMPOSITION RESEMBLING HORN.—William M. Welling, New York city. Antedated January 1, 1870.
98,728.—MOLDERS' FLASK.—Alanson Wilcox, Green Island, N. Y.
98,729.—SHEET-IRON WASH TUB AND BUCKETS.—David Alcorn and John Walsh, New York city.
98,730.—COFFIN.—Wm. G. Algeo, Allegheny, Pa.
98,731.—CAR BRAKE.—Arthur M. Allen, New York city.
98,732.—RAILROAD CAR SPRING.—Timothy F. Allyn, Nyack, N. Y.
98,733.—CAP FOR COFFIN NAILS.—Stephen A. Barker (assignor to New England Toy Company), Providence, R. I.
98,734.—FORCE PUMP.—William Beers and William Raynor, Milan, Ohio.
98,735.—MACHINE FOR JOINTING BARREL STAVES.—John B. Bell, Pittsburgh, Pa.
98,736.—KEY GUARD.—Max E. Berolzheimer, New York city.
98,737.—HARVESTER.—Cornelius R. Brinckerhoff, Rochester, N. Y.
98,738.—CIRCULAR LOOM.—Caroline Bryant (administratrix of the estate of Mertoun C. Bryant, deceased), Lowell, assignor to Wm. J. Towne, Newtonville, Mass.
98,739.—WATER WHEEL.—Edward M. Buckley, Amenia Union, N. Y.
98,740.—PUMP.—Wm. S. Carr, New York city.
98,741.—SCROLL CASE FOR WATER WHEELS.—John Chase, Paterson, N. J.
98,742.—WIRE CRADLE.—Louis Chevallier, Williamsburg, N. Y., and Robert Brass, Waterbury, Conn.
98,743.—FOLDING CHAIR.—Thomas Babbitt Comins, Jun., Lowell, Mass.
98,744.—GAS BURNER.—Joseph W. Cremin, New York city.
98,745.—PAPERING PINS.—C. O. Crosby, New Haven, Conn.
98,746.—MACHINE FOR TENONING SPOKES.—James P. Crutchfield and C. T. Whitten, Longmire's Store, S. C.
98,747.—PIPE TONGS.—Jonathan Dunlap Davis, Fitchburg, Mass.
98,748.—CARTRIDGE BOX.—S. Allan Day, Bowling Green, Ohio.
98,749.—FAUCET.—John H. Dorst, New Albany, Ind.
98,750.—STEP FOR STREET CAR.—Albert A. Duly, New York city.
98,751.—KITCHEN TABLE.—Ferdinand Ehrhardt, Washington, D. C.
98,752.—SASH-ROPE GUIDE.—Winslow W. Fifield, Medford, Mass.
98,753.—OSCILLATING STEAM VALVE.—I. W. Forbes, La Porte, Ind. Antedated Dec. 14, 1869.
98,754.—STEAM ENGINE VALVE GEAR.—I. W. Forbes, La Porte, Ind. Antedated Dec. 14, 1869.
98,755.—BALANCE SLIDE VALVE.—I. W. Forbes, La Porte, Ind. Antedated Dec. 14, 1869.
98,756.—HOLDER FOR BROOMS AND MOPS.—H. L. Franklin and Eugene Clark Nashua, N. H.
98,757.—CIDER MILL.—O. S. Garretson, Buffalo, N. Y.
98,758.—PROCESS OF PRESERVING GREEN CORN.—Washington L. Gilroy, Philadelphia, Pa. Antedated Jan. 1, 1870.
98,759.—FEATHER DUSTER.—M. A. Goodenough, New York city.
98,760.—PROPELLING BOATS ON CANALS.—W. F. Goodwin, Metuchen, N. J., assignor to himself, J. T. Sanford, and G. W. Sanford, New York city.
98,761.—BEEHIVE.—Joseph Gould, Grinnell, Iowa.
98,762.—ADJUSTABLE LETTERING BLOCK.—E. J. Griffin, Hart's Falls, N. Y.
98,763.—WASHING MACHINE.—John Habermehl, Allegheny, Pa.
98,764.—CLAY CRUSHER.—Alfred Hall, Perth Amboy, N. J.
98,765.—SASH AND DOOR CLAMP.—G. D. Hall and L. D. Farra, Germantown, Pa. Antedated Jan. 7, 1870.
98,766.—DRIVEN WELL.—John Harter, Colfax, Iowa. Antedated Jan. 6, 1870.
98,767.—GAS HEATER.—D. G. Haskins, Cambridge, Mass.
98,768.—REVOLVING FIRE-ARM.—Byron R. Hill, Cranston, R. I.
98,769.—PESSARY.—E. F. Hoffman, New York city.
98,770.—CAR COUPLING.—Cornelius F. Hornbeck, Slatersville, N. Y.
98,771.—SEWING MACHINE.—Henry A. House, Bridgeport, Conn.
98,772.—ROTARY PUMP.—C. W. Isbell, New York city. Antedated Jan. 6, 1870.
98,773.—SPELLING BOX.—A. Perley M. Jeffers, Allegan, Mich.
98,774.—HOSE COUPLING.—T. L. Johnson and John Fitzgerald, Rochester, N. Y.
98,775.—CAR COUPLING.—E. B. Keith, Galesburg, Mich.
98,776.—GAS REGULATOR.—Peter Keller, New York city.
98,777.—ENAMELING OVEN.—Victor Keller, Allegheny, Pa.
98,778.—SEAT CUSHION.—Richard A. Kendall, Mineral Point, Wis.
98,779.—WHIFFLETREE COUPLING.—Henry Killam, New Haven, Conn.
98,780.—SHEET METAL CAN.—William M. Lewis, New York city.
98,781.—GUN LOCK.—N. C. Lock, Salem, Mass.
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98,786.—ARTIFICIAL FUEL.—P. M. McGill, Washington, D. C.
98,787.—BRUSH.—Francis McLaughlin, deceased, Boston, Mass. (John Dwyer, administrator.)
98,788.—CAR BRAKE AND STARTER.—J. M. McMaster, Rochester, N. Y.
98,789.—MANUFACTURING AXES.—Henry D. Morris, Baldwinsville, N. Y.
98,790.—PNEUMATIC VALVE FOR ORGANS, ETC.—J. R. Mortimore, New York city. Antedated Jan. 3, 1870.
98,791.—CONCRETE PAVING BLOCK.—Rufus Norwood, Baltimore, Md.
98,792.—SUSPENDING UPPER BERTH IN SLEEPING CARS.—E. H. Paine, Louisville, Ky.
98,793.—FELT SHOE.—C. W. Palmer, Lynn, and C. Houghton, Boston, Mass.
98,794.—COMMUNICATING APPARATUS FOR HOTELS.—N. A. Patterson, Nashville, assignor to himself, T. S. Ramsey, Lenoirs, and D. E. Davenport, Decherd, Tenn.
98,795.—KNOB LATCH.—F. P. Pfleghar (assignor to himself and McLagan & Stevens), New Haven, Conn.
98,796.—SHOEMAKERS' PINCERS.—Theophile Pilote, Marlborough, Mass.
98,797.—LOCK FOR UMBRELLAS.—Hiram Plumb, Frankfort, assignor to himself and W. A. Drown, Jr., Philadelphia, Pa.
98,798.—BOLT-HEADING MACHINE.—F. B. Prindle, Southington, Conn.
98,799.—PRINTERS' RULE.—Conrad Reuter (assignor to "Cincinnati Type Foundery"), Cincinnati, Ohio.
98,800.—CHIMNEY TOP.—C. M. Reynolds, Mifflin, Wis.
98,801.—SCHOOL DESK.—A. E. Roberts, Des Moines, Iowa.
98,802.—STEAM GENERATOR.—J. B. Root, New York city. Antedated Nov. 24, 1869.
98,803.—VISE FOR HOLDING SAWS WHILE BEING SHARPENED.—H. S. Ross, Millville, Ohio.
98,804.—METHOD OF APPLYING ANTI-FRICTION ROLLERS TO WHEELS.—W. B. Scott, New York city.
98,805.—STEAM BOILER FURNACE.—J. Q. C. Searle, Topeka, Kansas.
98,806.—BASE-BURNING STOVE.—J. Q. C. Searle, Topeka, Kansas.
98,807.—APPARATUS FOR ROLLING METAL.—G. H. Sellers, Wilmington, Del.
98,808.—APPARATUS FOR DESICCATING SUBSTANCES.—B. R. Smith and J. C. Harris, Philadelphia, Pa.
98,809.—MEDICINE OR LINIMENT FOR TREATING NERVOUS DISEASES.—J. F. Smith, Forest Hill, Cal.
98,810.—STEAM PUMP.—Thomas Snowdon, G. T. Snowdon, and I. V. Lynn, Pittsburgh, Pa.
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98,812.—MEAT CHOPPER.—Leopold Steigert, Cincinnati, Ohio.
98,813.—WEATHER-BOARD GAGE.—W. E. Stoddard, Fort Edward, N. Y.
98,814.—WATER-CLOSET VALVE.—Herman Strater, Jr., Boston, Mass.
98,815.—ROOFING TONGS.—George E. Taylor, Philadelphia, Pa.
98,816.—APPARATUS FOR EVAPORATING SACCHARINE AND OTHER SOLUTIONS.—Abner Tolles, Weathersfield, assignor to himself and A. D. Tolles, Royalton, Vt.
98,817.—VAPOR BURNER.—W. W. Tyson, Allegheny City, assignor to Philipp Weisenberger, Pittsburgh, Pa.
98,818.—NON-CONDUCTING COMPOSITION FOR COVERING STEAM BOILERS.—J. D. Van Arnum and William Ives, Troy, N. Y.
98,819.—VELOCIPEDE.—Anthony Wanner, New York city. Antedated Jan. 1, 1870.
98,820.—CHUCK FOR GRINDING CRYSTALS.—J. S. Warner, Ogdensburg, N. Y.
98,821.—MILLING MACHINE.—James Watson, Philadelphia, Pa
98,822.—SHUTTLE FOR LOOMS.—Rudolf Webendorfer (assignor to himself and Carl Belter,) New York city.
98,823.—WASHING MACHINE.—Otis H. Weed, Boston, Mass.
98,824.—VAPOR BURNER.—Henry Wellington (assignor to himself and T. P. Doane), Chicago, Ill.
98,825.—JOURNAL BEARING.—Isaac P. Wendell (assignor to himself and S. P. M. Tasker), Philadelphia, Pa.
98,826.—PRUNING SHEARS.—H. Wendt, Elizabeth, N. J., assignor to H. Seymour & Co., New York city.
98,827.—HINGE.—Daniel Werner, St. Louis, Mo.
98,828.—WATER WHEEL.—William M. Wheeler, Berlin, Mass.
98,829.—PLATFORM ATTACHMENT FOR GRAIN SEPARATOR.—John Whiteside, Salinas, Cal.
98,830.—WASHING MACHINE.—A. J. Wilcox, Fall River, Mass.
98,831.—CARD RACK.—C. F. Wilson, Brooklyn, N. Y.
98,832.—VEGETABLE GRATER.—S. M. Wilson, New York city. Antedated Dec. 21, 1869.
98,833.—FLEXIBLE JOINT FOR TUBES.—N. R. Bates, Titusville, Pa.
98,834.—HAMES.—G. J. Letchworth, Auburn, N. Y.

## REISSUES.

92,556.—GRAIN CLEANER.—Dated July 13, 1869; reissue 3,788.—Division A.—Wilson Ager, Washington, D. C.
92,566.—GRAIN CLEANER.—Dated July 13, 1869; reissue, 3,789.—Division B.—Wilson Ager, Washington, D. C.
91,404.—RAILWAY CAR BRAKE.—Dated June 15, 1869; reissue 3,790.—A. M. Allen, New York city.
21,874.—CIDER MILL.—Dated October 26, 1858; reissue 3,791.—John S. Hall and Abel W. Hall, Jeffersonville, Ind., and J. A. Moore, and H. Burkhardt, Louisville, Ky., assignors of John Eberweiser.
63,517.—UMBRELLA SUPPORTER FOR VEHICLES.—Dated April 2, 1867; reissue 3,792.—H. S. Heermance, Claverack, N. Y.
50,489.—MACHINE FOR NECKING CARTRIDGE SHELLS.—Dated Oct. 17, 1865; reissue 3,793.—Brigham Payne, South Coventry, Conn.
8,861.—SMUT MILL AND GRAIN SEPARATOR.—Dated April 6, 1852; reissue 1,564, dated Nov. 3, 1863; extended 7 years; reissue 3,794.—Daniel Shaw, Elkhart, Ind.
42,036.—SEWING MACHINE.—Dated March 22, 1864; antedated May 13, 1862; reissue 3,795.—The Wilcox & Gibbs Sewing Machine Co., of New York city, assignees, by mense assignments, of Charles H. Wilcox.
79,615.—OVEN.—Dated July 7, 1868; reissue 3,796.—Joseph Vale, Beloit, Wis.

## DESIGNS.

3,811.—PRINTERS' TYPE.—T. M. Cash, San Francisco, Cal., assignor to Hagar & Co., New York city.
3,812.—INKSTAND.—Alonzo French, Philadelphia, Pa.
3,813.—PRINTERS' TYPE.—H. Henburg (assignor to Mackeller, Smiths & Jordan), Philadelphia, Pa.
3,814.—SAFE.—Wm. McFarland, Williamsburgh, N. Y.
3,815.—CLOCK FRAME.—G. B. Owen, Winsted, Conn.
3,816.—CASING FOR SODA-WATER APPARATUS.—J. W. Tufts, Medford, Mass.
3,817.—EGG CUP AND SALT STAND.—Geo. Wilkinson (assignor to Gorham Manufacturing Co.), Providence, R. I.


# U. S. Patent Office.

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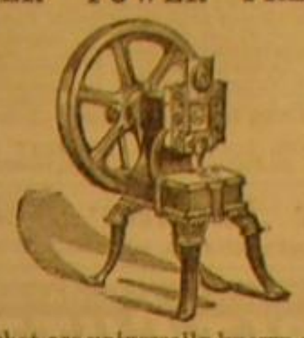

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# SCIENTIFIC AMERICAN

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

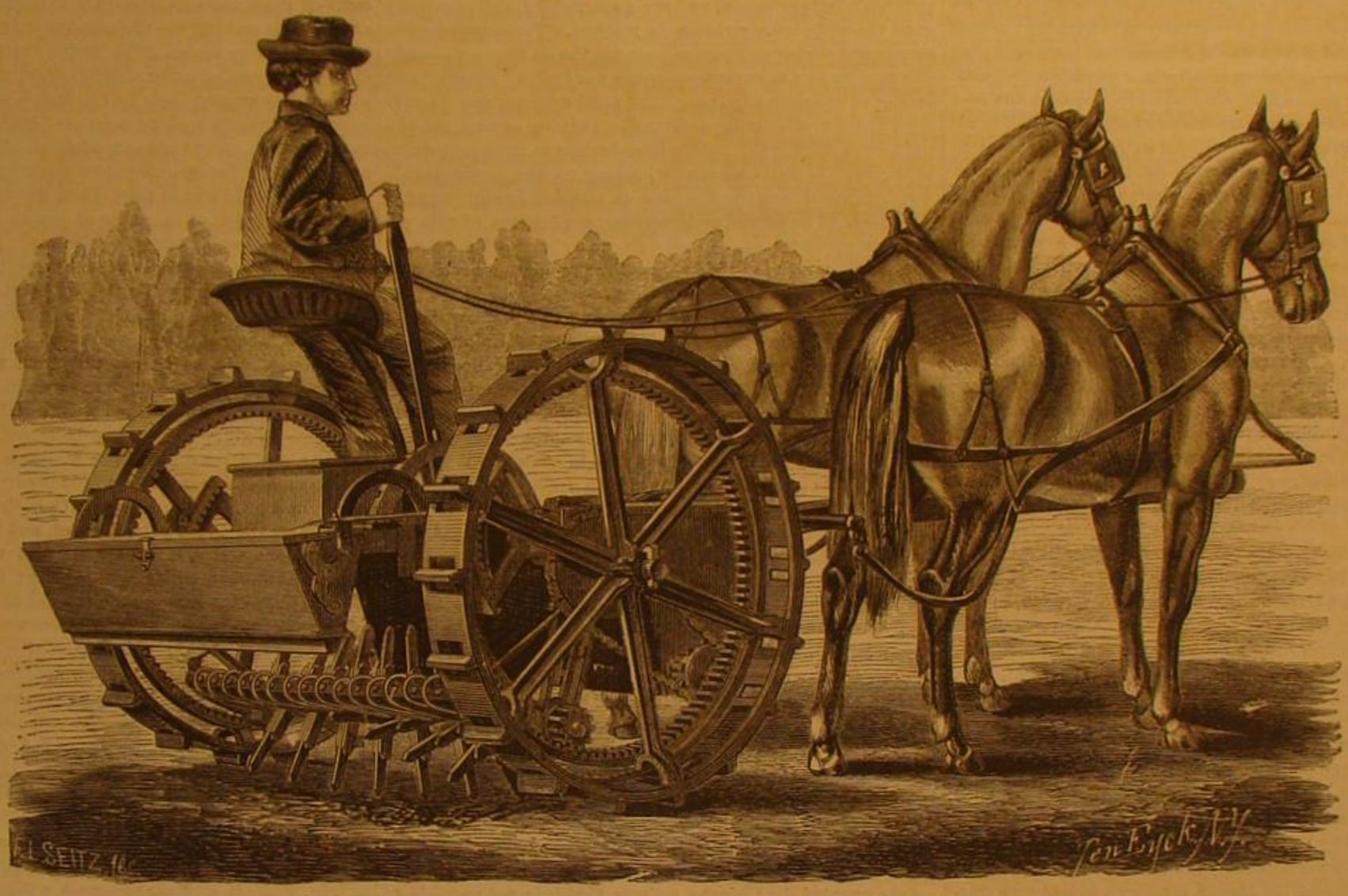
Vol. XXII.—No. 5. [NEW SERIES.] NEW YORK, JANUARY 29, 1870. $3 per Annum [IN ADVANCE.]


### Improvement in Sulky Harrows.

Almost daily our practice as patent solicitors confirms the view often expressed in these columns, that agriculture as an art is undergoing a mechanical revolution. The universal adoption of power machines for cultivating the soil is all that remains to render the revolution complete. The first step in this direction is the attempt which has for some time been in progress to substitute improved machines driven by horse power, for the operations of seeding, harrowing, and cultivating, which in the regular routine succeed the operation of plowing. The machine plow driven either by steam or horse power—most probably the former—will follow in due time.

The machine illustrated herewith is a Maryland invention, and it received a first class premium (a gold medal) at the late State Fair, Maryland.

It performs the operation of what is known as "broadcast" seeding and harrowing simultaneously, and as the inventor assures us, at the rate of from ten to fifteen acres per day; at the same time it distributes uniformly any fertilizers of a pulverulent character. It may be taken upon newly plowed land without any previous preparation of rolling, harrowing, etc., and is said to perform its work under such circumstances in a very satisfactory manner.



TAVEAU'S REVOLVING SULKY HARROW AND BROADCAST SEEDER.

The depth of the harrowing is controlled by the driver, and can be instantaneously adjusted to any required depth. The seeding is controlled by easily adjustable gages, requiring only a few seconds of time for their adjustment, without the employment of a wrench or hammer. We are informed that long and thorough trial of this machine has fully demonstrated the justness of the claims made for it, and its general applicability to all soils adapted to the production of cereals.

The revolving harrow is driven by pinions actuated by the inside teeth of the driving wheels, and is propelled with considerable velocity, its teeth penetrating and comminuting the soil, incorporating the fertilizer, and covering the seed to the proper depth.

The seed of grain crops is carried in a forward box, from whence it is scattered by an apparatus driven by rag-wheels and an endless chain belt.

When grass seed is also to be sown, it is carried in a box to the rear of the machine, and is delivered by a cam movement as wanted, and is strewn over the even and pulverized surface, thus being left in the best position to sprout when moistened by ensuing rain. The hand lever shown in the engraving as grasped by the left hand of the driver, acts through a toothed quadrant and a toothed segment to raise or lower the revolving harrow, and may be fixed when the required depth is attained by notches in an arc provided for that purpose.

Foot levers serve to throw the harrow and seeding apparatus in or out of gear. The driver is thus enabled to control the operation of the machine without neglecting his driving, and this control, it is claimed, requires so little effort that a boy or an infirm man may perform it without undue fatigue.

This invention was patented through the Scientific American Patent Agency, May 4, 1869, by Augustin L. Taveau, of Chaptico, St. Mary's county, Maryland, to whom, or R. Sinclair & Co., Baltimore, Md., communications for State rights may be addressed.

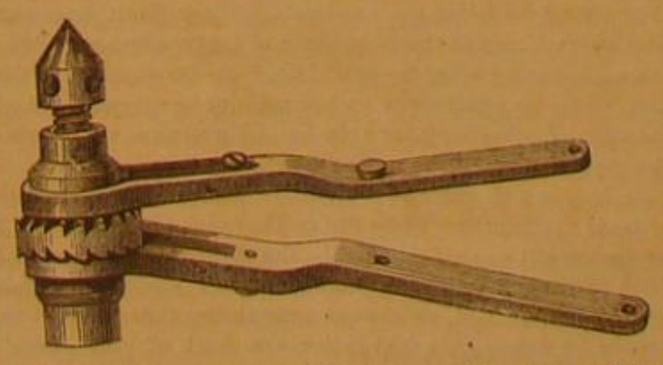
NONE deserve success less than those who will not earn it, and no others grumble so much at Providence.

### Lighting Mines with Gas.

In improving the method of lighting mines, M. Wilkin and J. Clark, of Paddington, London, propose to use lamps, burning gas, oil, or other illuminating materials, with air propelled from a pure source at the bottom or top of the shaft, through air-tight tubes, to the interior of the lamps. An overplus of air they cause to blow gently out by escape valves or covers near the top of the lamps, thereby preventing the entrance of foul air, or air which has become mixed with fire-damp. By preference they glaze the lamps about half their hight with glass; the upper half they prefer to make of sheet metal to withstand the heat. When gas lamps are used, the gas is produced, and conveyed in pipes in the usual way. The air is propelled through the tubes referred to by any well-understood method; such as by fans, air pumps, steam jet, etc. In lighting the lamps, they propose to use safety matches. After the match is inserted into the lamp by an escape valve, it is struck, and the lamp is lighted, while the match is extinguished in a tube into which it is thrust.

### DOUBLE RATCHET BRACE.

A new double ratchet brace, just out in England, is shown in our engraving. It is constructed with double ratchet teeth, pawls, and levers, which, on being moved from and toward each other simultaneously, impart to the ratchet



wheels continuous motion, thereby enabling it to effect its work in half the time of a single acting brace and drill, and hence its adaptability to working of lifting jacks and other purposes where continuous motion is a desideratum. By connecting the handles and using them as one the brace is rendered single acting.

THE Senate Committee on Patents, at the last meeting, had under consideration the bill for the extension of the Corliss steam engine patent, and agreed to report on it adversely. The Committee has caught the spirit of the President's late veto message, and intends scrutinizing very carefully all applications for extension of patents.

### Light and Life.

It has been proved by recent researches in France that the *red* rays of the spectrum are those to which the important physiological function exercised by the sun on plants is exclusively to be ascribed. The leaves act as analyzers of the white light which falls upon them; they reject and reflect the green rays, and thus get their natural color. If plants were exposed to green illumination only, they would be virtually in the dark. The light which the vegetable world thus refuses to absorb is precisely that which is coveted by animals. Red, the complementary color of green, is that which, owing to the blood, tinges the skin of the healthy human subject, just as the green color of plants is the complement of what they absorb.

These facts have been fully stated and illustrated in a paper read by M. Dulfrunfaut before the French Academy of Science; and from them he deduces certain practical suggestions.

All kinds of red should be avoided in our furniture, except curtains; our clothes, which play the part of screens, should never be green. This color should predominate in our furniture, while the complementary red should be reserved for our raiment. He also dwells upon the salubrious influences of sunshine. He mentions cases of patients whose broken constitutions were restored by continued exposure to the sun in gardens where there were no trees; and gives an account of four children that had become weak and sickly by living in a narrow street in Paris, but regained their health under the influence of the solar rays on a sandy sea coast.—*Boston Journal of Chemistry.*

### AGRICULTURAL ENGINEERING.

Year after year those who visit our exhibitions of agricultural machinery become witnesses of a steady progress—a progress that is doubtless more rapid in some departments than others, but still a progress in all. Let us take agricultural steam engines, for example. To a careless, or an unprofessional observer, the portable engine of to-day may appear the same as those exhibited seven or eight years ago; but a more careful examination will show numerous points of improvement, each of them small perhaps in itself; but still amounting in the aggregate to something important. Thus, in the first place, the workmanship generally—and particularly that of the smaller firms—is better than it used to be; while proportions also are better, and more care is taken to provide ample bearing surfaces and efficient means of lubrication. The pressure of steam carried is also gradually creeping up—though but slowly—and portables working regularly at 70 lb., 80 lb., and 90 lb., per square inch, are now to be met with. In this respect, however, our English makers are still decidedly behind their Continental neighbors. With higher pressure have come improvements in the boiler work, and it is now but comparatively seldom that we meet with such miserably constructed, insufficiently stayed boilers, as were but too commonly fitted to portable engines a few years ago. Still, however, there is room for further improvement in this direction. We should like to see the evil practice of placing a large manhole at the side of the firebox casing abolished, and greater facilities for washing out provided in the form of well arranged mud-plugs. A mud collector also under the barrel of the boiler would do good service, and add scarcely anything to the cost of the engine. The flat-topped form of firebox casing, having the crown stayed directly to the crown

of the inside firebox, which is now becoming a favorite with many locomotive engineers on the Continent, might also be adopted for portable engines in many instances with undoubted advantage, and with a noticeable saving not only of dead weight but we believe of cost also; while in the case of all engines worked at the higher pressures we hope soon to see the longitudinal lap joints superseded by welded joints or by butt-joints with inside and outside covering strips. All engines, too, without exception should be provided with two safety valves,and more care should be taken to protect the boiler by efficient cleaning than is now generally the case. These latter matters we know all involve extra expense; but they are worth all they cost and much more, and this fact will be appreciated one of these days. As pressures increase, too, it will be found advisable to relieve the boiler of the strain due to the working of the engine by connecting the cylinder and crank shaft plummer blocks by framing of some kind, the boiler being of course allowed to expand and contract freely. On the Continent, in fact, this is even now very generally done by the fixing of the engine proper on a cast-iron base plate, which is in its turn fitted to the top of the boiler; and this plan, although somewhat clumsy, undoubtedly had its advantages. The system of wrought-iron framing proposed by Messrs. Hartnell and Guthrie, and described by us in this journal a few months ago appears to us decidedly preferable.

Then, again, besides improvements in the boiler work, we find that steam jacketing, formerly considered an extra refinement, is now becoming the ordinary rule with all the best makers, and several of the leading firms are now applying steam jackets to the cylinders of all their portables, without exception. Arrangements of some kind for heating the feed water by the exhaust steam are now supplied by almost all makers, and the practice—at one time so dear, apparently, to the hearts of agricultural engineers—of leading the exhaust pipe through the boiler, is rapidly becoming a thing of the past. In the construction of the various details, steel is coming extensively into use, and portable engines with steel crank shafts, piston rods, guide bars, and even connecting rods, are now far from being rare. In speaking of guide bars, we may remark that agricultural steam-engine builders appear to us to generally spend more money on these details than is necessary. In most instances cast-iron guides, cast in one piece with the front cylinder cover, will answer every purpose. Such guides, if provided with ample surface, and if the crosshead blocks are of proper materials, will wear quite as well as bars of case-hardened wrought iron or steel, while, if properly designed, they will present no unsightly appearance, and will require no adjustment after being put in place.

Besides the ordinary portables, the term agricultural steam engines now includes steam plowing and traction engines, and most important classes these both are. There can, in fact be little doubt that it is to the introduction of these two classes of engines amongst farming machinery that the improvement of the ordinary portable engine is, to a great extent, due. Steam plowing and traction engines are called upon to perform work which is probably, taken altogether, more severe than that to which engines of any other class are exposed; and it is only by the employment of the best materials and workmanship that the heavy wear and tear induced by such work can be withstood. In fact, the plowing engines now sent into the field by the great Leeds firm, for instance, fully equal in design and workmanship the best locomotive practice, and the same may be said of Messrs. Aveling's well known traction engines. Year by year, too, the conviction is gaining ground that the more powerful the engine and tackle employed, the more economically steam cultivation can be carried out; and thus it is that the 12 and 14-horse power engines formerly employed are being supplanted by steam plowing engines rated at 20, 24, and 30 nominal horse power—engines working with steam at 130 lb. and 140 lb. per square inch, and developing from 60 to 120-horse power indicated—and stronger and stronger implements and accessories. Where this increase in the power of steam plowing machinery will end we cannot say; but it is certain that it has not yet reached its limits, nor is it perhaps likely to do so for some years to come.

It is, however, not only in the construction of agricultural steam engines that agricultural engineers have made progress during the past few years. A noble advance has been made in the general application of light iron and steel framing to reaping and mowing machines, horse-rakes, plows, and other implements in place of the cumbrous wooden frames which were formerly universal; while the more extensive use of malleable and toughened castings of various kinds has done much to insure freedom from breakages, and extra durability has been obtained by providing more efficient means of lubricating working parts.—*Engineering.*

## ANCIENT AND MODERN INDUSTRIES OF THE CHINESE.

Despite the offerings of peace and the threats of war, despite the presence of a foreign foe within the walls of its capital, and the burning of an imperial residence, China still refuses to receive the evidences of civilization. She cannot be taught to understand that in the present time nations cannot, any more than individuals, exist solitary and secluded, and that national prosperity and advancement are in direct ratio to the extent and frequency of the intercommunication with other countries. Although there has been a colony of European race established on her own shores, she is deaf, blind, and dumb to their habits and customs, and persists, with invincible obstinacy, in refusing to accept anything from the hand of the "barbarian." Her mechanical inventions and appliances, her trades, manufactures, her government and legislation, are virtually the same now as they were during the dynasty of Shang, who reigned some thousand years or so A. C. Her progress has literally been *nil*. The China of today is in every sense the Kathay of ancient times, the land famous for the skill of its magicians, its Aladdins, and the slaves of the ring and the lamp. No improvements, alterations, or modifications have ever attended their mechanical operations, or broken the uninterrupted monotony of their manufactures, their page of progress is a blank.

Of coal there is no lack in China, and there are two precautions adopted by the natives in working the mines which might be imitated with advantage among ourselves. Whenever gas of a mephitic or inflammable character is encountered in the pits, a bamboo tube is introduced throughout the various workings, terminated at the lower extremity by a conical point. This is inserted in the fiery or dangerous seam, and the gas conducted away to the external atmosphere. A timber framework is erected occasionally to support the roof, but only for so long as it is required to maintain a free passage underneath. When there is no further necessity for it the general practice is to fill up the excavated spaces by earth well rammed in and consolidated. All "creeps" and fallings in the roof are thus avoided. The quality of Chinese coal varies considerably; so much so, that European steamers rarely avail themselves of it for fuel.

Mineral oils, notably petroleum, abound in certain districts of this vast empire. They exist in the form of extensive subterranean beds or ponds, and are procured by sinking wells until the oil-bearing stratum is reached. The upward pressure is sometimes so great as to cause the oil to rise violently and rapidly to the surface—directly the bed is "tapped," and to spread over the adjoining land until a large area is covered, and a veritable lake formed. This oil is used for the purpose of lighting; but its illumination is far from bright, as the flame is dull and smoky, owing to the circumstance that the liquid is never distilled or purified in any manner whatever. The partial and imperfect combustion of this petroleum produces an exceedingly finely divided species of lampblack, which is employed in the preparation of the well known "*encre de Chine*"—China ink.

With the exception of the seasoning and preservation of articles of food, the inhabitants of the Celestial Empire make but little use of salt. It has no industrial application among them. Marine salt, rock salt, and two or three other varieties common to nearly every other country, are indigenous to the land. There is also a description known as efflorescent salt, which is found in some localities in a manner very similar to that in which niter appears in India. A simple but rather ingenious method is employed for raising the salt liquid from wells sunk to reach a saline substratum. A long bamboo is hollowed out, and a valve, opening inwards, is fixed to the lower end. This is lowered down and sunk into the liquid, which rises through the valve into the hollow bamboo. As soon as it is considered to be full it is hauled up, the pressure of the contained fluid keeping the valve close. In one particular province the salt pits are not free from an inflammable gas. This is utilized for heating the boilers in which the saline liquid is evaporated, thus proving that the natives have an eye to the economy of fuel. The boilers are erected near the pits, and the gas brought to them in bamboo tubes, furnished with a copper burner. In the northern portions of the realm, salt is used for preserving and embalming the bodies of defunct mandarins and officials of high position.

It is asserted by Chinese writers that it is not possible to travel thirty miles in any part of the country, without meeting with either a calcareous or carbonaceous stone fit for the manufacture of lime. This may be a piece of national metaphor; but M. Champion, author of a recent work on the industries of China, indorses the statement that the raw material is exceedingly abundant, and that the manufactured produce has a very extensive application. One of the most original of these is the fabrication of receptacles or vessels for the transport of oils and varnishes, which is carried on upon a large scale throughout the kingdom. In this manufacture, as well as in every other that we shall notice, the everlasting bamboo plays an important part. It is difficult to imagine what the Chinaman would do, or what he would be, without the bamboo. If we were to be deprived of iron, wood, stone, brick, coal, glass, or any one particular element adapted for the purposes of construction or convenience, we should not be long without a substitute; indeed, we have frequently reviewed and discussed such a contingency without demonstrating much alarm at the possibility of its occurrence. But to ask a Chinaman what he would do, were he deprived of bamboo, would be equivalent to asking him to speculate on the infinite. Apologizing for this little digression, we return to the manufacture of the native vessels for containing oils and varnishes which exercise a corrosive action upon metals and organic substances. They are neither casks nor metallic receptacles, but are constructed in the following manner: An open carcass or frame is made of small pieces of bamboo closely intertwined, somewhat resembling those little trellis stands for flower pots that ladies are fond of purchasing at Covent garden. The interior of the carcass is lined with paper, manufactured also from a bamboo of an inferior quality, and is caused to adhere to the frame by a particular description of paste, prepared from a mixture of flour and a hot and strong solution of gelatin. This lining is covered by a layer of mastic composed of lime, sand, and a paste made from peas. When it is dried it is in its turn covered with paper, and the vessel is complete and ready for sale.

The element sulphur occupies the first position of the seventy-two substances included in the Chinese category of "useful," and is obtained from the ore by the ordinary process of roasting. It is used medicinally, in the treatment of ulcers, and to protect the bamboo from the attacks of insects and vermin. The preparation of sulphur, and its sale, is a business which requires especial permission from the authorities, and cannot be carried on, like the salt trade by any one who chooses. Similarly to the ancient alchemists, the Celestial philosophers have some curious notions respecting chemical products. Thus they regard sulphur as a male principle, and saltpeter as a female. The union of the two gives rise to the powder which explodes at the contact with a flame. Saltpeter, or niter, is found in China as an efflorescent production, and one of its chief applications is to the manufacture of gunpowder. If any proof were required to demonstrate the utter stagnation of the nation's industry it would be seen in this example. Notwithstanding that this destructive agent was known centuries ago, its manufacture and character has not advanced a step. At this very day Chinese gunpowder is large grained. The components are imperfectly mixed and incorporated; the inflammability is small compared with that of our own powder, and it fouls the interior of cannons and gun barrels to a degree that renders accurate firing a sheer impossibility. Although their method of manufacturing and preparing explosive and detonating powders is crude and imperfect, their acquaintance with them is very extensive and varied. For the purposes of war they employ a number of different powders, containing arsenic, cinnabar, orpiment, antimony, and many other metallic ingredients. Their invention in this unenviable line is very prolific, and some of the results may be truly termed diabolical. Of the art of glass making the Chinese know little or nothing, and never were acquainted with either the process or the ingredients for manufacturing this beautiful material. Since the introduction among them by the Dutch of cobalt blue, they have succeeded in making a coarse imitation of lapis-lazuli, but here their efforts have terminated. The substances soda and potash, in the strict sense of their signification, are also unknown to them: but they obtain impure solutions of them by the lixiviation of the ashes of plants which they use for purposes of bleaching textile fabrics.

All Orientals, as well as the inhabitants of tropical countries, have a strong predilection for bright colors. This gipsy love of color is one of the distinguishing characteristics of the Zingari, and may be considered a proof of their exotic origin. We are not surprised, therefore, to discover that the Chinese are perfectly conversant with mineral colors, which are invariably more intense and durable than those of a vegetable origin. They prepare their own reds, blues, greens, yellows, and other colors, from minerals existing in the soil, and a considerable internal traffic is carried on in these articles. In a people who adhere with such invincible obstinacy to by-gone time, that past, present, and future, are for them synonymous terms, it is only natural to expect that they should be more familiar with ancient than modern science. This explains the reason that the Celestials are by no means ignorant of chemistry, although knowing but little of the nemerous useful and valuable applications of which that science is susceptible. They are not ignorant of the peculiar double salts which are classed under the head of alums, the various preparations of which are procured by processes nearly analogous to those employed among ourselves, and are applied to the same purposes. M. Champion observes that while the chemical knowledge of the Chinese is not to be despised, they take very little trouble about disseminating that knowledge. There is no recognized nomenclature, so that in one province black alum is represented by sulphate of iron, while in another the same substance appears as sulphate of copper.—*The Engineer.*

### The Cuttle Fish.

Mr. L. L. Hartt, in his "Chapter on Cuttle Fishes," in the *American Naturalist*,describes his encounter with one of these octopods on the coast of Brazil, which wound its long arms, covered with numerous suckers, around his hands in such such a way as to hold him prisoner for a short time. On relinquishing its hold it dropped on the sand, and using its long, slimy arms as legs, made its way toward the water, looking like a huge and very tipsy spider. The cuttle fish belongs to the mollusks, a branch of the animal kingdom distinguished for its members being built upon the plan of a sac, and to which Mr. Hyatt has appplied the more appropriate name of *Saccata*. It is distinguished from all other mollusks, such as snails, clams, etc., by having a very large head, a pair of large eyes, and a mouth furnished with a pair of jaws, around which are arranged, in a circle, eight or ten arms furnished with suckers. In the common cuttle fish or squid of our coast, the body, which is long and narrow, is wrapped in a muscular cloak or mantle, like a bag, fitting tightly to the back, but loose in front. It is closed up to the neck, where it is open like a loosely-fitting overcoat, buttoned up to the throat. Attached to its throat, by a bridle,is a short tube,open at both ends. This tube or siphon, can be moved about in any direction. The animal breathes by means of gills, which are attached to the front of the body, inside the cloak, and look like the ruffles of a shirt-bosom. By means of these gills the air contained in the water is breathed, and they answer the same purpose for the cuttle fish that our lungs do for us. In order to swim, the animal swells out the cloak in front, so that the water flows in between it and the body. Then it closes the cloak tightly about the neck, so that the only way the water can get out is through the siphon. Then it contracts forcibly its coat, and the water is driven out in a jet from the siphon, and the body is propelled in an opposite direction, like a rocket through the water. This siphon is flexible, like a water hose, and can be bent so as to direct the stream, not only forward, but sideways and backward, so that the animal can move in almost any direction, and turn summersaults with perfect ease; and so rapidly do some cuttle fishes swim, that they are able to make long leaps out of the water.

Usually, however, the animal swims backward, with its long arms trailing behind. Our common cuttle fish of this coast has, in addition to its eight arms, two long, slender tenacles, which may be withdrawn into the body. The tail is pointed and furnished with a fin on each side. The octopods, to which the Brazilian cuttle fish belongs, have round, purse-like bodies, and eight arms, united at the base with a web, and they swim by opening and shutting their arms like an umbrella; in this mode of swimming they resemble the jelly fish. The paper nautilus is nothing in the world but a female cuttle fish that builds a shell. There was a very pretty story told of her habits by Aristotle, the old Greek naturalist, which everybody believed until quite lately. He said she rode on the top of the waves, seated in her boat-like shell, and spreading her broad arms to the winds for sails. But, unfortunately, the story has no foundation in fact. She either crawls about on the bottom of the sea, or swims quite like other cuttle fish, shell foremost, only occasionally coming to the surface. Strangely enough, she holds the two broad, hand-like extremities of the arms against her body, and it is the inside of these arms that secrete the paper-like shell, which is only a sort of cradle for her eggs. Not so with the pearly nautilus, which is furnished with a beautiful, coiled-up, pearly shell, formed on the outside of the animal. The shell is divided into numerous chambers, and the animal, living in the outer one, builds a partition across the back part of it as the shell grows. Cuttle fishes are sometimes used for food by the Brazilians, and different species may be seen in the markets, where one frequently finds them still alive. Sometimes, as we stoop to examine one, its body is suddenly suffused with a deep pinkish glow. Before we have the time to recover our surprise, this color fades, and a beautiful blue takes its place as rapidly as a blush sometimes diffuses a delicate cheek. The blue, perhaps, is succeeded by a green, and then the whole body becomes pink again. One can hardly conceive anything more beautiful than this rapid play of colors, which is produced by the successive distension of sets of little sacks containing fluids of colors which are situated under the skin. The cuttle-fish is also furnished with a bag containing an inky fluid, which, when the animal is attacked or pursued, it ejects into the water, thus completely blinding its adversary and effectual y covering its retreat. It is from this fluid the color sepia is made. Besides carrying an ink-bottle, some species of cuttle fish are provided with a long, delicate, horny pen, which forms a sort of stiffener to the back. In some species the pen is hard, thick, and broad, and the cuttle fish bone of commerce is of this kind. The species found in our waters is very small, and not at all dangerous, being barely large enough to draw blood from the hand; but in the tropical seas they are very large, powerful, and dangerous. The cuttle fish is the original of Victor Hugo's devil fish so vividly described in the "Toilers of the Sea." If the devil fish were a beneficent one, Mr. Hartt says he should be sorry to destroy our faith in it; but as it is, he believes it will be rather a relief than otherwise to know, that in some important respects Victor Hugo's story of it is a fable. The Kraken was a mythical cuttle fish of fabulous size.

## MANUFACTURE OF INDIAN INK.

From the Mechanics' Magazine.

A very large proportion of our readers are probably in the habit of using what we term Indian ink, or, at any rate, have used it during some portion of their lifetime. The term, although very ancient, is a complete misnomer. That employed by the French, *encre de Chine*, is the more correct and the one which has some tangible reference to the country whence this indispensable accessory to the drawing office is exported to our shores. A brief account of the method of manufacturing it in the ancient land of Kathay will not be without interest, the more especially as all attempts to prepare it of an equal quality, in this country or on the continent, have altogether failed. In times so remote as almost to carry us back to the ages of fable, the Chinese executed their specimens of caligraphy through the agency of a piece of bamboo dipped in a kind of black varnish. Subsequently, while the same *stylus* was retained, the liquid was represented by a syrupy fluid, in which particles of a black stone reduced to an impalpable powder were held in mechanical suspension. Later still, the ink assumed the appearance and nature of solid black balls, prepared from lampblack, and ever since their introduction this branch of industry has been gradually improved until it attained its present state of perfection. At the present day, the Chinese keep their ink in sticks, rub it with water or tea, and write by means of very fine pointed pencils dipped in it. The quality of the ink varies considerably, and depends upon the purity of the ingredients of which it is composed, and the care and skill displayed in its preparation. Among the best substances from which to obtain the lampblack are—firstly, pig's fat; secondly, ordinary oils and fats; and thirdly, resinous woods and resins themselves. Tolerably good inks are also made from the lampblack produced by the combustion of pine trees, and some other descriptions of timber indigenous to the country.

The materials from which the lampblack is procured are placed in a furnace about one hundred feet in length, and five in breadth, along the sides and top of which it condenses. That which condenses at the extremity of the furnace is the best adapted for the manufacture of the ink, while the rest, which is deposited near the neighborhood of the combustion, is too coarse in grain to be employed for the purpose. This evidently results from two causes. One is the quality of the material, and the other the relative rapidity with which it is consumed. Having obtained the lampblack, the next step is to prepare a particular kind of paste or glue with which to form a compact and solid substance. The preparation of this glue requires a great deal of care, and is one of the most important operations connected with the whole process. The best description is made from the horns of deer. After removing the outer skin, the horns are macerated for a period of seven days in rice water, and then subjected to a long and exhausting ebullition. It is only during the cold season of the year that this process is carried on, as hot weather would cause the fermentation of the glue and retard the operation. It must not be imagined that the lampblack is fit for use directly it is taken out of the furnace. On the contrary, it requires to be sifted through silken bags, so that the grains may all be of the same size, or otherwise the ink would not be homogeneous. This preliminary condition being insured, a certain quantity of the glue is melted and poured over an equal quantity of the other ingredient, and the whole thoroughly kneaded and incorporated by the hands. Occasionally a small portion of Chinese varnish is added, and the mixture transferred to an iron mortar, where it is beaten up with some degree of violence. The whole of the value of the future product depends, as is usual in all similar instances, upon the intimacy of the mixture, but, at the same time, the operation must not be protracted to too great a length. It is the duty of the manufacturer to time the process, and when, through negligence or ignorance, the proper time has been exceeded, the error is rectified by enveloping the ink in paper, and holding it before a slow fire, which restores to it its elasticity, and prevents it splitting. In spite, however of this partial remedy, the ink so treated is never equal in quality to that which has not been subjected to such treatment. From the mortar the mixture passes into the hand of the molder. The molds are formed of wood, with a cavity corresponding to the form it is desired to give to the ink. Within certain limits the smaller the cakes the better, as there is less chance of their splitting or warping during the time they are drying. Thus, the best cakes of Indian ink are never of a very large size. As soon as the cakes have acquired a firm and solid consistency, they are removed from the molds and dried. The desiccation is effected by enveloping the ink in very fine paper, and surrounding it by cinders or powdered chalk. When the latter desiccator is used care must be taken that it does not abstract the humidity from the cake with too great rapidity, or the latter will become brittle, and lose its superior quality. The cakes, together with the absorbent envelopes, are placed in a small stove, and kept exposed to a gentle heat for several days. Some manufacturers do not take the trouble to perform this last drying process, but leave the cakes to dry by simple exposure to the air.

M. Paul Champion, in his work entitled "Industries Anciennes et Modernes de l'Empire Chinois," gives some practical suggestions for distinguishing good from bad Indian ink, which will, we do not doubt, be very acceptable to our readers. Ink of a superior quality rubs easily and marks upon paper, without leaving any apparent trace of solid matter. The best cakes have a brownish hue when rubbed. A black, gray, or blue tinge indicates ink of an inferior quality. The brown tinge will remain in cakes for many years after manufacture, and is visible in some very ancient specimens that exist in China. Another somewhat curious test will determine the quality of Indian ink. If a cake of good quality be struck gently on a hard substance, the sound should be sharp. If it be flat, it is a sign that it is not homogeneous in consistency, and belongs to a second class description. Moreover, the heaviest ink is the most valuable. The Chinese say that the value of lampblack depends upon its lightness, and that of ink upon its heaviness, being in the inverse ratio one to the other. As the ink gets older, so, like wine, it improves in quality. It becomes harder without at the same time becoming brittle, and acquires a brilliancy that is highly prized by connoisseurs. Strictly speaking, it ought not to be used for three years after manufacture. Whenever it happens that old ink loses in value by absorbing damp, it may be re-prepared by grinding it with a mixture of glue and water, but the operation is not always successful. In order to keep Indian ink—in other words to preserve it—it should be placed in a well-aired situation, exposed now and then to the action of the sun, and rubbed frequently on the surface to prevent it losing its polish.

The manufacture of Chinese ink, to give it its proper term, is carried on upon a very large scale at Shanghai, where a very superior description is prepared. The difference in quality between the various inks made in China results from the non-employment of a constant material for the production of the lampblack. In order to impart an agreeable odor to the production, the Chinese add a small portion of musk and camphor, from the Isle of Borneo, two articles which are exceedingly dear in the Celestial empire. Ordinary Chinese ink for home use is not scented in any manner whatever. The gilded mystic letters that are so attractive to young pupils and students are first formed by the action of the mold. When the cake is dry, the letters are traced over with a solution of gelatin in water, and the gold or copper is laid on with a fine brush. Like their neighbors, the Japanese manufacture Indian ink, but consider it of a quality inferior to that which they obtain from the mainland. Not having given so much attention to the matter as the Celestials, they are not so well versed in the manner of preparing the lampblack, which is the real secret of the whole art.

### The Ransome Process.

Almost every one is familiar with the ordinary process by which Mr. Frederick Ransome manufactures artificial stone, and knows how the sand, mixed with silicate of soda, is treated then with chloride of calcium, with the result of their mutual decomposition and reformation as silicate of lime and chloride of sodium, the former remaining as an indestructible bond throughout the stone, the latter soluble and easily removed. The process, beautiful and simple, can be seen any day in extensive application at the works at East Greenwich. The sand, after being dried, is worked up in a mill with the soluble silicate brewed from caustic soda and flints, the latter being dissolved by the former, and evaporated down to a specific gravity of 1·700. The plastic mass thus produced is obedient to the will of the molder, and can be manipulated into any form, from a cube to elaborate screens, such as those decorating the India Office; from a grindstone to an exquisitely chiseled fountain like that recently erected in the public gardens at Hong Kong. The mass so prepared is then saturated with chloride of calcium, applied either simply by immersion, or assisted by the action of an air pump, in either process the solution being gradually heated to a temperature of 212° Fah. Mr. Ransome has recently made some further important improvements, which promise great results.

These consist, first, in submitting the molded mass to the indurating action of the chloride solution at a higher temperature in closed chambers connected with a steam boiler. When this has been carried on for a sufficient length of time, by opening a cock, the solution is forced by steam pressure into a separate chamber, leaving the stone to cool gradually in a partial vacuo, by which all danger of cracking is avoided—a casualty which is liable to happen when large masses are exposed to rapid extremes of temperature in the open air.

The next feature in these improvements lies in the ingenious method adopted by the inventor for extracting the soluble salts of calcium and sodium from the body of the stone, which is effected in the same closed chamber by the admission of steam (or steam and water alternately), which as it condenses and becomes saturated with the salts referred to, is returned into the boiler, where the steam is generated, and the chloride of calcium is again made available for future operations, thus obviating the serious loss incurred by washing the stone in the way hitherto adopted.

It is gratifying to learn that the manufacture of this stone is being adopted even in most distant parts of the globe. We have already, in previous notices, informed our readers that manufactories have been established for its production in India, America, Australia, Belgium, Denmark, and Sweden. But little actual progress has, however, been made in the practical introduction of the Ransome process in the United States. The proprietors of the patent right for the State of California have established large works in San Francisco, under the title of the Pacific Stone Company, for the production of artificial stone, and, but for the slight drawback of being ignorant of the practical details of the process, would probably have developed an extensive business. Being unable to obtain the necessary information from the American proprietor, and tired of working in the dark, they have at last adopted the most satisfactory and common-sense course of coming from California to Greenwich to learn the whole course of the manufacture at the fountain head. To this end the managing director, and principal shareholder of the Pacific Stone Company, Dr. W. May, has recently arrived from California, and is rapidly acquiring the mysteries of artificial stone manufacture from Mr. Frederick Ransome, by whom every facility is offered for the benefit of American licensees. We mention this because it is a matter much to be regretted that for so long a time the vastly important Ransome process should have remained almost a dead letter in the United States, so far as real utility is concerned; the American proprietor having apparently devoted his attention to making money rather than stone, from his purchased patent right. This is, of course, at an end now, and the manufacture under this patent in America will be so much greater than it is in England as the demand for the production is proportionately increased.—*Engineering.*

## THE TANITE SOLID EMERY WHEEL.

We desire to call attention to the advertisement of the Tanite Company in another column. The solid emery wheels made by this company are of the most excellent quality and might be to advantage much more widely used than they are at present, although the present demand for them is great.

The wheel is called the "Tanite Solid Emery Wheel," from the composition, tanite, which holds the solid grains of emery by its cohesive power. This substance is sufficiently strong to hold the emery and yet does not act to interfere with its sharp cutting effect. It does not, it is claimed, glaze, and it wears uniformly. It may be made into other forms as well as into wheels, such as slipstones, blocks for hand use, etc., etc.

Past experience has taught us the great value of emery wheels, as a substitute for files in a great many kinds of work. In fact, we should say that there are very few branches of mechanical work where the materials used are metals, wood, horn, or bone, that such wheels cannot be employed at a great saving of expense both for files and other tools and labor. Certain it is that whenever the emery wheel can be substituted for the file it will result in such saving.

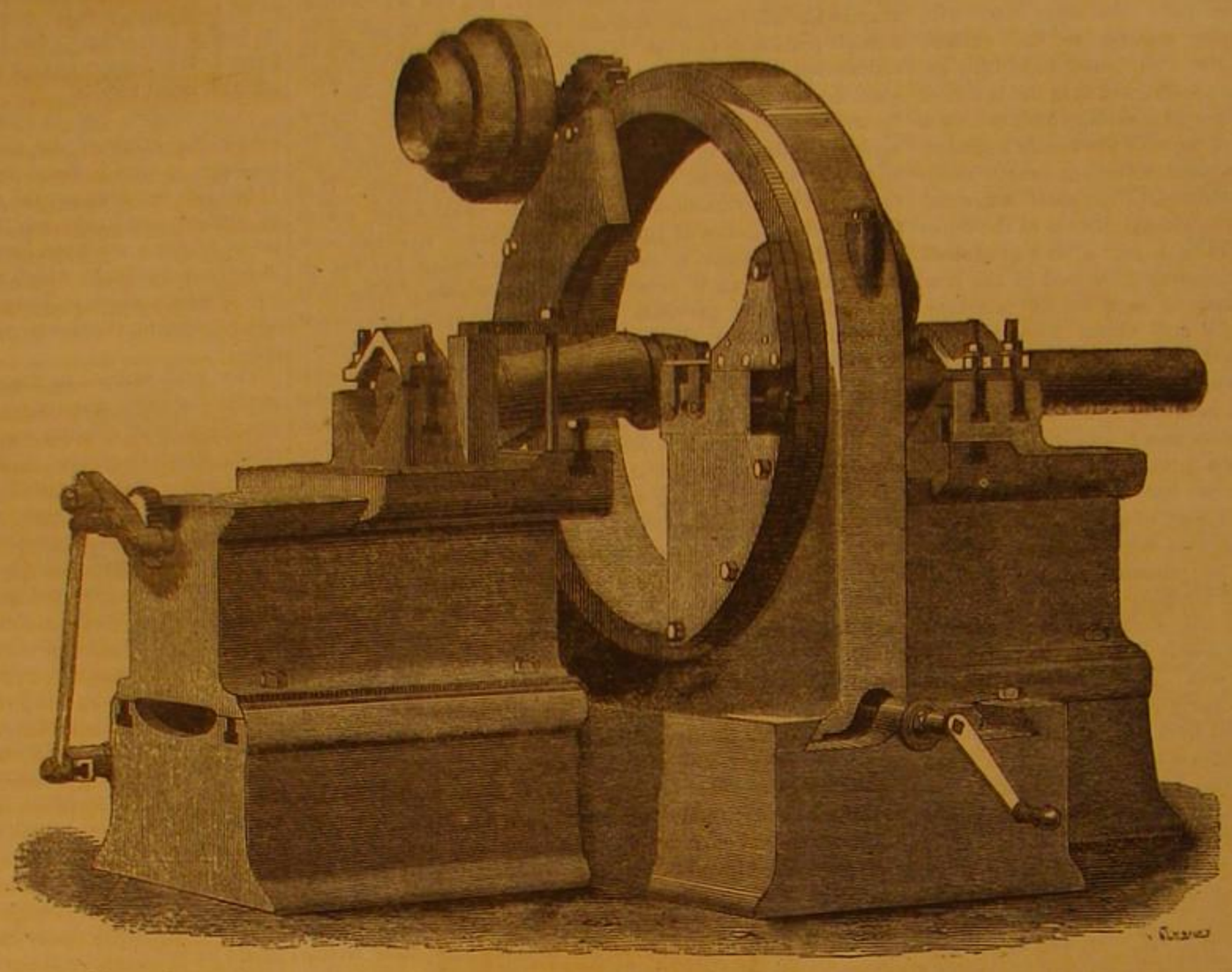
The tanite solid emery wheel is however infinitely superior to the old emery wheel, far more convenient in use, cheaper, and extremely durable. It is also easily kept in order, and free from smell, or from any substance calculated to produce injury by the generation of poisonous dust; and its strength is such that twenty-inch wheels are run at a trial speed of 2,800 revolutions per minute before leaving the shop

THE Smithsonian Institute has published a descriptive list of the *Smithsonian Publications*, to be had on application to the librarian of the institute, at Washington.

### Useful Machine for Turning Crank Pins.

We illustrate, annexed, a useful machine for turning crank pins which has been designed and constructed by Craven Brothers, of the Vauxhall Ironworks, Manchester, England. This machine is adapted for turning the crank-pin bearings of bent and other crank shafts, the tool being carried round the bearing while the latter remains stationary. The machine, in fact, belongs to the same class as the large crank-turning machine which is in use at Messrs. Penn's factory at Greenwich, and of which other examples are to be found in some of the large marine engine works on the Continent. In the machine of which we now publish an engraving, the tool is carried by a sliding tool-holder attached to a ring which revolves in V-bearings, and which is driven by a pinion and cone pulleys, as shown. The headstock carrying the bearings for the ring just mentioned is adjustable laterally on slides, and the tool can thus be brought to bear on the pins of cranks of any throw up to 15 inches, the machine being capable of turning cranks of the latter throw with pins of 7½ inches in diameter.

The crank to be turned is first "slided" in an ordinary lathe on the shaft part, and is then secured in the two V-blocks shown in our engraving. These blocks are formed in one piece with slides which have a self-acting traverse motion, this motion giving the requisite feed. A great advantage with this machine is that the crank bearing is turned truly cylindrical and perfectly parallel with the shaft portion; while, when the headstock is once set to the length of stroke required, any number of cranks may be turned exactly alike. The time required to turn a crank also is less than that required to fix it in an ordinary lathe, and disk plates, balance weights, etc., are entirely dispensed with. One of the machines we have described is now in use at one of the large factories in the neighborhood of Manchester, where it is employed in turning the crank shaft made out of round iron and used for wood-working machinery, etc., and we have no doubt that it will do its work well and economically. The machine could also be adapted for turning locomotive crank axles.—*Engineering.*



MACHINE FOR TURNING CRANK PINS.

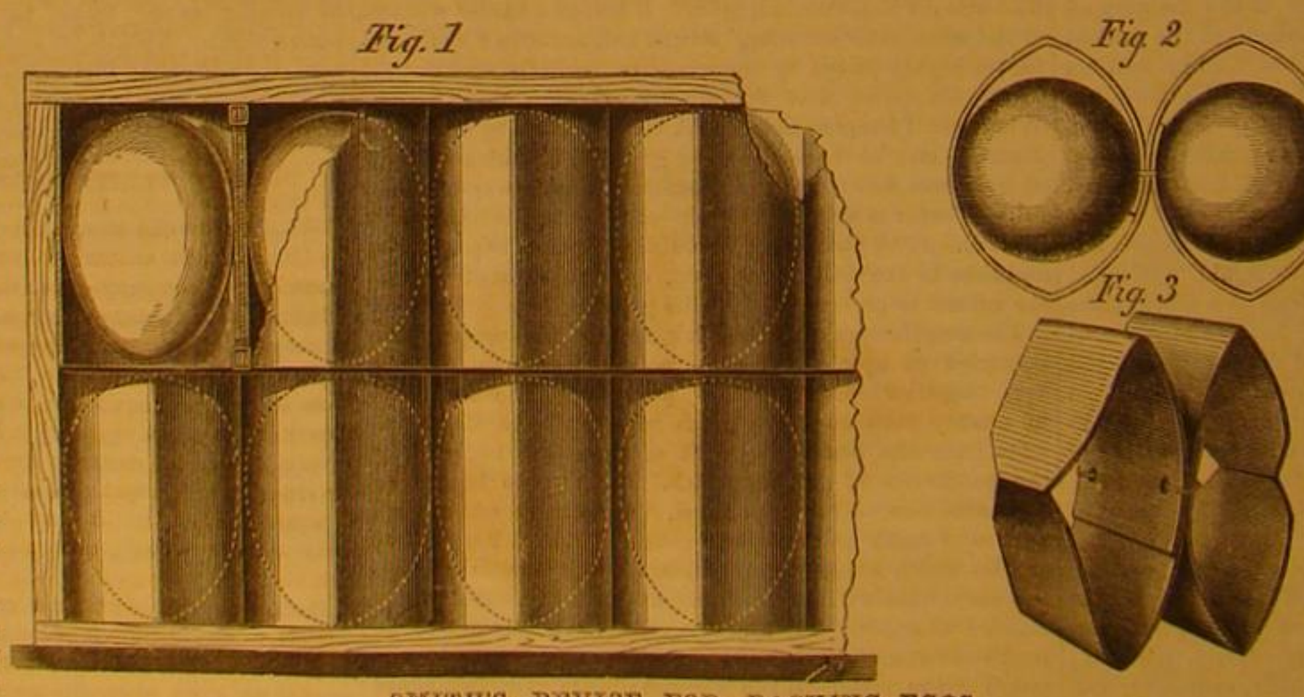
### Improved Device for Packing Eggs.

Few articles of food are in more universal demand, and more desirable in a sanitary point of view, than fresh eggs, and few articles brought to our city markets are sold for a higher price in proportion to the cost of production. This high price is owing in great measure to the difficulty of transporting them over long distances without breakage and decay. The old method of packing in oats does not satisfactorily prevent either of the sources of loss specified.

Breakage will result more or less in spite of the greatest care in packing, and the oats are liable to heat from dampness or other causes, and in this state eggs are very liable to spoil.

It has, hence, been deemed very desirable to devise improved methods of packing in which the faults of the old method do not exist, and various inventions have been introduced with considerable success for the purpose.

The invention we herewith illustrate consists chiefly in the form and construction of the pockets, designed to hold each egg entirely free from any contact with its fellows, and also to provide a free circulation of air, whereby the package may be kept cool.



SMITH'S DEVICE FOR PACKING EGGS.

The form of the pockets is shown in Figs. 2 and 3. They are made of bark, straw-board, or any other very cheap material possessing the requisite stiffness. The walls are cut out by a stamper to the proper shape, and fastened either by a wire loop, as shown, or by eyelets, which can be done with great rapidity by the use of an eyelet machine. When fastened together the walls of the pockets inclose ellipsoid spaces in which the eggs are placed, as shown in Fig 2.

The pockets, with the eggs, are placed on shelves in the general package, as shown in Fig. 1, each layer being separated from the others by the intervening shelves. The form of the pockets is such that free ventilation is secured, while it would seem almost impossible that breakage should occur through any amount of rude and careless handling. The device has, moreover, the very great merit that it is exceedingly cheap. The device is well worthy the attention of manufacturers and dealers in agricultural implements, etc.

Patented through the Scientific American Patent Agency, November 23, 1869, by Austin S. Smith, No. 55 Tremont street, Lawrence, Mass., who may be addressed for the entire right, or who may be negotiated with for the privilege to manufacture on royalty by responsible parties.

### On Glycerin Lotion.

Having what I consider a most excellent recipe for such a preparation, I here offer it for the benefit of those who wish to make such a preparation and have not already a better formula:

Glycerin, 3 fluid ounces; mucilage quince seeds, U.S.D., 10 fluid drams; pulverized cochineal, 5 grains; hot water, 1½ fluid ounce; deodorized alcohol, 2½ fluid ounces; oil rose, 8 drops; pulverized gum-arabic, ½ dram; water, 8 fluid ounces.

Rub the powdered cochineal first with the hot water gradually added, and then add the alcohol. Then triturate the oil of rose well with the powdered gum-arabic, and gradually add the water as in making emulsion. With this mix well the solution first formed and filter, and to the filtered liquid add the glycerin and mucilage of quince seeds, and shake well. The mucilage of quince seeds should always be freshly made. If the alcohol is sweet and free from foreign odor, and the glycerin perfectly inodorous, a less quantity of oil of rose may suffice.

If care is taken in its manufacture, this will form a beautiful and elegant preparation, with a rich rosy fragrance.

When applied to the skin it imparts an agreeably soft, smooth, and velvety feel. It is an excellent application for the face after shaving.

I have tried many similar combinations but have never sold an article that has been so generally admired and so universally popular as this.—*J. B. Moore, in the Journal of Pharmacy.*

### On Mounting Fish.

Mr. C. A. Walker gives some suggestions on the method of skinning and mounting fish in the "American Naturalist," which some of our readers may find useful. He says this class of animals possesses many beauties which, when removed from their native element, vanish forever, and it is in vain for the taxidermist to try to imitate those iridescent tints which characterize the living specimens. The best he can do is to preserve in form and general outline those characteristics by which he may be able to recognize his subject. Before proceeding to describe the operation of skinning, it may be well to state that the scales, as well as their color, may be preserved to a certain degree by applying tissue paper to them, which, from the natural glutinous matter which covers the scales, will adhere firmly; this being allowed to remain until the skin has dried, may be easily removed by moistening with a damp cloth. All small fish should be mounted in section, while the larger varieties may be preserved entire. Suppose the fish to be of such a size as to be mounted in section, first, it is necessary that it be as fresh as possible, as the scales will become detached if decay be allowed to commence. Lay the fish on one side, and cover the side uppermost with tissue paper, as stated above; also extend the fins by means of the same, and allow them to remain a a few moments until they become fixed and dry; this will be a protection to the fins and scales during the process of skinning. Having provided yourself with a damp cloth, spread it smoothly upon the table, and place the fish upon it with the papered side down. With the dissecting scissors cut the skin along a line following the contour of the body, but a little below the extreme dorsal edge, and a little above the ventral one, and remove the skin included within this line. The remaining skin must now be detached from the flesh, beginning at the head and separating it downward toward the tail. The spine must be severed close to the head, and also at the tail, and the entire body removed.

All the flesh having been taken from the skin, and the eyes removed, the inside must be wiped out and the preservative applied. It is necessary here to repeat the caution not to use any unnecessary strain that will be liable to distend the skin.

The skin should now be filled with cotton or tow, and this must be laid so evenly that there shall be no prominences upon the outside of the same. When filled it should be laid with the open side down, upon a board of proper dimensions previously prepared, and fastened to it by means of small tacks commencing at the head and fastening the edges downward toward the tail. It should then be set aside in the air to dry, care being taken not to expose it to the rays of the sun. When dry the paper which covers the exposed side, and with which the rays are distended, may be removed in the manner previously stated, and the glass eyes inserted with a little putty. As the glass eyes used by taxidermists are generally too spherical, and polished, it is well to manufacture them of wood, using common paint to restore the color, avoiding the use of varnish. Finally, the skin should receive a coat of thin colorless varnish, after which it is ready for the cabinet. In sharks and large fishes an incision should be made below the head at its base, along the ridge of the back, following either side of the dorsal fin down to the tail. The skin can then be separated on each side, and by severing the vertebræ at the head and tail, the entire body may be removed.

The tail having been skinned, the head should be pushed inward and the skin passed over it, when all the cartilage can be freely cut away. In stuffing these large species it becomes necessary to use a body support, and a bar of light wood may be used for this purpose; this should enter the skull, thereby being more easily kept in position, and extend to the base of the tail. Hooks can be fastened to this bar, and by means of wire the specimen can be suspended from above. The body should then be stuffed with hay, and the incision upon the back carefully sewed up. If the first coa

of varnish is observed to rise in scales, it should be removed with a solution of nitric acid and water, and the skin allowed to dry, when a second application of varnish will ever afterwards remain quite solid.

We may state in conclusion that with the exception of large turtles, alligators, and their allies, large sharks and a few other fishes of great size, stuffed specimens of the two classes of reptiles and fishes are very unsatisfactory to the naturalist, and that whenever it is practicable to preserve the specimen in alcohol, that method should be adopted in place of skinning and stuffing.

### The Voyage of the Floating Dock to Bermuda.

An interesting account of this voyage has been written by "One of those on Board," from which we find that, contrary to the forebodings of many nautical men, this gigantic structure arrived perfectly safe, and apparently without any difficulty.

It will be remembered that she was finished in May, 1869, at a cost of close upon $1,250,000. She was fitted with a gigantic rudder, and two light wooden bridges were thrown across her for purposes of navigation; lighthouses, semaphores for signaling to her consorts by day, and flashing lanterns for night work were supplied to her; she was also provided with steam whistles and guns in case of fog, and at each corner was fixed a lightning conductor.

Her crew consisted of 82 hands, under a staff commander and other officers, and were quartered in several of the upper water-tight compartments, which were fitted as cabins, etc. As these had no ports, their ventilation was only such as the hatchways afforded, and in hot weather the "'tween decks" of the dock were almost unbearable. Her high sides were decked with wood, and afforded fair walking room, but by descending 53 feet of ladders her floor could be reached, and its clear space of 110 yards in length was a famous exercise ground.

The *Bermuda* was sent to sea without her caissons, which weigh about 400 tuns. These, having been made and fitted in England, were conveyed in pieces to Bermuda, and there riveted together by a body of workmen sent out for that purpose by the contractor. Even without them the dock weighed 8,200 tuns, and although when the wind was fair a sort of sail or curtain was set between her sides, neither this nor her ponderous rudder was found to be of much assistance. She had to trust entirely, both for towing and steering, to the engines of the men-of-war appointed to convey her to her destination. The vessels selected carried, perhaps, the most powerful machinery afloat, and, by the skillful application of competent strength, the *Bermuda* was moved through the water at an average speed of about five knots an hour.

On the 23d of June last she slipped her moorings in the Medway, and, being taken in tow by six tugs, proceeded to the rendzevous at the Nore, where the iron-clads *Northumberland* and *Agincourt* were in waiting to pick her up. The *Terrible*, whose paddlewheels have been doing good service for the last 25 years, steamed astern and in tow of the dock, for the double purpose of steering and of acting as a check upon her should she prove unruly.

The work of attaching the dock to the *Northumberland* was quickly accomplished. She was brought under the iron-clad's stern; the immense hawsers, 620 feet in length and 26 inches in circumference, were at once passed between the vessels, and the squadron started down the Channel. These hawsers were secured to the riding-bits in the cut-water deck, with which the dock had been fitted, and which formed part of the original design for rendering her navigable. This deck projected 24 feet, and was sloped away on the under side, so as to offer the least possible resistance to her progress; the after end of the dock was rounded off in a similar manner. The squadron made its way slowly down the Channel, the *Agincourt* and *Northumberland*, harnessed in tandem fashion, in front of the *Bermuda*, and the *Terrible* partly steaming and partly towing astern to keep the huge mass from yawing. The *Buzzard* and *Medusa*, soon afterwards relieved by the *Helicon* and *Lapwing*, took up their positions on either side, acting as a sort of police to warn off any vessels that might approach dangerously near to this strange ocean procession. The decks of her high sides were at about the elevation of the mizentop of the *Agincourt*, and outside the house which served as the captain's cabin was a regular flower garden, in which sweet peas, mignonette, and other common flowers flourished, giving to the place, as the writer of the journal observes, more the appearance of an Australian shanty in the bush than of anything appertaining to shipboard.

The hydrographer to the Admiralty had laid down a track, which was carefully adhered to by the squadron; it was based, as was the date of sailing, on the most careful consideration of probable wind and weather, and the result showed how soundly statistical knowledge of this sort may be applied. During the whole of her voyage, which lasted 36 days, nothing but the finest weather was met with; good luck, as well as good management, contributed to a prosperous conclusion, and the *Bermuda* was towed into Grassy Bay, off Ireland Island, on Thursday, the 29th of July, and rode at anchor opposite the camber in which her life is to be passed.

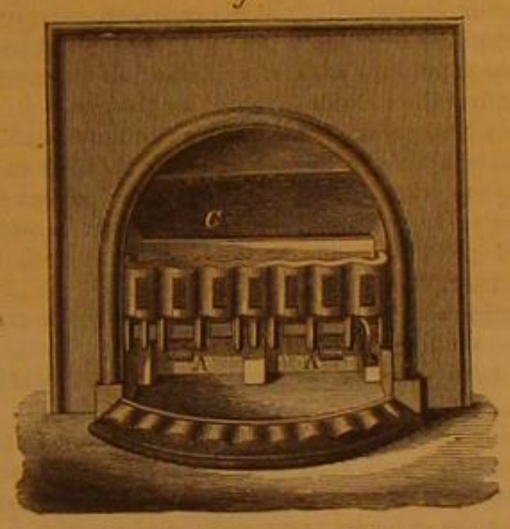
Since leaving the Medway there had been no accident to life or limb, although the clearing of the tackle, etc., often involved very dangerous service. The vessels towing her had been managed with a skill and delicacy only appreciable by those who know how much may depend in the crisis of an undertaking of this sort upon a few strokes of the wheel or turns of the screw. The careful selection and special qualifications of the officers are evident from the fact that in passing through the "Narrows" of Bermuda the dock was committed to the charge of two gunboats stationed at the island which were so badly handled that perhaps the whole undertaking would have been frustrated by some catastrophe had not some officers from the *Warrior* been sent to take command of them, after which they worked perfectly. The last few miles were the most anxious of the whole voyage, and the currents of the "Narrows," the tortuous and shallow channels involved great risk; the iron-clads drew too much water to be used here, and the *Bermuda* evinced at one time a disposition to start on her own account for Halifax, taking the *Terrible*, which was doing her best to persuade the dock to face the "Narrows" in tow. However, after a day's expenditure of tackle as has rarely been equaled in naval annals, the monster was coaxed into submission, and passed into the harbor all safe.

The only place touched at in the voyage was Porto Santo, in the Madeira group, when the *Agincourt* and *Northumberland* gave place to the *Warrior* and *Black Prince*. The highest speed ever attained was 6½ knots; but this involved a great consumption of coal, the husbanding of which was one of the chief necessities of the expedition. The senior officer was most unremitting in the carful performance of his duty; day and night, all through the voyage, flags, semaphores, and lanterns were at work, and the signalmen of the squadron had little rest; every *contretemps* was foreseen, and defeated by some new expedient, and the whole conduct of the expedition was without a single mistake. It is not often that a first venture so novel in itself, and involving such great risks, has had such perfect success.—*The* (London) *Artizan*.

## IMPROVED OPEN FIRE GRATE.

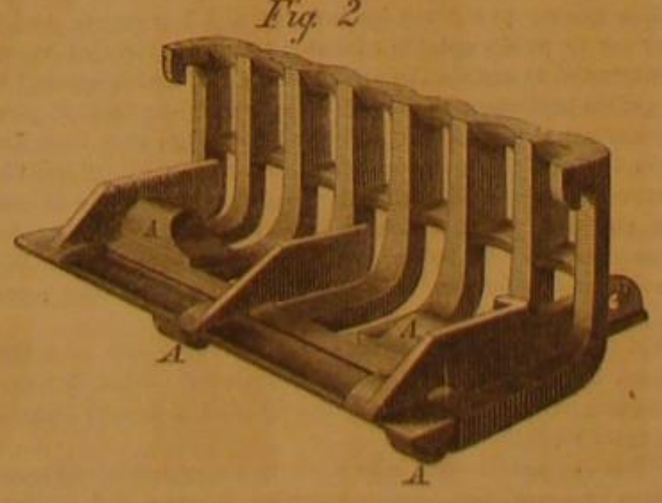
Our readers are already aware that we consider a well-constructed open fire grate the most pleasant as well as the least objectionable in a sanitary point of view of all forms of heating apparatus. It would be superflous in introducing to their notice another claimant of this kind for public favor, to dwell upon our reasons—so often stated in these columns—for that opinion.

*Fig. 1.*




It is claimed that in this grate, called by the inventor the "Utility Fire Grate," better combustion is obtained than in any form of grate heretofore employed; as the draft or air passage is at both the ends and back. And while by this arrangement the air finds its way readily to all parts of the fuel, leaving no black spots or unburned portions, it secures the contact of the oxygen to the hottest part of the combustible and the best conditions for perfect combustion are thereby secured; while the released gases, instead of escaping through the chimney are burned. This, it is claimed, is secured without admitting so much air as to carry off and waste the heat generated, which is equally as wasteful as to have the gases unconsumed.

*Fig. 2*



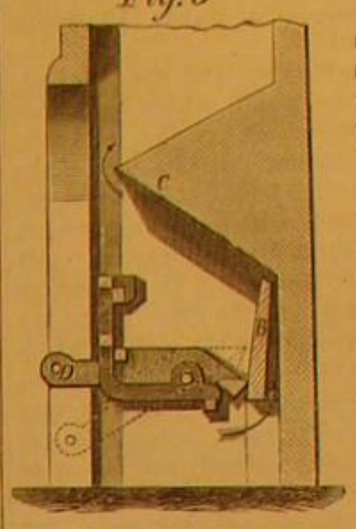

In this grate the back and ends are the hottest parts of the fire, as the movement of the shaking lever agitates and clears from ashes those portions, and leaves a free passage for the inflow of air. It is claimed that by this means even fine slack may be perfectly burned; and as all poking of the front of the fire is needless, the dust raised in shaking rises wholly through the chimney, without pouring forth into the room as with other grates; a most important advantage, as all good housekeepers will bear witness.

Fig. 1 is a front view of the form of grate as obtained by a change of old fire grates to secure the improved form, and mounted in the fire place.

Fig. 2 is a perspective view of the same removed from the fire place.

Fig. 3 is a sectional view of the fire place and the form of grate as made new. A brief description will give a full understanding of the parts and their respective uses.

*Fig. 3*




Lugs, A, to which the raking apparatus is pivoted, Figs. 1 and 2, are attached to any form of grate now in use, these lugs passing between the bars of the grate, and being held fast by pins driven through below the grate bars at right angles to them.

B is a back plate inclosing a flue through which air passes up to meet the hot and yet unconsumed gases, thereby supplying the necessary oxigen to perfectly consume them and mingling with them, as they are somewhat retarded in their flow over the bridge plate, C, Figs. 1 and 3. D, Figs. 2 and 3, is the socket for the lever employed to actuate the raker.

The principles upon which the grate is constructed are scientifically sound, and it has, we are informed, secured much popular favor where it has become introduced.

Patented by James Old, 175 Wood street, Pittsburgh, Pa. County and State rights may be applied for to his agent, Joseph Nicklin, of the same place, or to the patentee as above.

### The Divining Rod.

The following remarks on the supposed use of the divining rod in mining were made by Mr. Warrington Smyth, in a recent lecture at the Royal School of Mines:

"It is stated by some writers, and believed in some districts, that the backs of lodes may be followed by particular plants or herbs growing on them. There is some foundation for this idea, but it must not be taken as of unlimited application. The lode is composed of materials different from the ground at its sides; and if softer it will be lower, and the water will naturally flow along it, making the herbage brighter and greener, and nourishing a certain class of plants which will not grow on the dryer and harder soil adjacent. Quartzose veinstone often contains iron pyrites, which is decomposed by exposure to air, and soon producing a somewhat higher temperature, so that snow will melt sooner, and rime and hoar frost will not lie so long upon the line of the lode, and so indicate its presence. In some places it will not require a very acute sense of smelling to detect the presence of a lode by the nose; and anyone who has visited such mining districts as those of Wicklow, which abounds in pyrites, will remember the peculiar odor which prevails. In some places sulphurous acid arising from the decomposed lodes may be distinctly tasted. It has also been affirmed, not only in this country and in Hungary, but in late times in the United States, that lodes have been discovered and traced out by means of luminous coruscations playing along them. You will find statements of this kind in Pryce's 'Mineralogia Cornubiensis,' on the authority of credible observers. The mine of Nagybanya, in Transylvania, which is rich in gold and tellurium, was, it is said, discovered by appearances of this sort. Another curious method of searching for lodes is that by means of the 'dowsing rod.' Those who are inquisitive on the subject will find interesting details respecting this system in a curious book published in 1826 by the Count de Tristram, and in 1854 an ingenious book was published on the same subject by M. Chevreuil, a member of the French Academy, 'On the Bagnette Divinatoire (as the French call it); its Use,' etc., which combated the objection raised to the divining rod as a pure deception, and ascribed its action to philosophic causes. The 'dowsing' or 'divining' rod is a forked stick of some fruit-bearing wood, generally hazel, held by the extremity of each prong of the fork in a peculiar way. The 'dowser' then walks over the country he is to try, and when he approaches a mineral deposit the thicker end or handle of the fork turns down in spite, it is said, of all the efforts of the holder to the contrary, and points to the lode. There is no doubt that, owing to the way in which it is held, it has, when once it begins to move, a mechanical tendency to turn. As a general fact, however, it may be taken that it has not led to the discovery of any valuable lodes, and I am inclined to agree with the old author, Agricola, who says 'That a miner ought not to use this enchanted rod, because I want him to be a man skillful in other means, learned in geology and mineralogy, and able to give a right judgment as to the locality of the lodes without resorting to this questionable art.' Although it seems unnecessary to discuss seriously anything so doubtful as this 'divining rod,' many eminent persons have believed in it. A very clever man, Mr. Cookworthy, of Plymouth, the first man to apply to useful purposes the china clay of Cornwall, was a great adept at the use of the 'divining rod,' and a French ecclesiastic in 1863 was making a handsome income by discovering springs of water by its aid. A case occurred in Cornwall last year, in which what is called the Chiverton lode was said to have been discovered by the 'divining rod.'"

*Morgan's British Trade Journal* states that a kind of wrapping paper is now made in England which contains iron filings incorporated in a peuliar manner, and which, weighing much more than more costly commodities in proportion to its bulk, is recommended by the manufacturers to the use of tea dealers, and the venders of such articles as are usually weighed in paper. Well, indeed; can we Yankees beat this?

## Correspondence.

*The Editors are not responsible for the Opinions expressed by their Correspondents.*

### Small Turbine used to Drive a Large Flouring Mill.

MESSRS. EDITORS:—A very interesting and successful experiment in driving a large flouring mill, with a high head of water and a very small turbine wheel, has just been completed in this place. The Cascadilla Brook is one of the smaller streams that comes down the hills that surround our town, through a very beautiful glen, with numerous cascades, and hence its name. Near Cascadilla Place, a large and costly building connected with Cornell University, these cascades are high and the glen is very deep, and the whole gorge is a picturesque one to its lower end, where is the mill of which I have spoken. The last one hundred and twenty-five feet fall belongs to the mill. The capacity of the stream in very low water is only about ten or twelve cubic inches. In our high spring flood it often is a torrent violently rushing of as many or more cubic feet; indeed, in the words of an old lady, "Cascadilla is quite a cat when she gets her back up." But curbed with piles and plank, it, of late years, goes quite quietly through our town.

The problem of the mill was to make available this high head, at the minimum capacity of the stream, so as to drive at least two run of stone, in the lowest water, and at least four run in ordinary water, and the bolts and other machinery, which with fans, and cleaners of grain, elevators, etc., make quite a quantity and variety in a modern mill. The first indication was a pipe for the water. This was decided to be of iron, laid in a trench up the slope of the hill, just outside of the ravine. The second was a suitable wheel; and it was decided that if speed could be had, the whole mill could be driven by a very small wheel.

The matter ultimately took this shape. From a stone dam not quite a quarter of a mile off, a flume has for years run along the side of the gorge, to a spot a few hundred feet up the slope from the mill. Near about one hundred feet perpendicular hight above the wheel pit began the iron pipe and was laid down the slope 320 feet, to where it branched into two parts, one for the plaster mill that grinds the Cayuga plaster, that great fertilizer for our wheat lands; and the other to the flouring mill, some one hundred feet further on.

These branches were laid with sixteen-inch pipe. At the flouring mill the branch terminates in a large globular case some three feet in diameter and two feet high. In this is located first the water wheel gates, and just beneath them the, at first sight, insignificant little wheel, only *eleven and a half inches in diameter*. This wheel is supported on a two or two and a quarter inch steel shaft, which comes out of the top of the globular case by a water-tight packing; and on the top of the shaft is a belt pinion about a foot in diameter with a belt of the enormous width of sixteen inches, which belt passes about a wheel seven feet in diameter, and which wheel is connected by a cog pinion to the large common driver of the four run of stones of the mill. This gives the stone driver and its upright shaft about twenty-eight revolutions to the minute; while the puny water-wheel, in its little iron case, shall make the surprising number of *nine hundred* revolutions per minute. As they say of inheriting property, this is planning with "large expectations" of the wheel. But I can say that I have seen this actually accomplished. The wheel runs its nine hundred revolutions as quietly as if it had for years understood the business, and was not a novice in high speed; and as certainly and smoothly drives the four run of stone, and their bolts, and the other packing and cleaning machinery. So quietly does it do its work that we can hardly realize its full power; for turning flouring mill stones is no child's play, even for thirty and forty feet overshot wheels.

The vent of this wheel is in technical language fourteen and three-fourth inches; but it runs with ninety-five feet head of water, this whole mill and its four run of stone with the use of only two thirds of its ventage. The wheel is made of bell metal, as are the gates and other important parts.

Its existence is due mainly to the skill and energy of Howard C. Williams, Esq., who owns the mill, and has expended some five thousand dollars in this experiment. Thus is demonstrated the fact that great overshot wheels, enormous and costly machines, often in our eastern States costing as much for wheels alone as the pipe and all have cost in this, are matters of a by-gone age. And it is in the power of our wheelwrights to make useful many a small stream, that comes down a sloping hill, in such a manner as to make it impossible to construct these now useless large wheels. Further, it proves that any degree of speed on small wheels is attainable, and any number of feet of fall can be used on these excessively small wheels. For low heads, speed in the water cannot be had, and hence large wheels moving slowly must always be used; but in proportion as the head becomes high, motion rapidly can be had by its pressure, and the small wheel moving proportionally fast, can be belted down to the speed required in the arts of daily life.

It will be seen by the attentive wheelwright or mechanical engineer that the relative adjustment of this mill and wheel and its pipes can be improved. But the demonstrated value of this trial is of world-wide value. This mill has been driven day and night without hardly a stop. A hand wheel operating a screw, slowly opens its gates. A night cut-off, closes at pleasure the whole of the water from the wheel.

Ithaca, N. Y. S. J. PARKER, M. D.

### Gravitation Not the Result of Magnetic Attraction.

MESSRS. EDITORS:—In your valuable paper of January 8th, your correspondent, W. T. Stewart, has tried to explain the rising of a cannon ball above the horizontal line by temporary suspension of the earth's attraction upon the atoms of revolving bodies; having found by his experiments, as he claims, that magnetic attraction is the true cause of gravitation, and that rapid reversion cuts off the magnetic currents, the cause of gravitation.

If this should be the case gravitation would be many times greater near the poles of the earth than near the equator, because the magnetic poles of the earth nearly accord with the rotation poles.

Iron is much more strongly attracted by magnetic poles than any other metal, and would be, in that case, the heaviest of all metals.

Some metals (the diamagnetic ones) are repulsed by any magnetic pole. Such metals could have no weight at all.

I request your correspondent to put his gyroscope in a good balance, and he will find that it does not lose the least part of its weight by being brought into rotation. By the gyroscope can only be proved that rapidly rotating bodies resist change in the direction of the axis of rotation, but not that they lose any part of their weight. HUGO BILGRAM.

Philadelphia, Pa.

### Monopolies.

MESSRS. EDITORS:—In your article on the "Growth of Monopolies" in the number of January 8, you hold out but slender prospect of relief from the incubus so clearly pointed out—an incubus which, like the feudal land monopolies of the Old World has for so many centuries swallowed up the earnings of the very class (the workmen) whose prosperity is the surest source of national wealth and strength; and which keeps them in beggary and ignorance, and thereby limits the number of the rich and well-to-do.

But, you will allow one of the people to say that he thinks we can correct this evil, if we will—not by a direct attack through courts of law or violence—for both would fail—but by such a change in the practice of law as would insure to every man security in the possession of all his earnings.]

As we at present stand there is no remedy against those who have the faculty of lying and opportunity to rob others. In a small way, if a poor man swindles you the law soon furnishes a means of redress. But when a rich man robs a poor man what lawyer will fight his case earnestly, or what court do otherwise than countenance the delays and tricks by which a case is put into such a condition as to enable the court to confirm the swindle invented by the rich?

Now if we really want to have justice and give stability to the fortunes of all, there is no better way than by enabling the weak to protect themselves. The grand object of law ought to be to keep up a proper equilibrium between all classes, and prevent frauds by the poor on the rich, or the rich on the poor.

The "decline and fall of nations" is simply the result of a license to swindle each other—a "let alone," "let do" system—that false direction of the intellect and energies of men.

A change in the system of law practice does not imply the destruction of the profession of law, but a modification of it that will make it more popular than the present system, which is of class or feudal organization and practice.

Reading Bell's Law Dictionary (Scotch) I was struck with the fact that in certain cases a jury can be called together to examine evidence and return their verdict thereon, which verdict is attested by a judge and returned to chancery for proper action.

Let us extend this suggestion to a case of cornering railroad stock, and similar directors' swindles to rob shareholders of their little investments, and let us give to every man thus wronged "by his own acts" (into which he is entrapped) the power of calling together his own court, and obtaining without an hour's delay a verdict upon which he can pursue and punish in their persons all such swindlers; and would we not soon have better management, more general wealth, and fewer respectable rascals?

The answer now given by lawyers, and law courts, and I may say by public opinion educated to their interested views—interested to sustain the aristocratic class, which created it as a class profession to defend class rights—is that, if you, not having the foresight and foreknowledge of a God, act upon the positive evidence presented to you, all of which, however, is false and artificially made up especially to rob you, and find yourself deceived and wronged, that you "deserve your fate" for being so deceived and wronged! "We can do nothing for you," say the court; "we are very sorry for you, but there is no law to meet the case!"

Yet if a poor man "chisels" a rich man out of a few dollars by far less deceptive representation, what lawyer, what magistrate will not immediately find a law to punish the petty swindler?

What the people want is to work into a system of self-protection by a generous, just, and fair law practice and arbitration. We do not need to be governed by enormously-paid aristocratic officials, but we wanted to be protected at a cheap rate, and by immediate action, from all those selfish and crazy practices of individual power, which demoralizes the best and most capable of men. C. L. A.

Washington, D. C.

### Aerial Navigation.

MESSRS. EDITORS:—I hear a good deal said and see a good deal written about aerial navigation. I don't believe in it. I'm not an old fogy, nothing of the sort; on the contrary, I believe that "some things can be done as well as others," as Sam Patch said when he jumped off the factory roof into the mill pond, but when he jumped off Genesee Falls, he found that to be one of the things he could not accomplish successfully.

I have been a close observer and reader of what has been going on these fifty years in the world of art, mechanics, and science, and therefore am very slow to say or even to think that there are any bounds to possibility in the mechanical world; but no doubt there are impossibilities, and among them I put perpetual motion, and aerial navigation against the wind.

Now let us see whether I am right? Here is the air ship, finished, let us assume, in the best possible manner, with every necessary condition fulfilled; sufficient buoyancy and sufficient motive power, with the lightest possible machinery, and with ability of the propellers, whatever they may be, to take sufficient hold of the air to drive the apparatus.

It is a condition absolutely necessary, to provide sufficient floatage for the machine, and this involves a very large float opposed to the action of the wind, blowing sometimes with tremendous force. Assume that the propelling power is sufficient to resist this, then what must happen? The machinery—the ship—keeping its place or advancing against the wind, and the float yielding to the tempest, as it must, in which case the float no longer acts as a support to the ship, for the whole concern will be for the moment nearly or quite horizontal, succeeded instantly by a violent oscillation.

Who has not observed this in the ordinary balloon in even a moderate gale, the wide swing of the car, and sometimes a violent pendulous motion, causing the green navigator to fear that he is to be thrown out of the basket.

Ships like to anchor in a gale if they can, and thus ride it out: a good thing to do, if they can get fast hold of a good bottom with sufficient ground tackle. Now imagine your air ship securely anchored, so that the hull, containing the machinery, will not yield to any stress of wind; what will happen to the immense float by which the hull is sustained? Let him answer who has seen a close reefed main top-sail, of the heaviest duck, blown out of the bolt-rope with a report like that of a six pounder. N. D.

Portland, Me.

### Errors in Regard to Gravitation.

MESSRS. EDITORS:—Articles from correspondents in a recent number of your paper, in relation to cars jumping the track, rifle shots rising, boilers and grindstones bursting and flying up, tops spinning, and gyroscopes gyrating, "in defiance of gravity," bring us nearer than ever to the long sought flying machine.

All we have to do—according to these philosophers—is to put on the steam until the centrifugal force of the moving train overbalances gravity, when we could ignore the track, give the train an extra twist, reverse our polarity, and take a range high above mountain and forest. Coals would become superfluous, as the boiler would soon be hotter than Brick Pomeroy's paper and the passengers done brown.

These theories on false assumptions would be simply amusing were they not liable to mislead the novice.

Let us first ascertain whether the pail of water is really no heavier with two fishes in it, before attempting any explanation of the assumed fact.

The notion that shots rise after leaving the gun is probably much older than rifles.

There are weighty reasons why they should fall, but only one thin and airy argument in favor of their rising, and that is the difference in density of the air through which the upper and lower half of the shot is passing.

With balls some miles in diameter and great velocity, this might have some appreciable effect; but with any velocity and caliber we have yet attained with our biggest guns and longest range, the ball would probably be about the same through air as in a vacuum.

"Weight is the measure of gravity" and also an essential element of momentum. If by whirling a shot we detract from its weight we make it less harmful to the foe, and by increasing the "twist" artillery firing might resemble pelting the enemy with feathers.

"Change of polarity" is very ingenious, but gravity is too wary a bird to be caught with such chaff. A locomotive at high speed might leap a short break in the track by reason of its inertia as a mass, with which the revolution of the wheels has nothing to do. A sleigh would do the same thing. A skater, to pass a weak place, quits his gyrations and glides swiftly forward, bating his breath and fixing his muscles to prevent oscillation.

It is doubtless true that the wind sometimes assists to throw a train off, when it blows from the right quarter. It is, no doubt, quite as true that the wind often assists to keep the train on the track, as when passing round a curve with the wind on the outside.

The great prime causes of trains jumping the track are to be found in sharp curves, oscillating locomotives, and uneven road beds.

Tops and gyroscopes weigh just as much when rapidly revolving as when at rest; so do grindstones and car wheels.

Boilers generally fly up on exploding because they usually give way at the bottom.

Why detached portions of bodies revolving in a vertical plane take an upward angle, is a very nice question and worthy an able pen. B. F. WILSON.

Syracuse, N. Y.

### Improved Upholstering Material Wanted.

MESSRS. EDITORS:—Permit a protest through your columns against the all but universal use in public conveyances, of that dirty and pestilential abomination, the plush or cloth cushion.

The King of Prussia who banished upholstery from his

apartments showed a stamp of genuine refinement, not visible on some railroad boards.

As yet, Western civilization (?) has devised nothing that, in a sanitary point of view, will bear comparison with the familiar cane seat of Oriental origin.

The inventor has here a fine opportunity to contrive a self-ventilating seat for the million, accessible at all parts for cleansing or repairs, and self-adaptable to the human form, however fearfully and wonderfully made.

Cincinnati, Ohio. C. H. KNIGHT.

For the Scientific American.

## THE EGYPTIAN FELLAH.

BY I. CANTINI.

Since the beginning, progress, and final success of the works of the canal of Suez, the word "fellah" has often been introduced into writings and discussions of matters connected with this great work. It will not therefore be out of place to give a short description of the interesting and ancient people to whom this name applies.

"Fellah" is an Arabic word, and signifies "laborer of the soil." It distinguishes this class of Egyptians from the nomadic Bedouins. They are not to be confounded with the Foulahs, a largely scattered negro race of Soudan, nor with the Fellatahs, another negro tribe of western Africa. Long before the age when the dates of events began to be recorded, this patient, gentle, and ingenious race possessed a system of agriculture surpassing in perfection that of the present time. The tombs of antiquity speak of the life of this ancient race; and the type of the present generation is the same as that found in the mummies of their sepulchres. The fellah of to-day may see and meet with his own image amid the silent dwellers of the graves. Their blood must have been of a particular quality, that it so long retained its purity. This race has alternately been conquered by Ethiopians, Persians, Macedonians, Romans, and Turks, yet through all these invasions they have come forth unchanged; the type is unaltered.

The face of the fellah is oval, his skin dark. It is brown in the delta of the Nile, and becomes darker, even black in upper Egypt, yet his features are regular, the physiognomy noble, proud, and frank, and his manners more distinguished than would seem to correspond with his hitherto oppressed position. The fellahs are often misrepresented as being lazy, dirty, and wretched; the two first epithets are false, the last, alas! is but too true. They are poor, but their poverty is not a crime. They undergo fatigue and labor with great endurance and courage, and are all good Musselmen, and as such scrupulously observe the precepts of the Koran, which demands ablutions every day before each prayer.

Charity and hospitality are carried to a point which almost approaches the ridiculous, for they are too poor to do justice to these great virtues. The fellah works hard, and yet he possesses nothing, or if he does acquire riches, he is afraid to show or make use of them, for until of late years, the government snatched it from him as soon as it became known; and this has caused the fellah from time immemorial to hide his treasures, if such he had, by burying them in the ground.

The dwelling of the fellah is but a cube of earth, without roof or windows; the only furniture thereof is a mat, on which he sleeps, an earthen jar, wherein he fetches water from the Nile, and perhaps a few cooking utensils. His food consists of maize, sorgho, beans, and rice. The costume is a simple blue shirt or tunic to cover his body, and a felt hat to protect his head against the intensity of the Egyptian sun.

The men are in general kind to their wives, who share with them all the toils and hardships of life. The Koran authorizes polygamy amongst its followers, but this is a law which little affects the poor fellah, who contents himself with one wife. Children are everywhere considered a blessing, they cost so little to bring up and their hands are so much wanted in cultivating and irrigating the soil. The old habit of the Orient, sanctioned, though not invented by the great Mohammed, that the women should hide their face from public gaze is fast losing followers, especially among the poorest fellah women.

The degradation of the women is a greater curse to the East than tobacco or opium, yet there are certain limits; it does not extend to all classes of society. There are high grades of society to which it does not reach, nor does it descend to the humble laborious fellah woman.

The art of hygiene is much neglected in Egypt, and the nation is drained from its very source; they lose three out of five children on an average. Many parents among them had the courage to mutilate their own children, by putting out one of their eyes or cutting off a finger, so as to make them unfit for military duties, which were so much dreaded under Mohamet Ibrahim and Abbas Pacha. For the first time in 5,000 years the forced labor has been made easier; only one month and a half per annum are demanded by government to perform a duty which formerly occupied the greater part of the year, and left the fellah no time to cultivate his own land.

In Egypt, where it hardly rains, three times a year the ruler of the country causes irrigation of the fields by the distribution of the waters of the Nile. He can do this only by the help of men, and it is therefore in the interest of the people to serve their master. The patient fellah never bargains with the sweat of his brow for the demands of his sovereign, but he is not always so willing to serve a stranger and get nothing in return; his patience now and then gives out, and often an innocent foreigner is the victim of his anger. When the news of such an act of violence is received abroad, the public exclaims, "Behold the fanaticism of these infidels!" but this is a wrong interpretation; it is only misery which takes revenge.

There is hardly a country under the sun with such a healthy climate, such a generous stream and such an inexhaustible soil as Egypt, and yet these toilers of the land are the poorest of men. They are badly lodged, badly clad, and still worse nourished. From accounts given in Genesis, it is clearly shown that at that time, 1,700 years before the Christian era, despotism was the rule in Egypt. Moses says in his book that the kings were the owners of the lands, the nation, every individual with his goods and chattels, and that by a particular generosity he allowed the laborers one fourth of the harvest. This shows that not only has their type been the same for many centuries, but also their fate and their social position has been the same.

Nevertheless, they are, perhaps, without their equals as an agricultural people. The eye of the fellah is as sure and as straight in the laying out of his land as the instruments of a surveyor, and the defects in his agriculture have to be attributed to his poverty, and to the impossibility of working for his own advantage.

It would be wrong to believe the fellahs an inferior race, or devoid of intellect because their social position has always been an inferior one. Of late years, many have risen to high honors and functions. Among the most prominent in the present reign are Mazhar Pacha, Beghet Pacha, and Giraffer Pacha, Governor General of Soudan. This proves that even in Egypt, where the rich and the poor, the tax payer and the functionary are so distinctly separated, personal merit can overcome every obstacle to preferment.

A happier future is dawning to these poor fellahs under their present governor, Ismail Pacha, who but too plainly sees that the future prosperity of Egypt depends in a great measure upon its commerce and agriculture; he fully appreciates their worth and acknowledges their integrity by proudly calling himself "Prince of the Fellahs."

[For the Scientific American.]

## THE BARRACOUTA.

BY JOHN RAMSAY GORDON.

The barracouta, or barracuda, a species of pike, is a fish which abounds in tropical seas. According to Webster, it is termed in Ichthyology, *Sphyræna Barracuda*. It is found principally in the waters surrounding the West India and Bahama groups of islands. In the Spanish colonies it has received the name, *Paricotas*, and in the French, *Becayune*. This fish varies in length from six inches to ten feet; it is very voracious, and has been known to devour its own species. Like the pike, it is long and narrow, is very swift in its movements, and can take its prey instantaneously. Its mouth is capacious and is provided with sharp teeth in both jaws. Though the barracouta is greedy it is very subtile, and will look two or three times at a bait before it will take it, but if it once lays hold it is sure to be captured, as it closes its mouth with such force that the hook enters it securely.

The manner of taking this fish is by trolling with a live bait—usually a small fish—and this is termed by the natives of the islands "towing for barracoutas." It is necessary that the boat used for this purpose should move very rapidly through the water and as noiselessly as possible. The line used must be strong, as the fish is very powerful, and the hook ought to be firmly attached to it by means of a long piece of wire about four feet in length. This is termed by the the natives "a tail wire." If the hook were fastened to the cord without the wire the fish would cut it away immediately.

The boat having been set in motion, no time transpires before a gentle tug is felt at the line, and upon the increase of its speed, the resistance of the ensnared fish is felt very strong. To prevent the line from breaking, more of it is run out slowly, until it is deemed necessary to pull the captive on board.

The barracouta, unlike most fish, can take its prey without turning on its side, as its superior jaw is shorter than the inferior, and, on this account, it is extremely dangerous to persons who happen to enter the water where it abounds; like other fish, did it turn on its side to seize the object of its desire, the scales would glitter and so give warning to its unwary victim. This voracious tyrant rarely goes to the bottom; its domain is in midwater, where it can capture the innocent fry which swarm the sea at certain periods of the year.

I have thought that it was unnecessary to describe the appearance of the barracouta, because it resembles exactly the pike, which is universally known.

The negroes are afraid to eat the flesh of the barracouta; they assert that it is not safe to use it as food, because it is poisonous at certain seasons, and the explanation they give of this peculiarity is, that it feeds at stated times in the vicinity of copper banks or veins running in the bottom of the sea. It is said, too, that sprats are poisonous at times, and the French writer, Pierre L'Abbat, who visited the West Indies, seems to have thought that this was wholly the cause of the barracouta possessing this deadly quality. He says that the sprats feed upon the mangenele-apple, which is exceedingly poisonous, and they are swallowed by this tyrant of the sea, thereby conveying the effects to those who partake of this fish. Now, it so happens that the mangenele bears its fruit at the very time when the fish is deemed poisonous; and, it is more likely that this is the cause than that copper veins should effect this change in the fish. Some persons, however, are regardless of fear, and, after having pickled the fish, they eat it indiscriminately.

I am not aware that the barracouta is in any way serviceable, and I believe it is captured more on account of the sport it affords than for any remuneration which it might render.

### New Mode of Setting Boilers.

Several boilers in Sheffield, England, have been set upon a new plan. By a simple arrangement of fire-clay plates, says the Sheffield *Independent*, so managed as not to contract the capacity of the flue at any single point, the gases, after being thoroughly intermixed, are at four successive stages in their progress through the flue, thrown, in thin streams, against the surface of the boiler. No part of the gases can escape this repeated forcible contact with the boiler, and in the process the heat they contain is so thoroughly extracted and absorbed that the result obtained, as proved by careful tests, is the evaporation of nearly 12 pounds of water for every single pound of fuel, common boiler slack being used. This gives a large saving of fuel as compared with the best modes of setting previously in use. The patentees, we understand guarantee a saving of 25 per cent. The apparatus has the additional advantage of being an effective smoke consumer. The plan is applicable to any class of boiler; can be applied without unseating boilers already fixed; and the plates being of fire-clay, the cost is so moderate as to be very soon recouped by the saving of fuel.

### New Method of Preparing Oxygen, by MM. St. Claire Deville & Debray.

New processes of manufacturing oxygen have lately been discovered by the two well known French chemists, St. Claire Deville and Debray. These gentlemen have observed that where sulphate of zinc is submitted to a red heat it is decomposed in oxide of zinc, so much used in painting; in pure oxygen, and in sulphurous acid—the latter gas being also much used in industry.

Also, sulphuric acid being submitted to a great heat will decompose itself in pure oxygen and sulphurous gas.

Also, by passing a constant small stream of sulphuric acid through a platina worm filled with platina moss, the sulphuric acid is decomposed; the oxygen gas is collected in a gasometer, and the sulphurous gas is passed through water containing carbonate of potassa or carbonate of soda in order to obtain a sulphite of potassa or soda, being also much used in the arts.

### Disinfecting Fluid.

The Board of Health of the city of New York have recommended a disinfecting fluid composed of the following constituents: 1. Sesqui-chloride of iron. 2. Chloride of manganese. 3. Chlorine. 4. Carbolic acid. The sesqui-chloride of iron has been found by experiment to deodorize more effectually than chloride of lime, sulphate of zinc, or other disinfectant. It is therefore recommended as an important constituent of any disinfectant. Carbolic acid has a marked effect in preventing fermentation and putrefection, and is particularly destructive to insects and lower forms of life. In consequence of improved methods of distillation of coal tar products, this substance can now be obtained in large quantities and at reasonable rates. A disinfecting fluid having a proper mixture of the above constituents would be a valuable article of commerce.

INTERESTING TO COLLEGES DESIRING MINERALOGICAL SPECIMENS.—The Nye Forwarding Co.,—we are informed by Professor Edward B. Coe, of Yale College—whose business it is to forward goods of all sorts to and from the territories, and especially to attend to shipments of ores and specimens from Colorado—has among its members a man interested in science, and acquainted with the value of minerals, fossils, etc., and who will see to their careful handling. The company will also forward free of charge to colleges, all specimens of fossils, etc., and will cheerfully answer all inquiries as to country, means of travel, prices, etc. Address Wm. McCord, Evans, Colorado.

SPONTANEOUS COMBUSTION OF THE HUMAN BODY.—Mr. A. B. Flowers, of Alexander, La., writes us that the statement made in a recent article on this subject, to the effect that no one has ever witnessed a case of spontaneous combustion in the human body, is a mistake, as he was himself, with several others, an eye witness to a case of the kind. The person who was the victim was a hard drinker, and was sitting by the fire surrounded by Christmas guests, when suddenly flames of a bluish tint gushed from his mouth and nostrils, and he was soon a corpse. The body, he states, remained extremely warm for a much longer period than usual.

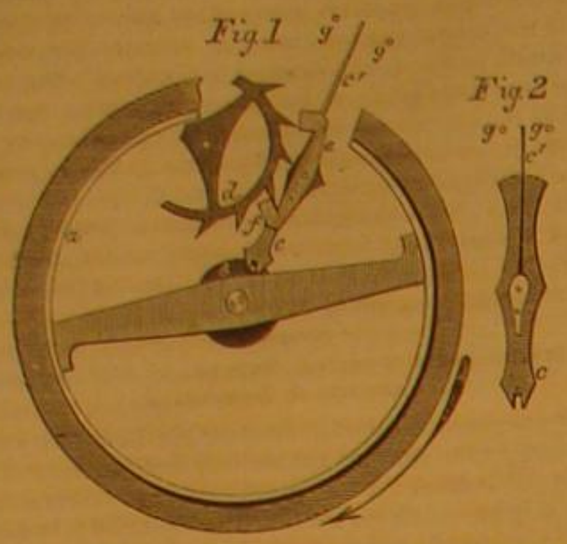
MANUFACTURE OF SAGO STARCH.—The wet starch is brushed through a sieve with one eighth inch holes, and falls into a cylinder which makes twenty-five revolutions per minute, by which the kernels are rounded, and from which they are removed on flat trays, and dried by steam. They are afterwards assorted by sieves to various sizes.

A GREAT PICTURE SALE.—Messrs. H. H. Leeds & Miner, auctioneers, of this city, will commence on the evening of February 4, at their art gallery, 817 and 819 Broadway, the sale of the most extensive and valuable collection of pictures ever offered in this country. The catalogue embraces over 1,700 pictures, ancient and modern, collected by the late Thomas Thompson, of Boston, who spent the best portion of his lifetime in gathering these art treasures.

TO TAKE STAINS OUT OF WHITE MARBLE.—Take 1 ox-gall, 1 wineglass of soap lees, ½ wineglassful of turpentine, mix and make into a paste with pipe clay. Put on the paste over the stain and let it remain for several days. If the stain is not fully removed a second application will generally prove sufficient.

## IMPROVED LEVER ESCAPEMENT.

In watches and other timepieces acting with a balance wheel and lever escapement, it sometimes occurs that by a greater than ordinary impulse imparted to the balance wheel from any cause, the ruby pin after the lever has been moved over into the one position is carried sufficiently far round to cause it to strike the outside of the fork of the lever in the same direction, whereby, as the lever when thrown over is in contact with the one banking pin, and cannot,




therefore, yield to such striking of the ruby pin, it sometimes happens that the ruby pin is fractured or the balance wheel or pallet staff pivots broken or bent. Various contrivances have been proposed to obviate these inconveniences, but all have been either too complicated and consequently expensive in their construction, or too uncertain in their action for general adoption. An invention, however, recently patented in England, has for its object to provide both an efficient and simple means for preventing the above liabilities. The *Mechanics' Magazine* thus describes it.

"It consists in placing the banking pins at the tail of the lever, and in so forming this tail as to act as a spring instead of making it rigid as heretofore, the spring being sufficiently stiff as in coming in contact with the banking pins to limit the ordinary motion of the lever to the required extent, while it is sufficiently elastic to allow the lever to yield to the second blow of the ruby pin, and to assume its correct position after the ruby pin has passed it. In place of making the tail of the lever act as a spring, Mr. Cole sometimes fits a spring on to the pallet staff in addition to the ordinary lever, so that the spring shall act on the banking pins and yield to the second blow of the ruby pin.

"Our engraving shows a plan of the escapement of a watch with this invention applied to it: *a* is the balance wheel, with ruby pin, *b*, which works in the fork of the lever, *c*, in the usual manner; *d* is the escape wheel, and *e* are the pallets carried by the pallet staff, *f*, and secured to the lever, *c*. The tail of this lever is formed quite thin so as to act as a spring, and works between the banking pins, *g g*. If now the balance wheel, having received the impulse given by the action of a tooth of the escape wheel on one of the pallets communicated through the lever, should from any cause be moved so far round that the ruby pin, *b*, strikes against the outside of the fork of the lever, *c*, the tail of this lever resting at the time against the one banking pin will, through its spring action and the shape given to the forked end of the lever, allow the ruby pin, *b*, to pass by, when the spring tail will immediately cause the lever to regain its correct position for the ruby pin to act upon it in the contrary direction. The tail is, however, made sufficiently stiff to limit the ordinary motion of the lever by coming in contact with the banking pins."

## OUR SPLENDID ENGRAVING.

The splendid engraving entitled "Men of Progress," engraved by John Sartain, of Philadelphia, at a cost of nearly $4,000 has received the unqualified praise of those who have been fortunate enough to secure a copy. There are nineteen figures on the plate, all good likenesses of the following eminent American inventors: Prof. Morse, Prof. Henry, Thomas Blanchard, Dr. Nott, Isaiah Jennings, Charles Goodyear, Joseph Saxton, Dr. W. T. G. Morton, Erastus Bigelow, Henry Burden, Capt. John Ericsson, Elias Howe, Jr., Col. Samuel Colt, Col. R. M. Hoe, Peter Cooper, Jordan L. Mott, C. H. McCormick, James Bogardus, and Frederick E. Sickles.

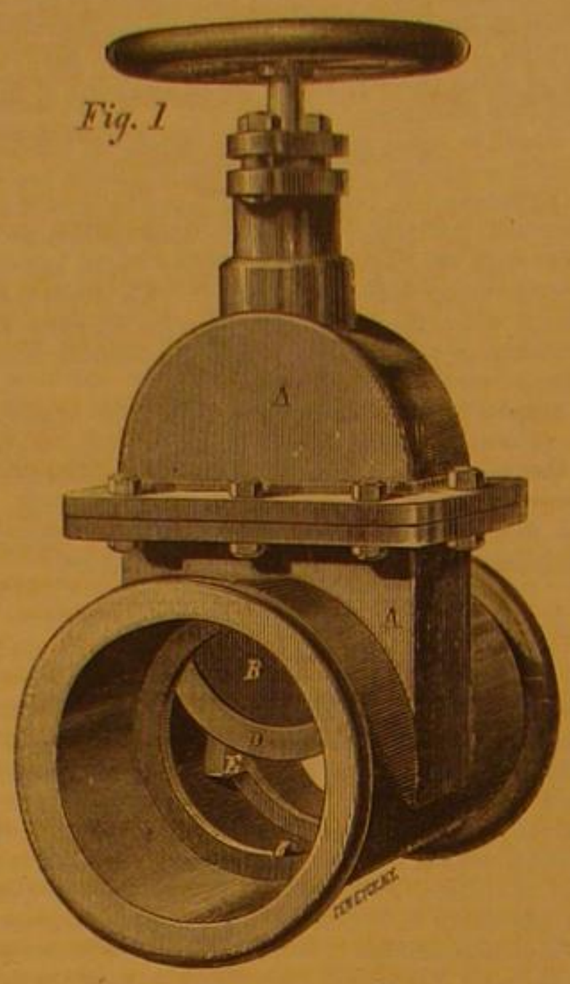
We continue to offer this beautiful work of art as a premium for clubs of subscribers, as follows, viz: Any one sending ten names and $30, will be entitled to receive for getting up the club one picture, delivered free; or if twenty names are sent with $50, one copy of the picture will be sent; thirty names with $75, two pictures. We are fully justified in urging our readers to possess themselves of this picture now while they have the opportunity.

REPORT OF THE AMERICAN RAILWAY MASTER MECHANICS' ASSOCIATION.—By the courtesy of Mr. L. P. Dodge, Secretary of the American Railway Master Mechanic's Association, we are in receipt of the Second Annual Report of that Association. The report contains much of practical value and interest to railroad men and to mechanics in general, and we may hereafter extract some portions of it for the benefit of our readers. We are requested by the Secretary to say that any party entitled to this report who shall fail to receive it by the 15th of January, will be supplied on application to the office of the Secretary, No. 53, Dearborn street, Chicago, Ill., either personally, or by mail. Mr. Dodge will please accept our thanks for his favor.

## LUDLOW'S SLIDING STOP VALVES FOR STEAM, WATER, AND GAS.

The most noteworthy and essential qualities of a stop valve may be briefly summarized. It should give a free and unobstructed flow to the liquid or gas, or in other words it should provide an opening as large as the caliber of the pipe, and in the direct line of flow. It should provide for the taking up of all wear upon the valve face and valve seat, as such wear occurs; so that it may keep constantly tight and free from leakage. It should not be liable to stick in its seat, however unfrequently employed. It should be readily and easily repaired, while at the same time it should be so durable that repairs are rarely needful. It should be easily worked under heavy pressure. Lastly, it should be simple in construction and cheap.

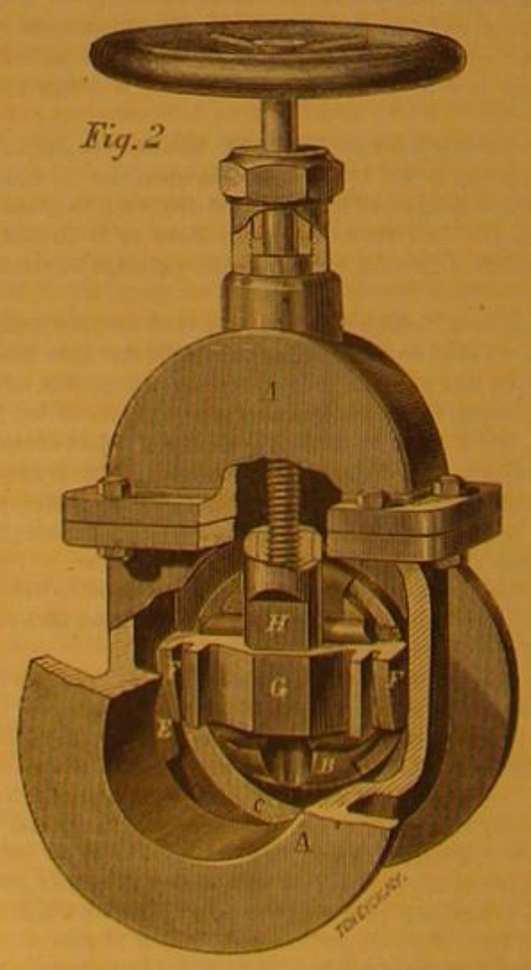
*Fig. 1*



The valve illustrated in the accompanying engravings, combines all these advantages with, so far as we can judge, no drawbacks of any kind.

Fig. 1 is a perspective view of the valve-box, and a partial view of the valve partly raised, with its face to the front. Fig. 2 is a view of the rear side of the valve; the valve box being partly broken away to distinctly show the arrangement and connection of the parts of the device. Fig. 3 is a view of the portion of the valve box at the back side of the valve. Such portions of the device as are shown in each of the engravings are indicated by the same letters on each.

*Fig. 2*




A, Figs. 1, 2, and 3, is the valve box; B, Figs. 1 and 2, is the valve; C, Fig. 2, is the valve seat, of annular form, and made of brass. D, Fig. 1, is the valve-face, also of annular form, and of the same material as the seat. E, Figs. 1, 2, and 3, are inclines cast on the part of the valve box lying back of the valve, the uses of which will be subsequently described. G, Fig. 2, is a wedge-bar or plate, lying across the back of the valve, having inclines, F, cast thereon, which inclines rest against the inclines, E, of the valve box, A, when the valve is closed. H, Fig. 2, is an upright, or nut, rising from the wedge-bar, G, having a female screw formed in it to fit the screw stem.

When the valve is closed by the action of the screw, the wedge-bar, G, moves slightly, after the valve has fully covered its seat and port, and by the action of the inclines, E, and F, pressure is exerted on the back of the valve, holding it firmly to its seat; the combined power of the screw, inclined plane and wedge, being used for that purpose. In opening the valve the wedge-bar starts first, releasing the valve from pressure before it is moved. The inclines, E and F, are so abrupt that they do not stick, and their movement in opening the valve is easily accomplished.

*Fig. 3*

A double gate valve for large sizes used in water works, is also manufactured, the faces of the valves being turned from each other. The wedge-bar acts between these gates so as to close both simultaneously, and yet to open without friction. This arrangement provides for the absolute prevention of any leakage, as under enormous pressures, should a large gate be slightly sprung from its seat—the pressure being against its face—the opposite one would be all the more tightly closed, as it would receive the same pressure on its back.

Valves intended for steam are made of the best steam brass. The manufacturers will fill orders for all sizes of valves for steam, gas, and water, from one half an inch diameter to thirty-six inches diameter.

Some people having used valves purporting to be the genuine Ludlow valves, have been disappointed, the valves being merely imitations. These failures have been in some instances wrongly charged to the Ludlow valve, which is open to none of the objections raised against the imitations. The genuine valves have the name of the inventor cast on the side of the valve box.

The value of this valve is attested by a large number of gas engineers, hydraulic engineers, water commissioners, manufacturers, and superintendents of works, all of the highest standing and reputation. The manager of the celebrated Harmony Mills, at Cohoes, N. Y., states that they have been used in that establishment for water, gas, and steam, during two years, and that they have proved so satisfactory that henceforth no others will be used in those mills Many other similar testimonials from some of the largest works in America have been shown us, which leave no doubt that the valve is all that is claimed for it. For further information address Fred Stone & Co., 18 Dey street, N. Y.

### Great Strike at La Creuzot.

The telegraph announces the strike of ten thousand operators employed at the immense coal and iron works at La Creuzot, in France.

Favored by the protection afforded to French industry, the business of the place has progressed, and at present the annual product is 250 000 tuns of coal, and 110,000 tuns of wrought iron. The works cover an area of 300 acres, of which more than 50 acres are buildings wherein mechanical operations are carried on. They have 15 blast furnaces of large dimensions, fed by 160 coke ovens, and using the blast of seven blowing machines of 1,350-horse power, and ten other engines for other purposes. The forge contains 150 puddling furnaces, 85 heating furnaces, 41 separate trains of rolls, 30 hammers, and 85 steam engines of 6,500 horse-power in the aggregate. This mill is all under one uniform roof, made of iron, and is about 1,400 feet in length, and is altogether in appearance and construction the most complete rolling mill in the world. Within the last few years the proprietors abandoned their old works and machinery, and in order to avail themselves of all improvements in machinery and process of manufacture, they erected an entirely new establishment. Forty-five miles of railway, 15 locomotives, and 500 cars, are required for the local operation of the works, and the enormous quantity of 1,400,000 tuns of traffic is annually moved at the central depot of La Creuzot.

The average wages paid for the whole ten thousand workmen was equal to 82 cents currency per day. These wages, so far below what are paid in the United States, explain and justify the discontent of the French workmen.

### 40,000.

It will be gratifying to the advertising patrons and friends of the SCIENTIFIC AMERICAN to learn that its present circulation is several thousand copies larger than at any previous time in its history. We are now printing a regular weekly edition of 40,000 copies, and subscriptions are flowing in from all sections of the country as they never came before. We confidently expect to run up our edition to 50,000 copies within a short time.

Since the opening of the new volume we have increased the number of contributors to our columns, and shall labor earnestly to give all the practical and popular scientific intelligence of the day.

DR. PIDTMANN, writing in *Virchow's Archie.*, does not hesitate to assume that chronic poisoning by carbonic acid is comparatively frequent in his part of the country, which is rich in iron stoves.

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## THE "SCIENTIFIC AMERICAN" IN 1869.

It will well repay our readers to turn back and examine the 826 pages of printed matter that we have furnished to them during the year 1869, and to study carefully the list of nearly 13,000 patents. No important invention or valuable discovery was permitted to pass unnoticed, and we have put into the hands of our subscribers ample material for the construction of a table of the wants of the community as expressed in a demand for a certain class of articles. The list of inventions preserved at the Patent Office in Washington is analogous to the meteorological record kept at the Smithsonian Intitution.

The one tells us of the fluctuations in trade and commerce, and the other indicates the change in wind and weather. We have long been in the habit of studying our barometers to see what the weather is likely to become, and no prudent mariner would venture out to sea without such an instrument to warn him of the approaching storm. Meteorology has been reduced to a science, and we have a monthly report upon all the questions relating to it, issued by the Department of Agriculture in Washington.

Few persons have reflected that a similar table could be prepared from our patent list. The record of inventions is the barometrical table of the value set upon certain contrivances by the people. No man in his senses offers a machine that does work for which there is no demand; but every one tries to produce something that exactly hits the wants of the times, and hence the patent record tells us what are the prevailing wants. The history of the manners and customs of a people could be written from the roll of patents. A time of war will show warlike implements, guns, cannon, shot, and shell; times of peace will give us mowers, reapers, and steam engines. It would be easy to see when war ended and peace was proclaimed, by scrutinizing the patent list.

We have made these observations for the sake of calling the attention of inventors to the importance of anticipating the future by a study of the past; and we shall illustrate our idea by pointing out some of the peculiarities of the present age, as indicated by the inventions recorded in our pages. During the early part of 1869 the velocipede was all the rage. No well-regulated household was considered complete without it, and sanguine people predicted that going on foot would soon become a matter of history; but the machine did not really meet a want, neither health nor comfort was promoted by it, and it disappeared as mysteriously as it came.

Solar heat as a motive power next claimed our attention, and before such a grand discovery every one felt disposed to bow his head. The precise apparatus by which this can be accomplished has not yet been invented, but we are on the threshold of the discovery, and there is a firm conviction in the minds of scientific men that the preliminary investigations necessary to the completion of the work will soon be ended, and we shall ultimately see the half-open door thrown wide open, and the invention become an accomplished fact. There is something real or substantial in an invention of this character, and it is well worth all the thought our ingenious mechanics and physicists can bestow upon it.

The fashions of our day demand brilliant colors, and the chemist has set to work to gratify this taste. We find one color after another added to our list, each vieing with the other in beauty of shade and permanency of tint, and the historian will wonder what use could have been made by the present generation of so much that could alone serve to adorn the outer man, not to say, the outer woman of the period.

The aniline industry, from small beginning has grown to vast proportions; and the records of patents show that the present generation is a prosperous one and able to procure whatever it desires for ornament and show.

That we require more books and read more newspapers than in past years, is evinced by the invention of new processes for the manufacture of paper and the supply of new stock to be employed in this industry. The demand for this class of inventions is proved by the number of patents for the use of wood fiber, corn stalks, straw, ramie, sea weed, and grass, to be very great, and this feature of our civilization may be taken as an offset to the more superficial love of display to be inferred from other inventions.

A higher state of society is evinced by the introduction of inventions looking to the amelioration of the condition of mankind. The talent of mechanics and the learning of men of science, are applied to the study of such questions as the earth closet—how to disinfect and economize all fecal matter so as to prevent cholera and fever, as well as to add to the fertility of the soil. The Norwegian cooking apparatus has been brought to greater perfection; and philanthropic men look forward to its introduction into the houses of the poor as a great improvement in the cooking and keeping hot of food, and also as being equally effective in storing ice for the sick room or for household use.

How to prepare cheap food has also played a prominent part in the investigations of the year, and distant countries have been laid under contribution for this purpose, while preservatives of all kinds have been invented.

The number of inventions and contrivances for elevating the condition of society, is greater now than at any former period, and inventors may well take note of this and shape their efforts accordingly.

We have discussed in our columns all of the methods devised to prevent the decay of wood. We have described how glass is manufactured, and how its optical properties have been more closely studied than formerly. The revelations of the microscope have shown us that life is almost everywhere—in the bottom of the ocean, in the water we drink and the air we breathe—and thus new subjects are brought out for study, and presently new inventions will be required for their application. The man of science points out the object, the man of practice shows us how to use it.

In architecture the improvements have been numerous and great. As our taste in this direction increases our wants multiply also, and each want involves some new invention which the ingenious man must be on hand to supply.

We have noted all that has indicated progress in agriculture—new implements and new comforts, and have pointed out what was needed to improve the condition of the farmer.

The importance of experiments in the cultivation of the sugar beet has not escaped notice, and the attention of inventors has been called to new evaporating pans, new purifiers, and new machinery for cutting and preparing the beet.

The progress of metallurgy and working of ores and metals, has received its due share of attention, and we have recorded all the improvements already made, as well as those that are anxiously sought after by men engaged in this branch of industry.

How to burn petroleum as a fuel has been the subject of profound study and experiment, and we have given all that is at present known on the subject.

The want of some cheap and economical method for the evolution of ozone has been explained, and the immense advantages that would accrue to the cloth and paper manufacturer, to the deodorizing of all substances, and to the bleaching of every material by this agent, have been fully developed by us in various articles.

We recall some articles on the subject of dialysis, and invite attention to the important application of which this principle of the diffusion of liquids is capable in the refinery of sugar, in the extraction of tan bark, and in other directions. We have watched the progress of electricity in medicine and the arts, and where an improvement has been made have hastened to record it. Still there is so much left to be done in this field that no one ought to despair of important discoveries. We want a practical thermo-electric battery, a better magneto-electric machine, and a constant electric light, and many improvements in the telegraph and in galvanic batteries.

How to make better gas for illuminating purposes has demanded new inventions, and yet the subject is by no means exhausted, and even at the present time the most approved methods of purification are not adopted in this country.

Not the least important portion of our paper is devoted to the answers to correspondents. It is said that "any fool can ask a question," but no one ought to be deterred by this from getting all the information he can. It is only a little knowledge that is dangerous, a good deal can always find a ready market. Hence the questions of our correspondents often elicit valuable information and point out the wants of a large number of people who have no other way of communicating with the public than this. It would reward the industrious reader to review the questions and answers of the year and compare them with the wants of a former period. The public pulse can be well felt through the beats of these inquiries.

We cannot give a summary of all that we have published during the year, as the number of topics is too great and our index can be consulted for that purpose; but we have endeavored to show that the best way to ascertain what the demands of a community are, is to study the inventions that are offered for their acceptance, and to ascertain what class of them find ready sale. After this information has been well digested, the inventor is in the condition to confine his efforts to the production of such improvements as are certain to meet with general approbation.

## TIN—WHERE AND HOW IT IS OBTAINED.

Tin is one of the most valuable of metals, and its use, already widely extended, constantly increases. In a pure state it possesses no properties injurious to health, and hence it enters largely into the construction of culinary utensils. Its ores are not so widely and generally distributed as the ores of iron, copper, and lead, but in certain localities immense deposits of this beautiful metal are found.

One of the most celebrated of these localities is Cornwall, in England, where tin mines were worked before the invasion of the island by the Romans, and the mines of this district are the most important in the world. Tin ores of a very fine quality are also found on the Malay peninsula, Banca in Asia, and in Bohemia and Saxony in Europe. They also exist in Mexico and other localities in small quantities and of inferior quality.

Tin ores are found in veins, or in detached masses in alluvial soils, where they have been carried by the action of water. The latter ores are hence called "stream tin." The examination of the deposits of stream tin frequently leads to the discovery of the principal vein from which the broken masses of ore have drifted.

When the ores are got out of the mines they are sorted by hand to separate the purer portions from the inferior qualities. The inferior portions thus separated are crushed in a stamping mill and washed with water to remove earthy matters. It is next roasted in a reverberatory furnace to expel arsenic and sulphur which are nearly always found associated with tin ores. The heat in the roasting process expels these substances in the form of vapor, the arsenic almost wholly, and the sulphur partially. The remaining sulphur is mostly combined with copper in the form of a sulphate—blue vitrol. This is now removed by a leaching process which dissolves out the salt.

The iron which the ores contain having by these processes been converted into the peroxide of iron, is next removed by washing. The tin oxide being considerably heavier than the iron oxide, the latter is carried off by a stream too feeble to carry off the oxide of tin.

To get rid of the oxygen and the remains of silica still mixed with the ore is the next step. The washed ore being ready for reduction, it is mixed with from one fifth to one eighth of its weight of powdered anthracite or charcoal, the latter being by far the best, as it conveys no additional impurities to the tin. A small portion of lime is added as a flux and the whole is placed in the reducing furnace. The heat is slowly raised so that the oxygen of the ore combines with the carbon before the fusing point of the silica is reached. After five or six hours the heat is made very intense, and the silicious matters form a fluid slag which floats on the surface of the melted tin.

The latter is now drawn off and cast into ingots, which are however still too impure to be marketable.

The first step in the process of refining consists in what is termed "*liquation*." This is performed by heating the ingots until the purer portions melt and run off, leaving behind an alloy which is remelted and forms an inferior quality "block tin." The purer portion being drawn off into a pan is kept in a gentle state of fusion for some time, and is stirred with sticks previously soaked in water. The steam generated from the water-soaked sticks escapes with considerable force and carries to the surface the dust slag and other impurities acting precisely like the air or water used in jigging machines, for separating ores from their gangues.

The finer portion of metal lies on the surface of the molten mass directly beneath the floating slag and this is often reheated to a temperature just below the point of fusion. Pure tin at this temperature becomes crystalline, and is easily broken into small fragments called "grain tin."

The purest commercial tin is the celebrated Banca tin, brought from the island of Banca which lies east of Sumatra. This tin is employed in the manufacture of the finest bells. It is almost chemically pure. English tin is more or less contaminated with arsenic, iron, and lead.

## IS WATER NECESSARY TO MITIGATE THE EFFECTS OF DRY AIR FROM HEATING FURNACES?

The Boston *Journal of Chemistry* takes the negative of the above question? It maintains—what no one ever denied—that when air is heated it contains all the moisture it contained before heating, but it comes to a conclusion—which every scientific man will deny—that it is therefore absurd to suppose any addition of moisture is requisite.

As we have said, no one ever thought of denying that air loses none of its moisture by heating. The fact is, however, that when so heated its appetite for water is vastly increased, and not only its appetite is increased, but its capacity to seize upon and hold water is increased. In this state it sucks at every pore in the skin, robs the delicate membranes of the eyes and nostrils of their moisture, enters the lungs drying and irritating them, causes the lips to crack, and otherwise injures the animal economy.

If its appetite is appeased from other sources, it does no mischief, and this can best be done by putting a trough in its path at which it can drink its fill before it enters the apartment.

That air, heated, has its capacity for moisture increased, has long been a demonstrated fact, and calls for no additional proof at this time. But it finds a proof in a well known fact, which we only bring forward to show another kind of mischief resulting from not satisfying the demand for moisture, and to obviate which, were no other reason tenable, particular attention to supplying water to heating-furnaces is demanded. We allude to the effect produced by dry hot air upon furniture, and the joiner work in buildings.

Carpenters and cabinet-makers will affirm that wood of all kinds shrinks very much more under the circumstances mentioned, than where the air supplied to rooms attains a proper hygrometric condition before it enters them. And the most superficial observer can scarcely fail to be convinced of the truth of this statement if situated to observe and contrast the effects of moist and dry air upon wooden articles. We have seen these effects upon the panels of doors, almost ready to drop out, and upon furniture the glued joints of which were torn asunder by undue and unequal shrinkage caused by the breath of the fiery simooms from the registers, which too often convert parlors into ovens which kiln-dry not only every inanimate object containing any moisture, but also the dwellers in these health-blighting inclosures.

It costs some trouble to prevent these evil results by keeping an ample supply of water in the furnaces, but it will cost more trouble not to do it.

Any one who has attempted to cultivate house-plants in a room warmed by heated air has noticed how quickly they droop and languish when the water is out of the heater, and there are not a few people who are so sensitive to the effects of what is generally termed "dry heat," that they can determine almost immediately, by their uncomfortable sensations, when the water supply has failed.

We trust the article referred to will not have the effect to render any one who uses a hot-air furnace neglectful to keep the water reservoir constantly supplied. This subject has received the most careful attention from scientific men, and it has been long generally admitted that without proper attention to this important particular, hot-air furnaces are capable of doing great mischief.

## WANTED---BETTER SIDEWALKS.

The question of improved sidewalks is collateral to that of improved pavements. There are serious defects in the sidewalks now generally used. We sum up the case against them as follows; premising that our charge is against bricks and flags, which constitute for the most part the materials of our present sidewalks.

First. They will not stay where they are put. They become rough and uneven, and both tender toes and high heels are made to suffer by collision against the insignificant precipices which threaten the soles of all foot passengers.

Second. They are liable to get slippery and dangerous upon the slightest provocation of rain and frost. They are then simply inclined planes of ice, down which people slide incontinently, in peril of life and limb. A learned surgeon once remarked in our presence that injuries to the hip joint received by falls upon slippery pavements, were a fruitful cause of that painful and dangerous affection known as "hip disease," and it is quite probable that more wrists are broken in this way than in any other.

Third. Bricks, when employed for pavements are, unless of the best quality, apt to crumble under the action of frost and water, and become a first class nuisance. And even when they do not crumble, they absorb water and remain damp longer than is agreeable. Water getting beneath them and freezing upheaves them even worse than flags.

The ideal of a sidewalk is one that presents a continuous even surface not smooth and glassy, and not liable to get slippery except from a considerable accumulation of ice; impermeable to water, and somewhat elastic to the tread.

The only walks we have seen at all answering to these conditions are concrete walks similar to those in the Central Park of this city, and Prospect Park in Brooklyn. And we see no reason why these beautiful paths should not replace flags and bricks in all the streets of our American cities used for residences. For business streets the heavy flags now employed are perhaps, preferable, on account of the battering they can withstand, and which they receive from the unloading of heavy packages, etc., but for our quiet up-town streets, nothing could be, in our opinion, superior to the concrete.

## A PECULIAR FEATURE OF AGRICULTURAL INVENTION.

The progress of improvement in agricultural machinery has been very gradual. People not very old can recollect when the ground was plowed with the cumbrous and imperfect wooden plow; when seed was sown entirely by hand, and harrowed under by the old V-drag; when crops were reaped by the hand sickle, raked by the hand rake, thrashed with flails, and winnowed with a willow fan.

Now all this is changed. Machinery has taken the place of hand labor in all departments of farm work; but in the gradual adoption of such machinery a striking peculiarity may be observed. It might reasonably be thought, that one of the first things to engage the attention of inventors, in their attempts to devise machinery for farm work, would be the first operation in the cultivation of land—plowing; and that the natural law of progress would be from this fundamental operation to the final operations of thrashing and winnowing. But the history of agricultural invention shows that precisely the reverse has been the case. Such progress as has been made, has been from winnowing to plowing.

The first inventions in farm machinery we can find were machines for winnowing wheat and clover seed. Two patents were taken out in 1776 for machines of this kind. The details of these machines have so far as we know, passed into oblivion; but a long line of honorable successors has gradually brought us the improved fanning mills of the present day; and the march of improvement has at last wedded the fanning mill to the thrasher, and even a polygamous union of raker, thrasher, and fanning mill is now extensively adopted. Nay, even the harvester, one of the latest of agricultural inventions, is now joined to thrasher, raker, and winnower, so that the grain is delivered from the field in a single operation cleaned and bagged for market.

The next steps were the invention of the modern scythe, the cradle, and the horse rake. All these have undergone great improvements since their primitive forms were introduced. Only one of these, however, the horse rake, retains its supremacy, and there are strong indications that this will ere long be wedded to some sort of apparatus for loading, sufficiently practical to secure general adoption.

The next in the regular succession of machines for the farm (properly so called) after the fanning mill was the thrashing machine. This has passed through a long probation of trial and improvement, gaining in efficiency, and being combined with other devices, until little is left to be desired.

Following the thrasher came the machine cultivators, still in process of development, for the dressing and weeding of growing crops. Then inventors turned their attention to seeders and planters, and lastly, to machine plows, of which the coming steam plow is to be the crowning act of agricultural invention.

In looking over this field and tracing the progress of invention in it, we are forced to recognize that most prominent tendency of the age, the removal of the great burden of manual toil from the human race. The majority of producers must ever be found in the noble and manly occupation of agriculture, and yet the time must come when this shall not only be the most elevated of all the departments of labor, but it will also become the least exacting. There is plenty of room for improvement yet in machines already invented, but the most immediate and pressing want is a good, yet not too costly steam plow.

## THE STEAM ENGINE TRIALS AT THE AMERICAN INSTITUTE EXHIBITION.

The Superintendent's report of the steam engine trials at the American Institute Exhibition has at last been made public in what is termed the "final report" of the judges. The facts have been kept back so long that it may be necessary for us to remind our readers that the experiments were conducted for the judges by Mr. Charles E. Emery, an experienced engineer, then acting as General Superintendent of the Exhibition, and who was formerly connected with the Government experiments at the Novelty Iron Works, and who wrote for our columns a series of articles on testing steam engines. Mr. Emery states that his report contains not only the facts in the case but certain "explanations and calculations embodied by direction of the judges." To his report, therefore, we must look for an explanation of the stultifying and ridiculous decision regarding the engines, to which we have already given place in our columns.

We have examined the report carefully, and see no reason why we should modify the opinions we have heretofore expressed on this subject. As regards the two larger engines, either one or the other was the better, and the judges should have been decided enough to say which; then, if they wanted to make an explanation that the result was due to improper workmanship or attention, they could have done so consistently.

The experiments appear to have been in most respects carefully and fairly conducted. The exhibitors had an opportunity to take their own records, and while this made it impossible to tamper with the facts, it still left as much opportunity as in any case for dispute in regard to the way the facts should be presented and weighed by the judges.

The amount of coal consumed has not been considered in making the award, and had the water evaporation been accurately determined, it would not have been important to consider it otherwise than as a confirmation of the water measurement. The estimation of the coal consumption would have been liable to some error arising from differences in the state of the fire at the beginning and close of each experiment, while the water evaporation might have been obtained beyond dispute. It was necessary to estimate the quantity of coal on forty-five feet of grate at both the beginning and close of an eight hours' trial, but as this was done with great care by all the parties interested, and the coal was leveled off to a line of bricks previously agreed upon, the error could not have been large, and such a basis of computation was not much improved upon by the use of a meter to measure the feed water used. This meter did not, when tested, give the same measurement at different speeds, but from the fact that both engines used very nearly the same quantity of water in the same time it is claimed that at the equal rates of speed actually employed during the experiments, the measurements were practically accurate. This may possibly be true, but it is not known to be true. In the papers previously published by Mr. Emery on this subject he recommended the use of tanks for measuring the feed water. He explains that tanks were not used in this case for the reason that the necessary valves might be tampered with. Better erect a separate building for the tanks, and guard it by a cordon of policemen, than have any such question arise.

The boiler used it appears could not be depended upon to furnish dry steam uniformly. It may have been the best that was available at the time, but its use detracts much from the value of the experiments.

The want of time appears to have been the great drawback in conducting these trials. If similar tests be again attempted, they should be commenced earlier, and published as soon as completed, and before the public had lost all interest in them.

We extract from Mr. Emery's report such portions as will be of greatest value to our readers, and publish them in another column. Our readers will see that the calculations are reliable only on the assumption that the water was correctly measured, an assumption which we regard as so doubtful that, in our opinion, the coal consumption is by far the better basis for calculation. This coal consumption, as ascertained by the weighing during the trial, is given in the report as unreliable, and it is estimated from the water evaporation, on the *assumed* basis of 9 lbs. of water evaporated to each pound of coal burnt.

## ANCIENT MODES OF EXTINGUISHING FIRES.

Fire, which was anciently considered the most mysterious and terrible of the four "elements," and for that reason was the invariable accompaniment of the process of sorcery, divination, and magic, modern chemistry has shown to be no element at all, but simply the visible effect of rapid combustion; thus, indeed, it has lost its suppositious mystery, although its real capacity of producing terror must ever remain. There is hardly a scene which the mind can present to itself more heart-rending than that of a great conflagration—a city in flames and its inhabitants driven houseless and homeless into the bleak and icy air of winter; and this, too, by the very agent which they had used to further their comfort. Like all things, enough of which is good, but of which too much is disastrous, fire is a "good servant but a bad master."

We moderns, who have the telegraph to let us know in a moment in what part of a city there is a fire, and steam fire engines to appear at the scene of conflagration with a celerity which, a few years ago, was unknown even to us, can hardly conceive the terror which the outburst of a fire in a great city of antiquity caused in the minds of its inhabitants; especially frightful must such calamity have been in time of war, when, to be driven from a beleagured city was to be driven into the midst of cruel and implacable enemies, and it is well known that fire was one of the most common and destructive means employed in ancient warfare.

Antiquity, being thus put at its wit's end, devised means of extinguishing fires which must seem to us extremely ludicrous. The first hose used was probably the gut of an ox, having at one extremity a bag filled with water, which, upon being compressed, would eject the fluid in a stream; but such a contrivance would be of but little value when a city was on fire. At best it could send a stream but a short distance and the bag would need to be detached from the hose and replenished very frequently. The houses were not seldom quite lofty, and, altogether, this primitive hose must have been very unserviceable.

Buckets and syringes were used, as were also pumps, and doubtless other machinery of which history makes but little mention. At Rome there were professional firemen trained to their duties from youth, and known as *matricularii*. They appear to have been a boisterous set of men, not altogether unlike those who, a few years ago, were led to fights and fires in New York by the celebrated "Mose." The Emperor Trajan, writing to Pliny the Younger, who was Governor of Bithynia, and had asked instructions from headquarters in regard to raising a company of professional "fire laddies," said that they were not the most peaceable citizens possible, and that "they would not fail to form themselves into factious assemblies" on the slightest provocation. Just think for a moment what must have been the result of the meeting of the rival companies of *matricularii*! We all know what good service was done by "Mose" upon the devoted head of "Syksey" when the speaking trumpet was the weapon of offense—but how ridiculous as well as bloody must have been the fights of firemen in the narrow streets of Rome, when buckets, syringes, long poles with sponges attached to them, and stones, were the munitions of war. A party running down to the "yellow Tiber" to get water for the syringes, meet another party just returning with buckets, which they have filled with the precious fluid, intending it to be used by the mop-carriers. Instantly there occurs a row, upon the issue of which depends the possession of the buckets; the moppers and the bucketers run from all quarters to mingle in the affray, and, by the time that forty or fifty ringleaders have bitten the dust, the water is all spilled and the *casus belli* removed with a vengeance. In the meantime the conflagration is spreading, and it is lucky for Rome if, before long, a whole quarter be not burned down. That this is not merely a fancy sketch, may be seen from the accounts which have come down to us, showing that the rabble of Rome was the most quarrelsome and seditious of any in the ancient world with, perhaps, the single exception of the rabble of Alexandria. Also may it be seen from the fact that the firemen were pointed out as being especially fiery and riotous.

The houses of Rome were very high, and almost always their upper stories were made of wood; this, added to the fact that the streets were generally narrow, will show how easy it must have been for conflagrations to spread. The city suffered terribly from fire many times, and several times was almost entirely consumed. Every precaution was taken, such as compelling persons to build their houses a certain distance from each other, instituting bodies of public and private watchmen, and the like, and these means, when faithfully and diligently used, were no mean preventives; but what was really needed was engines more nearly approaching to perfection, both in construction and handiness; and we find that the law at one time required every citizen to keep a private engine or *sipho* in his house.

With such inefficient apparatus was Rome guarded from fire.

In the dark ages conflagrations were common and disastrous throughout Europe, and the use of even the old engines seems to have been forgotten, certainly they were hardly used;

and this fact may, among other things, be attributed to a superstition, by no means uncommon, that fires, plagues, and great calamities were visitations of Providence, and that it was impious to attempt to prevent them or to obtain mastery over them when they actually existed. The helplessness and ignorance of superstitious people are perhaps nowhere more clearly seen than in the fact that in medieval times it was believed that the most efficacious means against fire was the ringing of sacred bells and the exorcism of demons, who were apparently supposed to be very inflammable personages; and certainly, if we consider the temperature of the place whence they were supposed to come, the opinion would not seem to be altogether unfounded.

Syringes were in use in London till far into the seventeenth century. They were of brass, and the largest of them held no more than a gallon. Three men were required to work one of them—two to hold the instrument and one to work the piston. We, at this age of the world, sometimes have extensive fires, notwithstanding our improved methods of extinguishing them; but to see how unmanageable such calamities must have been two centuries ago—as at the great fire of 1666, when London was destroyed—it is only necessary to observe that, supposing one of the syringes then in use could be filled and discharged four times in a minute, four gallons only could be applied in that time by one instrument. A steam fire engine can throw twelve hundred gallons per minute a distance of two hundred and ten feet. Even supposing—a supposition manifestly absurd—that the syringe could throw water the same distance, it would require nine hundred men to do the work now done by one or two. All things being considered, fifty thousand syringes would not be as serviceable as one steam fire engine. As Ewbank says, "the whole act of using them appears rather as a farce or the gambols of overgrown boys at play than the well directed energies of men to subdue the raging element."

In the sixteenth century syringes were made which differed from those previously in use only in being larger and being placed on wheels. A picture of one of these is preserved in Besson's "Theater," and looks, for all the world, like an immense sausage stuffer, capable of holding about a barrel of water. It had no hose (the ox's gut contrivance had been lost during the middle ages), and consequently the direction of the stream of water could not readily be changed, had the contrivance been placed simply on wheels. To avoid this difficulty, the syringe swung on pivots, and thus could be elevated and depressed, but when motion from side to side was required, the whole machine had to be turned.

It has already been said that pumps were used in very ancient times; but these, too, were lost in the darkness of the Middle Ages, to appear again in Germany near the close of the sixteenth century. A picture of the pump for extinguishing fire, given by Decaus, shows that it was worked by four men, two of whom pumped, while one held the "squirt," and another turned pailfuls of water into the machine. If a covered washtub be put on a sled, a board nailed to one side and rising two or three feet higher than it, and the whole thing considered a churn, the top of whose handle is inserted in a lever, one end of which is inserted in the board and the other end worked by hand, a very good idea of this pump will be obtained. The whole contrivance was a single forcing pump secured in a tub; afterwards, as in Hautsch's engine—a very efficient one—two pumps were employed, but it was not till some years later, that the air chamber and hose came into use; and thenceforth, until the invention of steam fire engines, variations in structure were simply those of detail in convenience of carriage and working.

## SLATE PENCILS.

Twenty years ago all the slate pencils used were manufactured in Germany. She then supplied America with this commodity. In 1850, there was a young man living in West Rutland, Vt., eighteen years of age, who fortunately discovered a supply of stone for making a first-class article of slate pencils. He began by whittling out the pencils and selling them to school children. Being a better article than that for sale in the stores, he found a ready sale for all he could whittle out.

He argued that if they would sell thus readily at home, they would sell readily everywhere. He became possessed of the idea that there was a fortune in the business, and his dream has been realized. This quarry of slate pencil stone was situated in a large ravine, four miles north of Castleton, Vt., near Bomoseen Lake. The land on which it was situated was for sale at one hundred dollars. He purchased it, and began operations by sawing out the pencils and whittling them round.

The business of making them grew immensely on his hands so that it was impossible to keep a clean order book.

Machinery was invented to facilitate the process, which has reached something like perfection, and enormously increases the production of pencils. At present the quarry and mills are owned by a joint stock company. They are valued at three hundred thousand dollars. From fifty to one hundred thousand pencils are turned out daily, and upward of a hundred hands are employed in the quarry and in the mill.

After the stone is quarried it passes through four processes before it is made into pencils. It is sawn into rectangular blocks five inches by seven, and split by hand into slabs of the same length and breadth, which are carefully assorted. These slabs pass through a machine which shaves them all to the uniform thickness of a quarter of an inch, when they are ready for the final process.

The machinery for reducing these slabs to pencils, consists of iron plates fitted to receive them, fastened to an endless chain which passes over rollers at either end.

These plates, of which there are about twenty on a chain, each receive a slab, and as it passes from one roller to the other the pencils are cut and rounded out half way to completion by semi-circular knives; a dozen different sets of knives being firmly fastened above them.

The slabs are then turned over and passed back through another machine exactly similar, and a perfect pencil is the product.

They are counted out by children and packed one hundred in a box. The pencils are sold by the manufacturers at half a cent a piece or fifty cents a box, or ten times the cost of slate pencils in Germany, where one thousand can be bought for less than fifty cents. Being made from a superior article of stone they are used throughout the United States in preference to those imported from Germany.

The slate pencil business, like the pin business is a small one in itself, but becomes large where it is necessary to supply all the school children of America with pencils. Twenty years ago the whole idea of it was in the brain of a young Yankee boy. To-day it is a business involving over a quarter million of money. It has been and will continue to be a profitable business as this is the only quarry and slate pencil mill in the United States.

Besides manufacturing the pencils the firm have a mill for grinding the stone to flour, bolting it finer than fine flour, to be used in the process of manufacturing paper, especially wall paper. This flour sells for twenty dollars a tun. The stone from which the pencils are made contains upwards of thirty per cent of alumina, from five to eight per cent more than the stone from which slate pencils are manufactured in Scotland. The company are putting up buildings and will soon be manufacturing alum on a large scale.

## ON COTTON SEED AND COTTON SEED OIL.

BY C. WIDEMANN, CHEMIST, PARIS, FRANCE.

No. II.

### THE OIL.

The quality, color, and density of the oil depend a great deal on the way it has been manufactured, the atmospheric air and heat having a great effect upon it, and also the condition of the seed. At first the crude oil is of a light yellowish green shade, but it soon becomes darker by oxidation of the coloring matter alluded to in the previous article.

Its fluidity is from 28 to 30 times less than that of water. Its density or specific gravity varies a great deal according to its temperature. At 54° Fah. (12·2° Cels.), it is 0·93074; at 58° Fah. it has a density of 0·93169. The specific gravity of a portion of the latter, after having been submitted to a current of steam at 212° Fah., and a thorough washing with boiling water, after filtering, increases to 0·9343305 at 52° Fah., care having been taken to have the sample freed from any adhering water by having a portion of the oil heated up to 212° Fah. for several days.

This crude cotton seed oil is soluble freely in ether, benzine, sulphide of carbon, and benzole, but not sensibly in alcohol even by the application of heat; the alcohol, however, takes up from the oil a portion of the substances which imparts to the oil its peculiar color.

The behavior of crude oil with reagents is certainly rather peculiar, but it should be borne in mind that the crude oil contains a large proportion of vegetable impurities which, no doubt, play an important part in regard to the reagents wherewith the oil is brought in contact. With sulphuric acid, concentrated, it causes a beautiful purplish color, which becomes stronger developed by stirring. After standing for twenty-four hours, the mixture is much thickened, and brownish red-colored. Solution of bichromate of potassa in strong sulphuric acid, being mixed with the oil, causes an energetic reaction to take place, sulphurous acid is evolved, and the color becomes deep blood-red. After standing for 24 hours the mixture exhibits a solid blackish mass.

With strong nitric acid, the color at first is dark olive green, but soon changes to light orange red. After 24 hours the oil is found solidified, and exhibits a dark orange red color.

With a solution of caustic potassa of a specific gravity of 1·22, the oil becomes thick, at first of a rather light yellowish color, while the solution of potassa becomes colored. On stirring the mixture with a glass rod those parts of the test tube, where air has more easy access to the mixture of oil and alkaline solution, assume a tinge of blue-purplish color. After 24 hours the oil becomes solidified. The bottom portion of the test tube, wherein the greater part of the solution of potassa separates, shows that solution deeply orange colored, and the blue purplish color is a shade darker. The same phenomenon is observed with caustic soda.

With strong ammonia a change of color to yellowish green.

Protonitrate of mercury, in aqueous solution, changes the color of the oil to a greenish yellow; after 24 hours the oil becomes solidified and the color dark olive green.

Strong phosphoric acid at first hardly affects the oil, but after 24 hours the oil becomes thicker and of an olive green.

With lime water the oil becomes soon solidified and of a brownish yellow color.

Sulphurous acid gas does not discolor the oil passing through it. Neither have some metallic combinations any decoloring effect on the oil; for instance, neither chloride of zinc, chloride of tin, acetate of lead, nor sulphate of zinc, has any effect in withdrawing from the oil its peculiar color, or if even some change appears to take place, it is not permanent.

In its oxidized state, and no doubt, also, under the influence of vegetable substances met with in the oil, the coloring matter appears to have a tendency to stick to fatty matters.

The crude oil freezes at 2° to 3° Cels., or 26° to 28° Fah., and this property is applied in this country to the manufacture of stearine and winter-pressed oil—which is pure oleine, used for lubricating purposes.

The weight adopted by oil merchants is 7½ lbs. of crude or refined oil to the gallon.

The specific gravity of the refined oil which has a yellowish color and is richer in oleine than in stearine, as it has been generally refined by a semi-saponification by the use of alkalies, which operation transforms a large amount of the stearine into stearates, is of 0·92647 at 61° Fah., or 16° Cels.

The crude oil is very similar in every respect to linseed oil in density and color, and can be classed among the drying oils used for painting.

In using it for painting purposes it has answered pretty well, though it appears to become sticky in damp weather. To prepare it for painting it is generally treated like linseed oil, that is boiled with oxidizing agents or litharge, or black oxide of manganese, but I have obtained better results with another agent, as I shall prove further on.

### THE CAKES.

As an average from 1,000 lbs. of meal, 730 lbs. of cakes are obtained, each cake weighing from 7 to 7½ lbs. These cakes are at first of a yellowish green, but become darker by age. They are nearly all shipped to England, where sometimes they are reground and repressed for the oil. They bring from $30 to $40 per tun; ground into meal they bring at retail about $2 per 100 lbs. The same bags used for the seed are used to ship the cake.

### USES OF THE COTTON SEED OIL, CRUDE, REFINED, BLEACHED, CAKES, MEAL, ETC.

As we have already seen, the husks have found their application, and it appears that everything in this extraordinary plant, called the cotton tree, with its productions, have their use and their applications. The cotton-seed oil (crude) is mostly used in soap manufacture, giving a remarkable fine soap, it is also used to grease wools, for adulterations of linseed oil, for its stearine products, its oleine, and for lubricating purposes. Refined, it takes the place of olive oil. It is used for cooking, for adulterations of lard oil, the oleine having the property of remaining at a low temperature without hardening, is used as a lubricator, white or bleached it is used for burning, and for adulterations of the finest qualities of lard oil. The cakes are used for feeding cattle, and the meal is used in adulterations of linseed meals. It is used for medical purposes, and also for adulteration of mustard meal.

Now that we have become acquainted with the article produced, I shall go through the manufacture of it, refining and bleaching.

## New Facts About the manufacture of Illuminating Gas from Mineral Oils.

Our cotemporary, the *Deutsch Industrie-zeitung*, communicates some interesting facts on the above topic, they being taken from a report of the gas inspector, Herr Mehlis, to the Association for the advancement of the mineral oil industry in Halle upon the Saale. The experiments undertaken have proved in the first place that the value of the oils, for the purpose referred to, depends upon the quantity of the paraffine they contain. The larger the percentage of the latter, the greater the yield and the better the quality. Still no essential factor for the valuation of the gas could be discovered either in the specific weight or in the degree of purity of the product; so much, however, has been ascertained, that the residue in the retort increases proportionally with the specific weight of the gas, and the quantity of the products of condensation with the boiling point. No definite conclusions have as yet been arrived at as to the most proper form of retorts, but the committee by which the experiments were conducted, is of the opinion that a cylindrical shape is to be preferred to any other, on account of the fact that the otherwise expensive repairs of the parts of iron are mostly avoided. No essential difference between the round and oval retorts could be ascertained. The use of pipes of decomposition is recommendable in so far as they enable the production of a certain quantity of gas with less furnaces. In regard to the temperature, a dark cherry-red heat was in all instances found most convenient. The illuminating gas from mineral oils distinguishes itself, as well known, by its richness in carbon, a great density and high luminosity; but, as the high cost of production of this gas can only be lessened by a proportionally high luminosity, it is above all necessary to select such burners and apply such a pressure as will develop the maximum of illuminating power. With regard to the application of different burners, it was found that gas which was prepared from one and the same oil yielded between 3·8 to 10·4 units of light per cubic foot; but with proper burners, the gas from mineral oils yields four times greater luminosity than ordinary gas, and, with regard to the construction of the apparatus, although they may be yet subject to many alterations, it can be said to have arrived at a point where the erection of larger works may be unreservedly commended. The city of Zeitz has, in fact, already made the necessary alterations in its gas-works, in order to be able to produce the new gas, at least during the summer months. The crude material is paraffine oil, as obtained in the distillation of shales, 1,000 cubic feet of gas being obtained from one barrel, which is got at the price of 2½ Prussian thalers. The cost of production of this quantity is stated to amount only to 4¼ thalers, while this volume is disposed of at 12 thalers.

ACCORDING to Reinsch, timber may be rendered incombustible by saturation with common salt, as well or better than by the use of water-glass, and a further advantage from salt thus applied, is a prevention of damage from certain insects.

## Summary of the Results of the Experiments made to Ascertain the Economy of the Non-Condensing Steam Engines, at the American Institute Exhibition of 1869. Extract from the Report of Charles E. Emery.

TABLE.

| | | | BABCOCK & WILCOX. | HARRIS. |
|---|---|---|---|---|
| a | Duration of experiment | Hours. | 8·00 | 8·00 |
| b | Diameter of cylinder | Inches. | 16·00 | 16·13 |
| c | Stroke of piston | " | 42·00 | 42·00 |
| d | Revolutions per minute | | 66·44 | 66·733 |
| e | Steam pressure in main pipe | Pounds. | 81·69 | 69·51 |
| | Mean initial pressure in cylinder per indicator | Pounds. | 76·148 | 76·943 |
| | Point of cut-off in fractions of the stroke | | ·180 | ·276 |
| | Mean terminal pressure in cylinder, per indicator | Pounds. | 9·055 | 5·178 |
| | Mean effective pressure in cylinder, per indicator | Pounds. | 34·057 | 29·738 |
| | Mean back pressure (independent of cushion) | Pounds. | ·800 | ·370 |
| | Mean friction pressure | " | 2·848 | 1·780 |
| | DISTRIBUTION OF THE POWER. | | | |
| A | Indicated horse-power | | 76·792 | 76·579 |
| f | Friction of engine per indicator diagrams | H.P. | 7·225 | 4·701 |
| k–h–f | Difference—gross load | " | 7·591 | 11·978 |
| | Ratio friction of engine caused by load | | 2·461 | 2·879 |
| m–j–k | Difference—{Net or effective horse-power transmitted thro' belt.} | Horse-power. | 69·794 | 69·039 |
| n | Dynamometer horse-power | | 64·732 | 67·814 |
| o–m–n | Difference—{Friction of connecting shaft.} | | 3·952 | 1·785 |
| | WATER. | | | |
| p | Feed water per hour by meter | Pounds. | 2,007·746 | 1,926·547 |
| q | Steam per hour by indicator | " | 1,593·496 | 1,815·723 |
| r–[100 q ÷ p] | Percentage of water accounted for by indicator | | 79·47 | 90·99 |
| | COST OF THE POWER. | | | |
| s | Water per indicated horse-power per hour | Pounds. | 25·482 | 26·039 |
| | Water per net horse-power per hour | Pounds. | 29·231 | 25·380 |
| u | Water per Dynamometer horse-power per hour | Pounds. | 31·007 | 29·645 |
| x–s ÷ 9 | Coal per indicated horse-power per hour, calculated from Water | Pounds. | 2·831 | 2·895 |
| w–t ÷ 9 | Coal per net horse-power per hour, calculated from water | Pounds. | 3·248 | 3·209 |
| z–u ÷ 9 | Coal per dynamometer horse-power per hour, calculated from water | Pounds. | 3·445 | 3·294 |

This table is a brief summary of the results of the experiments. The lines have been designated by letters for convenience of reference. The mean power developed in the cylinders, during each trial, in excess of that required to displace the back pressure of the atmosphere is shown in line, A, marked "Indicated horse-power."

The useful work done by each of the engines equals the power transmitted through its belt to the shafting, and must be obtained by adding to the dynamometer horse-power the power required to overcome the friction of the connecting shaft which carried the receiving pulleys of all the engines. The friction of this shaft was not the same for the two engines.

Having, however, both the indicated and dynamometer horse-power, the friction of this shaft in the two cases has been found, as shown in the table under the head of the "Distribution of the power." From the indicated horse-power (line A) is first subtracted the "Friction of the engine" per indicator (line f), and the remainder is the gross load (line j). The extra friction caused by the transmission of this load would usually be reckoned at 7½ per cent; but in these cases it was apparent that it was much less, for the reason that during the trial the lubrication was very well attended to. The low coefficient of 4 per cent has therefore been used to obtain the friction of the load (line k) which is substracted from the gross load, and the remainder (line m) equals the net or effective horse-power transmitted through the belt, or, in other words, the useful work done. From this is subtracted the dynamometer horse-power (line n), and the remainder equals the friction of the connecting shaft (line o), which shows by actual measure that the friction of the shaft, when the belt of the Babcock & Wilcox engine was in position, was much greater than when the belt of the Harris engine was in use.

Line p shows the average amount of water per hour pumped into the boilers, as measured by the meter.

Line q shows the quantity of water used, as calculated in the usual manner from the weight of the steam at the mean terminal total pressure shown by the indicator diagrams. The specific volumes of the steam were ascertained from tables founded on the experiments of Regnault and others.

The facts required for this calculation are shown in the table: namely, 1st. The terminal pressure from the indicator diagrams; 2d. The atmospheric pressure shown by the barometer (the total pressure equals the sum of the two); and 3d. The dimensions necessary to calculate the capacity of the cylinder clearances, etc., at the termination of the stroke of the piston.

Line r shows the percentage of the water used, which is accounted for by the amount of steam present in the cylinder at the end of the stroke.

The deficiency in each case shows, of course, the amount of water present with the steam at that point. A portion of this water was, undoubtedly, the steam condensed for the performance of the mechanical work, which was very nearly the same in the two cases.

Under the head of the "Cost of the power" are shown the water and coal required for the indicated, the net, and the dynamometer horse-powers. The coal required for the several kinds of power as shown in this table (lines s, t, u, and x) has been calculated from the water (lines s, t, u), on the assumption that the engine was supplied with steam from a boiler which would uniformly evaporate nine pounds of water per pound of coal. This evaporation is a fair result for a good boiler and would have been produced by those used in the experiments had the feed water been heated, as in usual practice, and the evaporation uniformly equal to the result on the second day of the trial.

The trial between the Babcock & Wilcox and Harris engines possesses considerable scientific interest, from the fact that the cylinder of the former was steam-jacketed, while that of the latter was made direct from the Corliss patterns, and without a jacket. The jacketed cylinder of the first-named engine was surrounded by an air jacket, having a polished external covering. The Harris cylinder was clothed with felt under a wood casing, with the exception of the steam chests, which were exposed and polished. The engines were of the same size, and as they were run also at the same speed the results are in every respect comparable.

The economy of these two engines is very remarkable. The best results possible by theory for an engine working under the circumstances of this trial is 21 pounds of water per indicated horse-power per hour, and both engines approached this limit very closely.

The steam applied to the Babcock & Wilcox engine was quite wet during much of the time, as was observed particularly by one of the judges and other persons present. This can only be accounted for by the same difference in firing, or in operating the fire doors, which caused the difference in coal.

The steam was dryer during the trial of the Harris engine. These observed facts are proved also by the meter and indicator measurements of the water (see lines p and q, the table, for only 79·47 per cent of the water pumped into the boiler was present as steam in the cylinder at the termination of the stroke in the Babcock & Wilcox engine, while the Harris engine showed 90·99 per cent (see line r), the deficiencies in the two cases show the amount of water present with the steam, and equaled, therefore, 20·53 per cent of the whole in the Babcock & Wilcox engine, and 9·01 per cent for the Harris engine.

The difference in the friction of the two engines is accounted for in the report by the undermining with water of the foundation of the Babcock & Wilcox engine.

## UNITED STATES CIRCUIT COURT---SOUTHERN DISTRICT. BEFORE JUDGE BLATCHFORD.

PATENT SHADES—INFRINGEMENT.

*Stewart Hartshorn* vs. *Lemon A. Tripp et al.*—This was a bill in equity for an injunction and an account of profits, founded on an alleged infringement of reissued letters patent granted to the plaintiff August 27, 1867, for an improved shade fixture, on the surrender of letters patent, granted to him as inventor, October 11, 1864.

The invention, as stated in the specification, relates to an improvement in that class of shade fixtures in which the shade roller is provided with a spiral spring for the purpose of automatically winding up the shade, and consists of an apparatus by means of which the shade may be stopped and retained at any desired hight by a simple manipulation of the shade. The defendants contended that the mode of operation of the shade fixture made by them is so different from that of the fixture made by the plaintiff as to relieve them from the charge of infringement. They also attacked the novelty of the plaintiff's invention, producing the testimony to the effect that an apparatus similar in operation to the invention of the plaintiff was in existence thirty-five years ago.

*Held by the Court*—That the fixture made by the defendants embodies the substance of the invention of the plaintiff. There is no difference between the two modes of operation so far as regards the real invention of the plaintiff and the scope of the claim of his patent. It may be that there is something in the defendants' arrangement that is patentable as an improvement on the device of the plaintiff, but that gives them no right to use such improvement without the license of the plaintiff, so long as the fixture embodying it contains, as it does, the invention patented by the plaintiff. The infringement by the defendants is therefore established. That inasmuch as the fixture referred to in the testimony is not shown to have been operated and used in a manner fairly accessible to the public, and passed out of existence, giving no hint to any one that it was of any use, and since the plaintiff never had any knowledge of it, it cannot be set up to invalidate his patent. (Gayler *vs.* Wilder, 10, How 477; Cahoon *vs.* Ring, 1 Clifford, 592, 611, 612). There must be a decree for the plaintiff for a perpetual injunction and an account of profits with costs.

For the plaintiffs, S. D. Law; for the defendants, C. M. Keller.

## Recent American and Foreign Patents.

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

CARRIAGE CLIP.—Clement St. James, Pittsfield, Mass.—This invention has for its object to furnish an improved carriage clip or thill and pole coupling, which shall be simple in construction, easily made, inexpensive, and at the same time, strong, durable, and noiseless.

HORSE HAY FORK.—Edwin G. Crandall, Belfast, N. Y.—This invention has for its object to furnish an improved horse hay fork, simple in construction, strong, and durable, not liable to get out of order, and convenient and reliable in use.

WASHING MACHINE.—George W. Stranahan, Westport, N. Y.—This invention has for its object to furnish a simple, convenient, and effective washing machine, which shall be so constructed and arranged that it may be also used as a boiler for heating the water and boiling the clothes.

HORSE HAY FORK.—F. W. Thorla, Hoskinsville, Ohio.—This invention has for its object to furnish an improved horse hay fork, simple in construction, easily operated, and effective in operation, being so constructed as to be readily thrust into the hay, and which will hold the load securely until it is discharged.

TIES FOR HOLLOW WALLS.—Edwin Tuttle, Fareham, England.—This invention relates to a new and useful improvement in tie for hollow walls, and it consists in the use of thin metallic plates placed on edge in the wall.

SPIKE PULLER.—William Kegg, Lasellsville, N. Y.—This invention relates to a new and useful improvement in a machine for pulling spikes, more especially designed for pulling railroad spikes but applicable to other purposes.

INCLOSED FOLDING SPRING BED.—Louis Derome, San Francisco, Cal.—This invention has for its object to improve the construction of the improved folding bed, described in letters patent No. 38,033, granted to the same inventor, March 31, 1863, so as to make it more convenient and effective in use.

HAND BARROW.—Minot S. Scofield, Stamford, Conn.—This invention has for its object to furnish an improved hand barrow, designed for use in handling barrels, boxes, and other packages, and which shall be so constructed that it will adjust itself to various sized packages.

HORSE POWER.—James Fraser and William Thomas, New York city.—This invention has for its object to furnish a simple, strong, durable, and convenient horse power.

TABLE.—Lambert Freeman, New York city.—This invention has for its object to improve the construction of tables, so as to make them stronger and more durable in construction, and adapt them to be used as extension tables when required.

COTTON SEED HULLER.—W. P. Callahan and D. R. DeRush, Dayton, Ohio.—This invention consists of a stationary and a running disk, working face to face, in the manner of grinding stones, and provided with steel plates in the faces set edgewise, projecting above the faces and arranged so as to have a shear action from the eyes of the disks outward, between which disks the seed are passed in the usual way.

SIDE DROPPERS FOR HARVESTERS.—W. G. Beels, Independence, Iowa.—This invention relates to improvements in side dropper attachments for harvesters, and consists in the combination with the apron of a carriage arranged to receive the grain as it falls and convey it backward to the rear side of the apron previous to discharging, away from contact with the grain cut while discharging, on which carriage a discharger, consisting of a series of arms reaching across the carriage and hinged at one side, is arranged to be turned up when the carriage has moved the grain back for discharging it.

NEEDLE CASE.—Wm. Avery and Albert Fenton, Redditch, England.—This invention relates to improvements in needle cases, and consists of an outer sheath, packet, or case, inside of which are arranged two or more cases or packets for needles, which are worked upwards and partly out of the end of the outer case, when required, by means of cranks or arms upon a small center, and having a thumb-bit projecting through and working in a curved slot in the outer case, one packet being attached to each arm and the arms so arranged that the motion of the thumb-bit simultaneously raises one packet and depresses the other.

SLED BRAKE.—L. P. Mosher, Stoney Creek, N. Y.—This invention relates to improvements in sled brakes, such as are set into action by the holding back action of the horses, and has for its object to provide a powerful brake, which when the horses are drawing, will be supported close under the sleigh bottom, out of the way, and which when brought into operation will not cut up and derange the paths wherein the horses travel. It is also designed to provide, in conjunction with the said brake, holding pawls or dogs pivoted to the rear ends of the runners, to be operated by the same means, and which will also act as brakes.

WAGON JACK.—Charles W. Mosher, East Leon, N. Y.—This invention relates to improvements in lifting jacks, and it consists in a combination on a platform, of a vertical hollow stand, or tube, having a long vertical slot extending from the platform upward, a vertically moving piston in the said hollow stand composed of a tube and a rod, adjustable as to length, and a T-headed operating lever and friction roller, connected to the lower end of the piston, the said roller operating as a movable fulcrum for the lever, which being worked up and down, will cause the head of the lever to assume either a vertical or horizontal position, thereby raising or lowering the piston on the top of which the weight rests.

CAPSTAN.—John Ericsson, New York city.—This invention has for its object to improve the construction of ships' capstans, so as to simplify the mechanism, increase the safety, reduce the expense, and facilitate the repair of the same. The invention consists, chiefly, in a novel manner of hanging the chain barrels, and of connecting them with the capstan proper, so that they can be readily and safely disconnected for dropping the anchor, and in the employment of eccentric shafts for holding them out of gear. The barrels are fitted loose around vertically adjustable shafts upon which gear wheels are mounted. These gear wheels connect with the barrels by clutches, and thereby revolve the same. When one shaft is elevated with its gear wheel its chain barrel will be entirely out of gear and will allow the anchor to drop.

SELF-ACTING THREAD GUIDE FOR BOBBIN WINDER FOR SEWING MACHINES.—Thomas Shanks, Baltimore, Md.—This invention consists of a mechanism to be attached to the ordinary apparatus for winding thread upon the shuttle bobbins of sewing machines, for the purpose of laying the thread evenly upon the bobbins, said mechanism deriving the motion from the shaft that rotates the bobbin, and therefore moving always with a speed bearing the same proportion to the velocity of the bobbin, whether that be greater or less.

BOILER.—A. N. Merrill, Batavia, Ill.—This invention consists of various improvements in boilers for farmers' use, in the preparation of feed for stock, all tending to increase the efficiency of the apparatus.

FASTENING BOXES TO GRAIN WAGONS.—George Seitzinger, Seneca, Ill.—This invention has for its object to provide means for increasing the capacity of the box of any ordinary wagon to adapt it for use in carrying grain and it consists in a hook-and-eye fastening for extra side boards which form a top box.

APPARATUS FOR STRAIGHTENING CAR AXLES.—B. S. Skates, Whistler, Ala.—This invention comprises a pair of housings having adjustable screw centers for suspending the axle by the "centers" in the ends and adjustable track for rolling the wheels and axle between the housings at the right hight to be taken by the centers, and a bending or straightening jack, to be placed under the bends in the axles to force them up to a straight line, the ends of the axles being secured by wedges under lugs on the housings to resist the upward pressure of the jacks.

CLOTHES SPRINKLER.—T. Rice Smith and James T. Mitchell, Jacksonville, Ill.—This invention relates to improvements in sprinklers for sprinkling clothes, floors, carpets, windows, etc., and it consists in the combination with a metal or other cup or disk, provided with a suitable handle, of a sponge confined in the said disk by wires attached to the edge of the disk and bent over the sponge, or a holder made wholly of wire, and provided with a handle may be used in substitution of the disk.

TWISTER FOR TWINE.—James McIntire, Hopewell Cotton Works, Pa.—This invention consists in an improved arrangement for holding down the arms that support the upper ends of the bobbin spindles, together with a simple and convenient substitute for the standards and leather belt around, the lower ends of said spindles.

CHURN.—J. A. and G. C. Hanger, Churchville, Va.—This invention consists chiefly in making the cogwheel that engages with the balance-wheel pinion, and which bears the crank by which the gearing is operated, adjustable with reference to said pinion, so that said cog-wheel may be placed in a position to suit the convenience of the operator.

PIPE COUPLING FOR HEATING CARS.—Henry R. Robbins, Baltimore, Md.—The object of this invention is so to improve the construction of the ball and socket joint, employed in connecting the pipes of one car to those of another, that with such joint the pipes can be easily connected or separated, when necessary, while the coupling shall be steam tight, and shall readily yield to the motion of the cars.

MEDICAL COMPOUND.—Mary J. Hanson, Manston, Wis.—This invention has for its object to furnish an improved medical compound, simple in its ingredients and preparation, and very effective for the cure of cholera morbus, diarrhœa, dysentery, colic, and similar diseases of the bowels.

PIPE TONGS.—John Clark, Astoria, N. Y.—This invention has for its object to furnish an improved pipe tongs, simple in construction and effective in operation, and which will operate with equal efficiency upon various sizes of pipe.

SCREW DRIVER.—David Drummond, McGregor, Iowa.—This invention has for its object to so construct a screw that it may be revolved like a brace for rapid, light work, or in the ordinary manner, by revolving the handle. The invention consists chiefly in so securing the handle that it may be swiveled or locked rigidly to the shank of the tool by means of a sliding ferrule.

GRATER.—Stephen S. Wilcox and Eli J. Colegrove, Linklaen, N. Y.—This invention relates to a new revolving grater for all kinds of vegetables, and consists in a novel manner of hanging the grater so that it can be readily taken out of the supporting frame or vessel to be cleaned.

GRAIN CLEANER.—Charles Jones, De Soto, Ill.—This invention relates to improvements in machines for cleaning grain, and consists of a series of screws of the form of truncated cones, arranged one above another around a vertical shaft in a frame, the small end of each opening into the large end of the next below, above a concave disk on the shaft; and a rotary fan also connected to the said shaft, the whole being arranged to separate the small matters through the screens, and to cause the light grains and refuse matters to rise to the top of the heavy grains by the quantity of the heavier grains, and to be upheld by centrifugal force and by the blast.

APPARATUS FOR PREPARING WOOL OR OTHER FIBRES.—Edward Holden, Laurel Mount, Baildon near Leeds, England.—This invention consists in a combination of several sets of gills, arranged in one machine, each set moving faster than the preceding set, and drawing rollers being arranged for conveying the fiber from one set to the other.

SUMMER COOKING STOVE.—A. H. Wellington, Woodstock, Vt.—This invention relates to an improvement in cooking apparatus designed for summer use.

KEYHOLE GUARD.—J. L. Russell, Prairie City, Iowa.—The object of this invention is to provide a safe and efficient means for protecting door locks from the depredations of thieves and burglars, and it consists in arranging a sliding guard for covering the keyhole, and also a catch for holding the keyhole guard in place.

BUTTER EXCAVATOR AND PRINT.—N. J. Eaton, Montana, Iowa.—This invention has for its object to furnish a device by means of which butter may be printed or stamped, and removed from a firkin, tub, or jar, in pieces of suitable shape and size to be placed upon the table, and in such a way as to leave the butter remaining in the vessel undisturbed.

JOURNAL BOXES AND JOURNALS.—Jeremiah McIlvain, Churchville, Md.—This invention relates to new and useful improvements in boxes for shaft journals and in the journals themselves, whereby the journals are kept cool and properly lubricated.

FREIGHT CAR LOCK.—J. L. Howard, Hartford, Conn.—This invention relates to locks for fastening the doors of railroad freight cars, having especial reference to locks where the bolt secures a hasp.

LANTERN.—E. F. Haskell, Sherman, Me.—This invention relates to improvements in lanterns, and consists in an improved construction and arrangement of the three-sided tin shell or case made of polished tin or other reflecting substance, for reflecting the light of the lamp within, to diffuse it throughout the room.

RUNNER ATTACHMENT FOR WAGONS.—J. W. Moore, Wataska, Ill.—This invention relates to improvements in the application of runner attachments to wagons, and consists in the employment of axle-supporting beams in substitution for the common axles, adapted for the support of short independent axles, for the wheels or bolts for connecting the bob-runners, so that the wheels or runners may be applied at any time as required, the said beams being the length of the distance between the wheels, and provided with two bearings for each axle, one at each end and the others near the center, and recesses are formed between the bearings for the reception of sleeves or hollow knees on the bob-runners by which they are connected to the beams, by bolts taking the places of the short axles of the wheels.

FLOOD GATE.—J. J. Kimball, Naperville, Ill.—This invention relates to improvements in self-opening flood gates, and consists in the combination with the main gate arranged between the two waters of a flume on trunnions, at or about the center lengthwise, and to stand in an inclined position when in the normal condition, of one or more auxiliary gates in flumes at the sides, with bulkheads over which the water will fall in times of floods, against the lower ends of the said auxiliary gates journaled at the upper ends, and carrying arms on the said journals, which, working in spaces in the walls of the flume, where they will not encounter floating ice or drift wood, will bear upon journals or friction rollers projecting into the said spaces from the upper end of the main gate and turn it on its trunnions to raise the lower end, and allow the water to escape under it.

COTTON PLANTER.—E. L. Sykes, Okolona, Miss.—This invention relates to improvements in cotton planters, and consists in arranging the wheels adjustably on a long axle, so that the machine may be used to plant the rows at different distances from each other; also, in an improved covering and clod scrapping attachment, the latter being arranged to move the clods away from the drills in advance of the coverer.

ROAD SCRAPER.—James Howland, Rock Falls, Ill.—This invention has for its object to provide a scraper by which the earth may be gathered from both sides of the road at once, and deposited on or about the center, in a raised oval bed, and which may be readily guided and navigated on the line of the road bed, or prevented from being thrown from side to side by unequal obstructions on either side.

CORN SHELLER.—Rupert Pfeifer, Linz, Austria.—This invention relates to a new corn sheller, which is so constructed that any person can readily and rapidly remove the kernels from the ears of corn by hand alone and without the use of stationary machinery.

CHAIR.—Wm. H. Joeckel, New York city.—This invention has for its object to so construct a chair whose seat can be folded up or down at will that the said seat will, when swung down, be supported by the jointed arm-rests of the chair, no fixed step being required either in the front or rear of the pivot. Another object of the invention is to provide chairs for sunday schools and lecture rooms, which will be adjustable both to children and adults.

PERCUSSION CAP CARTRIDGE CASE.—Sewell Newhouse, Oneida Community, Oneida, N. Y.—This invention relates to that class of metallic cartridge cases where a percussion cap is affixed to the case for igniting the charge, and consists in a movable anvil to which the cap is attached, by means of which the exploded cap is readily removed from the nipple.

THILL COUPLING.—J. I. Peck, Evansville, N. Y.—This invention relate to a new and useful improvement in the mode of coupling thills to buggies and other carriages.

**The Architectural Review**

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Glynn's Anti-Incrustator for Steam Boiler—The only reliable preventative. No foaming, and does not attack metals of boiler. Liberal terms to Agents. C. D. Fredricks, 587 Broadway, New York.

For solid wrought-iron beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Machinists, boiler makers, tinners, and workers of sheet metals read advertisement of the Parker Power Presses.

Diamond carbon, formed into wedge or other shapes for pointing and edging tools or cutters for drilling and working stone, etc. Send 3 stamp for circular. John Dickinson, 64 Nassau st., New York.

To ascertain where there will be a demand for new machinery or manufacturers' supplies read Boston Commercial Bulletin's manufacturing news of the United States. Terms $4 00 a year.

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## Answers to Correspondents.

*CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; besides, as sometimes happens, we may prefer to address correspondents by mail.*

*SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at $1·00 a line, under the head of "Business and Personal."*

*All reference to back numbers should be by volume and page.*

R. T. W., of Mo.—The horse power of any head of water is found by multiplying the number of pounds which fall per minute into the distance it falls, and dividing the product by 33,000.

J. H. McH.—We think your proposal not a very practicable one, yet if you wish to make it over your signature in our columns, we will give you the opportunity.

S. M. G., of Ca.—The force by which the circulation is kept up in plants is undoubtedly principally that called capillary attraction.

R. S., of Nova Scotia.—The siphon barometer was invented by Gay Lussac, not Torricelli, as you suppose.

F. G. H., of Vt.—It is estimated that the greatest amount an average horse can pull in a horizonal line will raise a weight of nine hundred pounds, but he can only do this momentarily. In a continued exertion he would probably not be able to do more than half that.

A. W., of Md.—We believe a concrete made of gravel or sand and Portland cement, or of gravel, sand, coal ashes, and coal tar, would make an excellent pavement for a farm yard. The latter is very easily made. You must dig away the earth to the depth of say five inches, then lay a bottom of pebbles, ramming them well down with a paving rammer. Sweep them off as clean as possible with a broom, and pay over the surface thinly with hot coal tar. Now put on a coat of smaller gravel (the first bed of pebbles should be as large as goose eggs), previously dipped in hot coal tar drained and rolled in coal ashes, with an intermixture of fine gravel, and roll it down as thoroughly as possible. Let the roller run slow, and let a boy follow it with a hoe to scrape up all adherent gravel. Next put on a coat of fine gravel or sand and coal tar with some coal ashes to complete the surface, and roll again as thoroughly as possible; the more rolling the better. It will take some weeks to harden, but makes a splendid hard surface which sheds water like a roof. Do not use too much tar. It is only necessary to use enough to make the ingredients cohere under pressure, and a little is better than too much. Such a surface will last in a farm yard a great while.

J. G. B., of Conn.—You may color different metals by the following method: Make a solution of four ounces of hyposulphite of soda in a pint and a half of water, and add a solution of one ounce of acetate of lead in the same quantity of water. Articles to be colored are placed in the mixture, which is then gradually heated to a boiling point. The effect of this solution is to give iron the effect of blue steel, zinc becomes bronze, and copper or brass becomes successively yellowish red, scarlet, deep blue, bluish white, and finally white with a tinge of rose. This solution has no effect on lead or tin. By replacing the acetate of lead in the solution by sulphate of copper, brass becomes of a fine rosy tint, then green, and finally, of an iridescent brown color. Zinc does not color in this solution. It throws down a precipitate of brown sulphuret of copper, but if boiled in a solution containing both lead and copper, it becomes covered with a black crust, which may be improved by a thin coating of wax.

N. P. C., of La.—You are entirely right in your views in regard to the adaptation of steam plows to needs of large sugar estates, and you are right also in regard to immense sacrifice of power in friction on draft plows. From your description we think your ideas are good, and shall be happy to give an opinion on your drawings. Send them along.

C. & Co., of Ill.—The deposit you send us proves to be chiefly carbonate of lime. It is deposited in a form very easily removed by blowing off. If the rapidity with which it forms is as great as you state, you ought to blow off at least twice a week, or even oftener. The deposit being a very fine light powder, it will be easily removed in this way.

J. S., of N. Y.—We have had no experience in the use of the New York Gas Company's coke under boilers, and therefore cannot say positively as to its effects upon boilers. Judging from the nature of and our experience with other coke, we are of the opinion that it would not prove more injurious than coal.

J. K. M., of Ill.—Your theory of terrestrial change and convulsion by the change of the position of the poles of the earth, as a cause of earthquakes and climatic variation, is not new, although new to yourself. It has much to support it but we do not wish to discuss it at present.

S. V., of Pa.—The form of the shadows cast by the planets into celestial space, is not supposed by astronomers to be merely a cone. The shadow consists of two parts, one called the umbra, or perfect shadow, and the penumbra, or partial shadow. It is only the umbra which is conical and terminates at a definite point; the penumbra diverges and extends indefinitely into space. You ought, before criticizing a statement, to post yourself in regard to it.

R. L., of R. I.—A good black japan is made of burnt umber, 4 ounces; true asphaltum, 2 ounces; and boiled oil, 2 quarts. Dissolve the asphaltum at first in a little oil, using a moderate heat; then add the umber, ground in oil, and lastly, the rest of the oil, and incorporate thoroughly. Thin with turpentine. It is a flexible japan and may be used on metal work which requires to be bent somewhat.

## NEW BOOKS AND PUBLICATIONS.

A SYSTEM OF INSTRUCTION IN QUANTITATIVE CHEMICAL ANALYSIS. By Dr. C. R. Fresenius, Professor of Chemistry and Natural Philosophy, Wiesbaden. From the last English and German Editions. Edited by Samuel W. Johnson, M.A., Professor of Analytical and Agricultural Chemistry in the Sheffield Scientific School, Yale College, New York: John Wiley & Son, No. 2 Clinton Hall, Astor Place.

The works of Fresenius have attained the enviable position of standard treatises on chemical analysis. Their method is admirable and either as text-books for students or as works of reference for the advanced analysts they are unrivaled. The present edition of the "Quantitative Analysis" has been considerably altered to suit the needs of American students. Its bulk has been reduced by the omission of some processes which the editor tells us in his preface his experience has convinced him are untrustworthy; and by the omission of others which are tedious and unnecessary. The entire chapter on the "Analysis of Mineral Waters" has been suppressed, the editor assuming that those who make extended investigations of this kind have access to the original sources of information. The section on organic analysis has also been reduced one half, without the omission of any useful or instructive processes. Other portions of the work have been also greatly condensed; but the alterations have not been confined solely to the elimination of matter considered unnecessary for American students. Important additions of new methods from the best sources have been made. The old chemical notation is retained, and we are glad that the editor has been in no haste to adopt what, in the minds of many of the best chemists of the age, is, to say the least, of doubtful value.

## APPLICATIONS FOR EXTENSION OF PATENTS.

MAKING SEAMLESS METAL TUBES.—William F. Brooks, New York city, has petitioned for an extension of the above patent. Day of hearing March 16, 1870.

CULINARY BOILER.—Edward Whiteley, Cambridge, Mass., has petitioned for an extension of the above patent. Day of hearing March 23, 1870.

SUBMARINE LANTERN.—Charles M. Gould, of Worcester, Mass., and Chas. B. Lamb, Woodstock Conn., has petitioned for the extension of the above patent. Day of hearing. March 23, 1870.

WHIP SOCKET.—W. H. Lyman, Tottenville, N. Y., has applied for an extension of the above patent. Day of hearing March 30, 1870.

MAKING BRASS KETTLES.—O. W. Minard, Johnsville, Pa., has applied for an extension of the above patent. Day of hearing March 30, 1870.

## Inventions Patented in England by Americans.

[Compiled from the "Journal of the Commissioners of Patents."]

PROVISIONAL PROTECTION FOR SIX MONTHS.

3,297.—FASTENING KNOBS OF DOORS, ETC.—C. Bristol, New Haven, Conn. November 15, 1869.

3,446.—ROTARY ENGINE.—G. B. McFarland, New York city. November 29, 1869.

3,563.—PROPELLER.—J. F. Alexander, New York city. December 9, 1869.

3,562.—APPARATUS FOR FOLDING PRINTED SHEETS OF PAPER, AND FOR CUTTING AND FOLDING PRINTED SHEETS OF PAPER AS THEY ISSUE FROM THE PRINTING MACHINE.—Richard M. Hoe, New York city. December 11, 1869.

3,568.—APPARATUS FOR SEWING THE NUMBERS OF A VOLUME IN BOOKBINDING.—H. G. Thompson and R. Martin, New York city. December 13, 1869.

3,603.—NUT MACHINE.—G. B. Lewis and W. M. Ward, East Boston, Mass. December 13, 1869.

3,604.—MANUFACTURE OF IRON AND STEEL.—S. W. Hopkins and F. H. Collins, New York city. December 13, 1869.

3,605.—MODE OF CUTTING VENEERS.—W. H. Williams, New York city. Dec. 13, 1869.

3,615.—HARNESS FOR LOOMS.—A. B. Corey, Providence, R. I. December 14, 1869.

3,616.—ROTARY ENGINE.—H. Olney, R. A. Delong, and J. A. Townsend New York city. Dec. 14, 1869.

3,620.—APPARATUS FOR MAKING AND BREAKING ELECTRO-MAGNETIC CIRCUITS.—E. S. Hidden, Millburn, N. J. December 15, 1869.

3,622.—GRANARIES, ETC.—Geo. H. Johnson, Buffalo, N. Y. December 15, 1869.

3,628.—WOOD-MOLDING AND PANELING MACHINE.—A. S. Gear, New Haven Conn. December 15, 1869.

## Official List of Patents.

### Issued by the United States Patent Office.

FOR THE WEEK ENDING JAN. 18, 1870.

*Reported Officially for the Scientific American*

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98,835.—DEVICE FOR SOLDERING EAVESTROUGHS.—Daniel Asire, Ada, Ohio.

98,836.—LAMP BURNER.—Lewis J. Atwood (assignor to himself, and Holmes, Booth & Haydens), Waterbury, Conn.

98,837.—TOOL HOLDER.—Joseph R. Bailey, Woonsocket, R. I.

98,838.—TOOL HOLDER.—Joseph R. Bailey, Woonsocket, R. I.

98,839.—FORGING AND STAMPING MACHINE.—William Ball, Chicopee, Mass.

98,840.—SHEEP SHEARS.—William B. Barnard, Waterville, Conn.

98,841.—GATE.—Isaac C. Bennett, Clinton, Ill. Antedated January 3, 1870.

98,842.—VAPOR BURNER.—William Bliesner, St. Louis, Mo.

98,843.—COMBINED WIRE CUTTER AND SHEARS.—Charles Brombacher, Tarrytown, N. Y.

98,844.—ROUND COMB.—Elias Brown, Wappinger's Falls, N. Y.

98,845.—WASHING MACHINE.—Milton V. Bulla and J. Benjamin Birdsell, South Bend, Ind.

98,846.—APPARATUS FOR TRANSMITTING POWER BY THE MEDIUM OF AIR.—Horace Call (assignor to himself and J. B. Rand), Concord, N. H.

98,847.—WRENCH.—George J. Capewell, West Cheshire, Conn.

98,848.—DREDGING MACHINE.—Octave Chanute and George S. Morison, Kansas City, Mo.

98,849.—FOOD FOR HORSES AND CATTLE.—Edward Harry Clowser, Boston, Mass.

98,850.—STONE-DRESSING MACHINE.—James Coulter and Herbert Harpin, Huddersfield, England.

98,851.—ADJUSTABLE RECLINING CHAIR.—Claud H. D'Arcus, Detroit, Mich.

98,852.—ICE-CRUSHING TABLE.—Samuel H. Davis and David W. Davis, Detroit, Mich.

98,853.—STILL FOR WHISKEY AND OTHER SPIRITS.—Henry G. Dayton, Dayton, Ohio.

98,854.—EXPLOSIVE COMPOUND.—Carl Dittmar, Charlottenberg, Prussia.

98,855.—CLOTHES WASHER.—James K. Dugdale, White Water, Ind.

98,856.—CLOTHES WASHER.—James K. Dugdale, White Water, Ind.

98,857.—SADDLE BAG.—George W. Elliott, Rocheport, Mo.

98,858.—SOFA BEDSTEAD.—William Farson, Philadelphia, Pa.

98,859.—TRAVELING SLEEPING CUSHION.—Edward G. Fast, Washington, D. C.

98,860.—PAPER BOX.—Franklin Field, Troy, N. Y.

98,861.—HARVESTER RAKE.—Jerome French, Independence, Iowa.

98,862.—COMPOSITION FOR COATING SHIPS, BOATS, ETC.—Edward Vincent Gardner, Oxford street, and Patrick Moiro Crane, Manchester, England. Patented in England, March 13, 1869.

98,863.—SAW HANDLE.—Reuben Gates, Parma, Ohio.

98,864.—UNIVERSAL GEARED JOINTS.—G. F. Green, Kalamazoo, Mich.

98,865.—NON-CONDUCTING COVERING FOR BOILERS, STEAM PIPES, ETC.—Washington Harris, Philadelphia, Pa.

98,866.—BRIDGE.—George P. Herthel, Jun., St. Louis, Mo.

98,867.—STOP FOR THE HINGED FRAME OF RECLINING CHAIR.—James G. Holmes, Charleston, S. C.

98,868.—OAR.—Wm. J. Hough, Martinez, Cal.

98,869.—READING AND WRITING STAND.—George Howell, Baltimore, Md.

98,870.—WRECKING TONGS AND EXCAVATOR.—Robert Hunter, Charleston, S. C.

98,871.—FELTING MACHINE.—Frederick S. Jennings, Danbury, Conn., assignor to himself, Morgan Chittenden, and Henry W. Duryee.

98,872.—SASH STOP OR HOLDER.—James P. Labar, Milford, Mich.

98,873.—STOVEPIPE DRUM.—George W. Lore, Dexter, Mich.

98,874.—METALLIC ALLOY FOR PLOW MOLD BOARDS.—Simon L. Madge, Toledo, Ohio.

98,875.—MEDICAL COMPOUND.—Peter Mays and Price Mays, Clearfield, Pa.

98,876.—HAY KNIFE.—Milo Merrill, Oneida county, N. Y.

98,877.—CIGAR MACHINE.—Frederick Meyer and Henry Schild (assignors to George J. Prentice), New York city; said Prentice assigns to Lewis Prentice, New York city.

98,878.—SERIES OF DIES FOR FORMING AXLES.—Joseph Nicol, Auburn, N. Y., asignor to Sheldon & Co.

98,879.—STOVE.—Benjamin Nott, Albany, N. Y.

98,880.—ELECTRO-MAGNETIC CAR BRAKE.—Joseph Olmsted, Knoxville, Ill.

98,881.—STEAM CULINARY APPARATUS.—Clinton I. Paine, Young America, Ill.

98,882.—HEATING STOVE.—Wm. M. Phelps and Samuel J Burpee, Marshall, Mich.

98,883.—MODE OF PRODUCING LIGHT BY THE COMBINATION OF SOLID AND LIQUID HYDROCARBONS.—Joseph Phillips, Cologne, Germany.

98,884.—MATERIAL FOR TANNING, DYEING, AND FOR OTHER PURPOSES.—Francis Peyre Porcher, Charleston, S. C.

98,885.—UNIVERSAL JOINT FOR SHAFTING.—Cyrus Roberts, Three Rivers, Mich.

98,886.—CORN PLANTER AND FERTILIZER.—Henry K. Roberts and George E. Roberts, Jefferson county, Ky.

98,887.—HORSE HAY FORK.—Luman Rogers, Pittsburgh, Pa.

98,888.—LEATHER-SPLITTING AND FLESHING MACHINE.—Joseph A. Safford, Winchester, Mass.

98,889.—MACHINE FOR ROLLING LEATHER.—Joseph A. Safford, Winchester, Mass.
98,890.—CIGAR MACHINE.—Henry Schild and George J. Prentice, New York city, assignors to George J. Prentice; said Prentice assignor to Lewis Prentice, New York city. Antedated January 10 1870.
98,891.—CURRENT WATER WHEEL.—Artaxerexes W. Sory, Prairie county, Arkansas.
98,892.—PLANT PROTECTOR.—Watson N. Sprague, Keene, N. H.
98,893.—CLOSING LEAKS IN HOSE, PIPES, AND TUBES.—Richard Street, Albany, N. Y.
98,894.—CASTING CANNON.—John Blake Tarr, Fair Haven, Mass. Antedated January 15, 1870.
98,895.—LOCOMOTIVE CAR WHEEL.—John Blake Tarr, Fair Haven, Mass. Antedated January 15, 1870.
98,896.—WATCH CASE.—Charles L. Thiery, Boston, Mass.
98,897.—STEAM DIGESTER FOR RENDERING LARD.—Leonard Thorn, New York city. Antedated May 25, 1868.
98,898.—MACHINERY FOR SAWING LATH.—Wm. Tuxworth, Sheridan, Mich.
98,899.—HARNESS SADDLE.—J. L. Van Wert, Tolland, Mass.
98,900.—APPARATUS FOR ROLLING METAL.—John I. Williams, Millvale Pa.
98,901.—PNEUMATIC RECIPROCATING MOVEMENT.—De Volson Wood, Ann Arbor, Mich. Antedated January 10, 1870.
98,902.—WASHING MACHINE.—Squire Ainsworth, Pittsburgh, Pa.
98,903.—DRAWING KNIFE.—John H. Atwater, Oshtemo, Mich.
98,904.—NEEDLE CASE.—Wm. Avery and Albert Fenton, Redditch, England, (assignors to Wm. Avery.
98,905.—STREET URINAL.—Moritz Bacharach, New York city.
98,906.—LEATHER CHANNELING AND FOLDING TOOL.—A. H. Bailey and Wm. G. Bratton, Marseilles, Ill.
98,907.—COMBINED LATCH AND LOCK.—W. N. Bailey, Duplain, Mich.
98,908.—SCAFFOLD.—George W. Baker, Lincoln, Ill.
98,909.—HARVESTER DROPPER.—W. G. Beels, Independence, Iowa.
98,910.—HARVESTER.—W. G. Beels, Independence, Iowa.
98,911.—PLASTIC ROOFING COMPOUND.—R. O. Benton, Buffalo, N. Y.
98,912.—CASTER FOR FURNITURE.—Leopold Bertsche, Allegheny, Pa.
98,913.—TURBINE WATER WHEEL.—Hugh Boyle, Waterloo, Iowa.
98,914.—FENDER FOR HEATING STOVE.—N. A. Boynton, New York city.
98,915.—BASE-BURNING STOVE.—N. A. Boynton, New York city.
98,916.—TANNING AND STUFFING LEATHER.—Wm. B. Brittingham, La Fayette, Ind.
98,917.—SEAL LOCK.—F. W. Brooks, New York city.
98,918.—CHURN.—S. W. Bruce, Laguardo, Tenn.
98,919.—POWER LOOM.—John Bullough, Accrington, Eng. Patented in England, July 28, 1868.
98,920.—CARRIAGE WHEEL.—John G. Buzzel, Lynn, Mass. Antedated Jan. 14, 1870.
98,921.—COTTON-SEED HULLER.—W. P. Callahan and D. R. De Rush, Dayton, Ohio.
98,922.—APPARATUS FOR OILING WOOL.—T. A. Campbell, New York city.
98,923.—PLATE HOLDER.—John Carlin, New York city.
98,924. CHURN.—John Chapple, Jasper, N. Y.
98,925.—PIPE TONGS.—John Clark, Astoria, N. Y.
98,926.—CHAIR TIP.—Edward Coogan, Washington, D. C.
98,927.—TELEGRAPHIC APPARATUS.—H. Cook, Paris, France. Antedated Jan. 10, 1870.
98,928.—SKIPPING ROPE.—S. Park Coon, Milwaukee, Wis.
98,929.—ROCKING HORSE.—Benjamin P. Crandall, New York city.
98,930.—HORSE HAY FORK.—Edwin G. Crandall, Belfast, N. Y.
98,931.—METHOD OF FORMING T-BOLTS.—J. Deeble, Plantsville, Conn.
98,932.—INCLOSED FOLDING SPRING BED.—Louis Derome, San Francisco, Cal.
98,933.—SCREW DRIVER.—David Drummond, McGregor, Iowa.
98,934.—RECLINING AND EXTENSION CHAIR.—John Runn (assignor to himself and Jonathan Stone), Charlestown, Mass.
98,935.—COMPOUND RAILWAY RAIL.—William B. Dunning, Geneva, N. Y.
98,936.—LAMP CHIMNEY.—R. N. Eagle, Washington, D. C.
98,937.—LAMP CHIMNEY.—R. N. Eagle, Washington, D. C.
98,938.—BUTTER EXCAVATOR.—N. J. Eaton, Montana, Iowa.
98,939.—WASHING MACHINE.—H. L. Ennes, Birmingham, Ohio.
98,940.—CAPSTAN.—John Ericsson, New York city.
98,941.—WASHING MACHINE.—Thos. R. Evans, Blacksburg, Va.
98,942.—EXTENSION TABLE.—William Farson, Philadelphia, Pa.
98,943.—SCREW TAP.—Christian L. Fehrenson, New York city.
98,944.—CORN SHELLER.—Samuel Field, Oakham, Mass.
98,945.—PEN.—D. D. Foley, Washington, D. C.
98,946.—HORSE HAY FORK.—Emanuel Forney and Jonas Swab, Elizabethville, Pa.
98,947.—HORSE-POWER.—James Fraser and Wm. Thomas, New York city.
98,948.—TABLE.—Lambert Freeman, New York city.
98,949.—PUTTY KNIFE.—S. W. Gerelds, Worcester, Mass.
98,950.—PORTABLE WATER CLOSET.—Joseph Gilbert, Philadelphia, Pa.
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98,968.—SAWING MACHINE.—S. C. Howe, Allen's Prairie, Mich.
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98,970.—CULTIVATOR.—B. S. Hyers, Pekin, Ill.
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98,972.—PERMUTATION LOCK.—F. E. Isham, Hartford, Conn., administratrix of the estate of Henry Isham, deceased.
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99,039.—STRIKE FOR LOCKS.—Wm. Weisner (assignor to himself and Claudius Kiefer), Elizabethtown, New Mexico Territory.
99,040.—SUMMER COOKING STOVE.—A. H. Wellington, Woodstock, Vt.
99,041.—STOVE GRATE.—M. D. Wellman, Allegheny City, Pa.
99,042.—REVOLVING GRATER.—S. S. Wilcox and E. J. Colegrove, Linklaen, N. Y. Antedated Jan. 8, 1870.
99,043.—WAGON.—James S. Wilson, Allegheny, assignor to Phelps, Park, & Co., Pittsburgh, Pa.
99,044.—LET OFF MECHANISM FOR LOOMS.—Daniel Long and John Preston, Fairview, Pa.
99,045.—MOLD FOR VULCANIZING RUBBER PENCIL TIPS.—Joseph Banigan and G. W. Miller, Smithfield, R. I.

## REISSUES.

87,487.—PURGING AND DRAINING SUGAR.—Dated March 2, 1869; reissue 3,797.—W. H. Guild, Brooklyn, N. Y.
16,797.—BREECH-LOADING FIRE-ARM.—Dated March 10, 1857; reissue 1,952, dated May 9 1865; reissue 3,798.—W. C. Hicks, Summit, N. J.
84,637.—STAY-LOG FOR CUTTING VENEERS.—Dated Dec. 1, 1868; reissue 3,799.—J. N. Lyman, New York city.
79,590.—STOVE GRATE.—Dated July 7, 1868; reissue 3,800.—Elie Moneuse and Louis Duparquet, New York city.
94,845.—COOKING STOVE.—Dated Sept. 14, 1869; reissue 3,801.—Robert Scorer, Troy, N. Y.
83,336.—BALANCE SLIDE VALVE.—Dated Oct. 20, 1868; reissue 3,802.—W. M. Stevenson, Newcastle, Pa.
HINGE.—(Design 3,354), dated Jan. 26, 1869; reissue 3,803.—P. Corbin and F. Corbin, New Britain, Conn., assignees of F. T. Fracker.

## DESIGNS.

3,818.—ORGAN OR MELODEON CASE.—George Cook, New Haven, Conn.
3,819.—TRADE MARK.—Robert Kerr and J. P. Kerr, Paisley, Scotland.

## EXTENSIONS.

SHIRT COLLAR.—Polloy Hunt and G. W. Hunt, of New York city, administrators of Walter Hunt, deceased.—Letters Patent No. 14,019, dated Jan. 1, 1856.
MAKING GUM-ELASTIC CLOTH.—Henry G. Tyer, of Andover, Mass., and John Helm, of New Brunswick, N. J.—Letters Patent No. 14,814, dated May 6, 1856, antedated Jan. 9, 1856.
GAS COOKING STOVE.—H. B. Musgrave, of Cincinnati, Ohio.—Letters Patent No. 14,064, dated Jan. 8, 1856.


# U. S. Patent Office.

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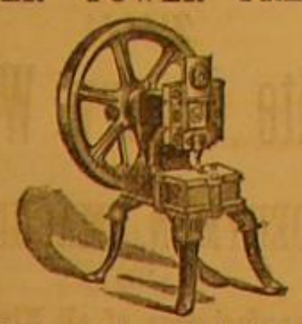

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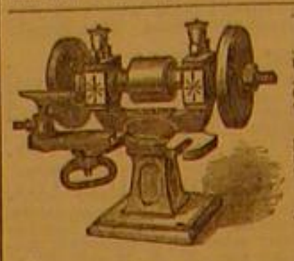

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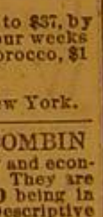

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# SCIENTIFIC AMERICAN

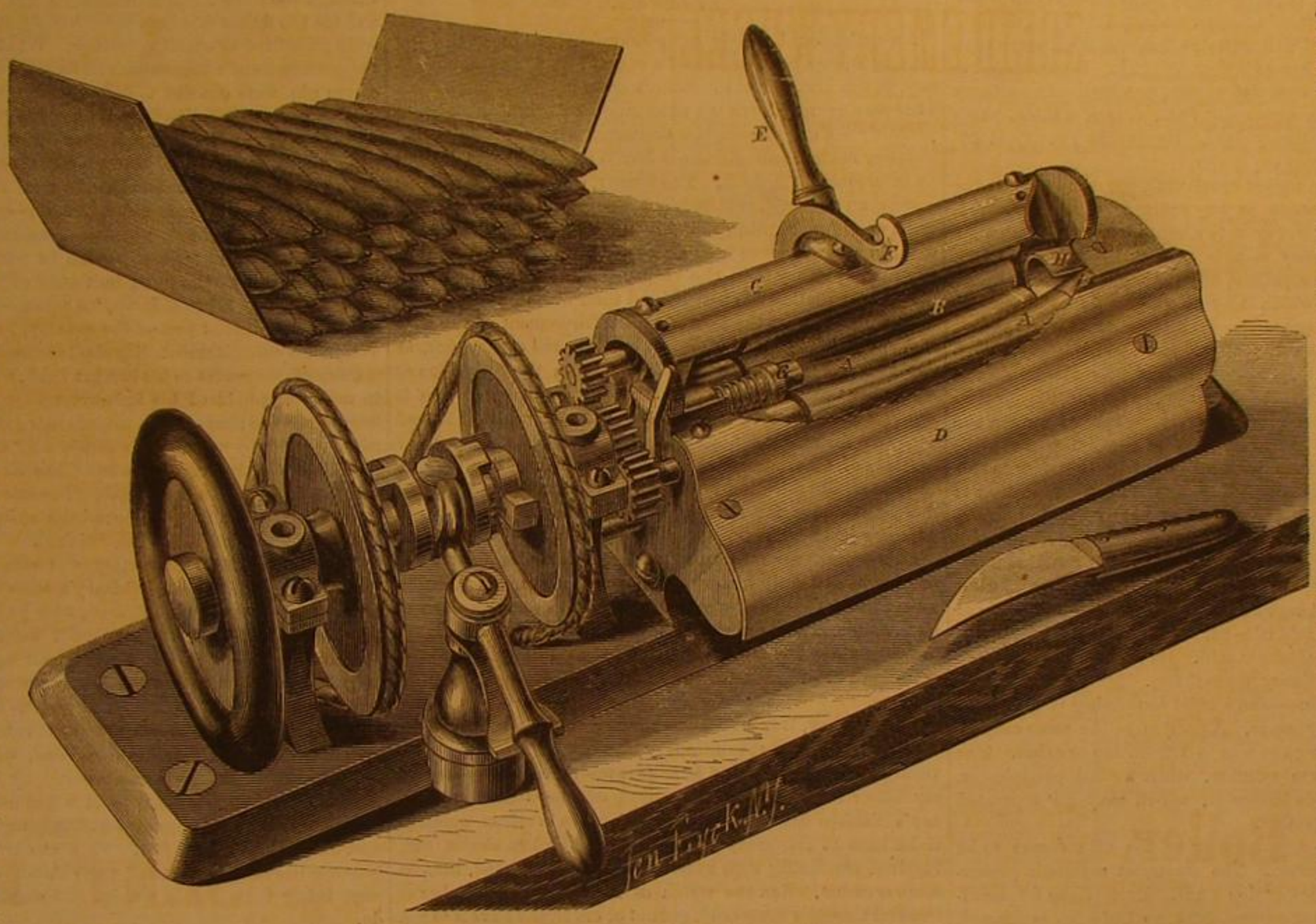
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXII.—No. 6. [NEW SERIES.] NEW YORK, FEBRUARY 5, 1870. $3 per Annum [IN ADVANCE.]


### Cigar Machine.

A very large item in the cost of manufacturing cigars is the labor. To make by hand a first-class cigar requires much skill, only to be acquired by long practice, and such skill always commands a high price. Eighteen dollars per thousand, is perhaps a fair average of the prices now paid in this country for the manufacture of prime Havana cigars. This, with the duty on imported tobacco and the large internal revenue tax, has raised the price of cigars to an unprecedented figure. Anything which could lessen the labor required to make cigars, would immediately increase the consumption in a much larger ratio than the labor would be diminished, so that a machine which, as is claimed for the one we herewith illustrate, would diminish the cost of labor to less than one fourth that required now to produce a given number of cigars, would probably increase the number of cigar makers required to meet the increased demand four fold.

This is the legitimate result of all labor saving machines. Labor-saving considered with reference to a single article produced, they, by the immense increase in the aggregate number of cheapened articles demanded, caused by their employment, are also, in the aggregate, *labor-creating* machines. The history of all labor-saving inventions which have superseded hand labor in their respective departments will bear us out in this assertion. When Arkwright invented cotton-spinning machines, the cotton spinners forcibly resisted their introduction; but the inventions of Arkwright, Whitney, and others, have increased the number, not only of cotton spinners, but all others engaged in the manufacture of cotton goods more than *ten thousand* fold.



CIGAR-MAKING MACHINE.

The machine we are about to describe, though a radical innovation upon the present mode of making cigars, and therefore destined to revolutionize the business, will cause a great increase in the number of cigar makers, as by cheapening cigars it will inevitably increase their consumption.

A pair of rollers, A, are revolved through a system of gearing, either by hand, foot, or other power. The rollers are turned concave longitudinally, the curve of the concavity corresponding to the required outline of the form of cigar desired. Another pair of rollers, B, of precisely the same shape as A, are journaled in the upper part of the machine. This upper half of the case, C, is pivoted or hinged to the lower half of the case, D; both C and D being of sheet brass and of a graceful form. A handle, E, is used to close the upper half, C, upon the lower half of the case, when the machine is in use, and a latch, F, then holds it firmly closed until it is again released.

When the machine is closed as described, the ends of the upper pair of rollers, B, shut down upon the small friction roller, G, and are also run into gear with the pinions of the lower pair, which communicate the motion of the lower pair of rollers to the upper pair. Each of the lower pair of rollers is geared to revolve in an opposite direction to the other, and consequently, when the upper pair are set in motion, they revolve also in opposite directions. A roll of tobacco, therefore, placed between these rollers, would be equally compressed toward the center, while it would be rolled around at the same speed of the rollers, but without causing any strain upon the leaf, which is liable to tear it. A "header," H, shapes the head or mouth end of the cigar, and the roll of tobacco is made to enter this "header," by the action of a small coiled spring behind the friction roller, G, which thrusts the roll of tobacco toward and into the "header." These are the essential parts of this simple machine.

The operation of making a cigar is as follows: The filling is portioned out in the hand as in making cigars by hand, and being lightly rolled together, and inclosed in a portion of a leaf or "binder" in the ordinary manner, is placed in the machine, which, being closed, immediately rolls it down to the proper shape. The wrapper, previously cut to the required form, and having a little gum tragacanth put on to the mouth end, as in ordinary cigar making, is then fed in obliquely under the front edge of C, and is beautifully and evenly wound about the filling; and the mouth end which enters the header is shaped with the utmost nicety and dispatch. All that remains to complete the cigar when taken from the machine is to cut it to the required length. From five to six sets of rollers are furnished with each machine, for different sizes and shapes of cigars, and the taking out of one set and the insertion of another occupies only about five minutes.

The machine is small and portable, and may be placed on any table, a favorite way being to use a table and treadle like a sewing machine when steam power is not employed, as is sometimes the case in large establishments. The power required is very slight indeed, and the labor of propelling by the foot is scarcely worth mentioning.

A girl, after a few weeks' practice, can make fifteen hundred cigars per day; or, with an assistant to bunch fillings, can make two thousand. These cigars are every way as perfectly made as can be done by hand, and are very pleasant to smoke, as we can personally vouch.

The machine will work tobacco so tender that it cannot be worked by hand at all; and the tobacco being prepared and moistened in bulk, the filthy practice, common among cigar makers, of taking water into the mouth and squirting it upon the tobacco to moisten it, is entirely abolished, as well as the kindred practice of biting off the points of the mouth end of cigars in the teeth.

The machine does not smoke, and consequently the manufacturer is not taxed to furnish eight or ten of his best cigars to each cigar maker per day, which amounts in the aggregate to thirty or forty cigars per each thousand produced. It is estimated that this saving alone will more than pay for the cost of license to use these machines. Cigars now costing eighteen dollars per thousand to make, can be made on this machine equally well, if not better, at a cost for labor of only four dollars. Anybody can run it successfully with a week or ten days' practice, and girls or children can be taught to use it with very little trouble. A saving is claimed on the wrappers, as they can be cut to greater advantage, and are not liable to break during the process; and thus the most expensive kind of stock is economized. We do not entertain the least doubt of the great merit of this invention. We have seen a large number of the machines running, and rapidly turning out well-made cigars where none but girls, having only a few weeks' practice, were employed, and therefore are enabled to speak from actual observation. This machine is the subject of seven separate patents issued at different times within a short period.

For further particulars all parties interested are invited to address the American Cigar Machine Co., at 113 and 115 Liberty street, New York, or to call and examine for themselves a large number of machines there kept constantly running in the manufacture of cigars.

### Scientific Nonsense.

The following choice piece of scientific nonsense has just been sent to the *Scientific Opinion* by its author, Mr. J. Hampden, of Swindon, England:

"What is to be said of the pretended philosophy of the nineteenth century, when not one educated man in ten thousand knows the shape of the earth on which he dwells? Why, that it must be a huge sham! The undersigned is willing to deposit from £50 to £500 on reciprocal terms, and defies all the philosophers, divines, and scientific professors in the United Kingdom to prove the rotundity and revolution of the world from Scripture, from reason, or from fact. He will acknowledge that he has forfeited his deposit if his opponent can exhibit, to the satisfaction of any intelligent referee, a convex railway, river, canal, or lake. Failing to do this by or before the 25th of February, the advertiser to claim the amount deposited, which shall be spent in exposing the falsehood and fraud of the Newtonian philosophers."

### Manufacture of Glass.

A novelty in glass making has been brought out by Albert Pütsch, Herman Pütsch, and George Leuffgen, of Berlin. It consists in using glass pots made of iron instead of fire clay. The inside of the iron vessel is to be lined with fire-proof material, but it may in some cases, be left partly or entirely without such lining. In some cases, the bottom or lower part only is made of iron, while the sides are of fire-proof material; but in all cases, no matter the shape of the vessel, it is necessary to keep the sides and bottom cool, either by atmospheric air or by artificial streams of air or water. The top of this vessel or tank is arched over, leaving the necessary openings for working, and for the entrance and exit of the flame, which passes over the surface of the materials contained in the tank, and melts them. The fireplace may be of any suitable form and construction, and the tank supported in the ordinary manner.

### Abolition of the Franking Privilege.

We have repeatedly called attention to the abuse of the franking privilege, and urged upon Congress to remedy these abuses by abolishing the privilege altogether. Our disinterestedness in this course is attested by the fact that, should this privilege be abolished it would cost us thousands of dollars on the matter which now passes free to and fro between us and the Patent Office. Notwithstanding this, we here avow, as we have heretofore avowed, that we prefer to sustain this extra expense rather than that the Government should be cheated, as it has been, in the abuse of the present law.

A bill abolishing the privilege has passed the House; let the Senate now show equal alacrity in completing this much needed reform.

## THE NIIN OF YUCATAN.

From the Report of the United States Commissioners of Agriculture.

A communication from Dr. Arthur Schott, late of the Scientific Commission of Yucatan, furnishes some descriptive statements concerning an insect, and the nature and uses of a grease-like or wax-like product, with the result of a chemical examination of its properties.

Among the numerous interesting natural productions of Yucatan, not the least remarkable is the niin (pronounced *neen*), the knowledge of which, and of its technical application, has survived the national independence of the gifted Maya race. The niin is the grease of an insect bearing the same generic name. The niin may be considered akin to the cochineal, also the product of a similar insect; but they differ essentially in their nature, one serving as a well-known dye, while the other finds its application as a drying oil.

The nature of the niin will be clearly understood by the annexed scientific analysis, made by Mr. V. G. Bloede, analytical chemist, of New York. The matter examined by that gentleman consisted of a small quantity which Dr. Schott brought some time before from the city of Merida, Yucatan.

The analysis is as follows:

The Yucatan niin is a yellowish-brown, fatty mass, having a peculiar oily odor. In its general properties it seems closely allied to hog's lard or suet. It is neutral to test-paper, neither presenting acid nor alkaline reaction, though when exposed to the air it acquires a very faint tendency to manifest the former. Its melting point is about 120° Fah., though, when once melted, it still remains in a semi-fluid state with the temperature as low as 80° or 85° Fah. When cooled to 10° Fah., it becomes hard and brittle, like suet. At ordinary temperature, that is, about 60° Fah., it is of a thick, pasty consistency, like ordinary lard. Its specific gravity at 60° Fah. is about ·92.

Its Solvents.—In regard to solvents, the niin presents the same general properties as any ordinary animal fat. It is not soluble in either hot or cold alcohol, even after extended maceration. It is freely soluble in both hot and cold ether, with which it forms a yellow, oily liquid. It is very soluble in turpentine, with which it forms an oily liquid possessing peculiarly valuable properties for mixing delicate oil colors, of which I shall speak hereafter. It dissolves freely in benzine; chloroform, also, is among its best solvents.

Chemical Properties.—The niin, in its classification in organic chemistry, must undoubtedly be ranked among the drying oils, though its absorption of oxygen takes place rather more slowly than with many other oils. Nor is this slowness in drying accelerated to any extent by boiling it with oxide of lead. It is the first, or nearly the first, example we have of a thoroughly drying animal butter or solid fat. Like some others of the animal fats, it contains a distinct volatile acid peculiar to itself. As, for instance, butter contains butyric and caproic acid; goat's fat, hircic acid; so the niin contains an acid of a peculiar, pungent smell, which might be aptly termed niinic acid. Its chemical composition differs little from ordinary animal fats. Like others, it contains a fluid oil—oleine—and a solid containing stearic, margaric, and other fatty acids. A portion of the acids may be obtained by dissolving the niin in turpentine or ether. The oily portions pass into solution, while a solid precipitates, consisting of the acids indicated, which may be separated from the fluid by filtration.

Saponification.—A peculiarity of the niin seems to be its difficult saponification. The strongest ammonia procurable has no saponifying action on it. Even if the fat be digested in ammonia for several days, no liniment is formed, but a marked transition from yellow to red seems to be the only change produced. This change of color depends merely on the action of ammonia on the coloring matter of the niin, which, like the yellow turmeric (*Curcuma longa*), changes to red as it assumes an alkaline reaction.

With potash, too, it saponifies but slowly and imperfectly, and a concentrated lye is necessary. With soda it forms a soap only after extended boiling with a strong lye. It is only after several hours' boiling with oxide of lead that it forms the so-called "lead soap," and then the product is very imperfect. From these facts we can at once deduce that the niin cannot be considered a "good saponifying fat," but belongs to the "drying oils."

Effects of High Heat.—When the niin is melted in a porcelain dish, and the resulting oil exposed to a continued and high heat (between 250° and 350° Fah.) for an hour, or until a considerable portion of it has evaporated, the residue in the dish will then be found to have assumed a tough, flexible, varnish-like condition—a gelatinous mass no longer soluble in turpentine, or affected by heat or cold, at least to a great extent.

If a piece of this gelatinized niin is placed on a piece of porcelain, moistened with turpentine, and ignited, another remarkable change takes place; for, if the plate is slightly inclined as the mass burns, a thick, yellow, resinous oil or gum flows from it, which possesses most remarkable adhesiveness, closely resembling a thick solution of india-rubber, but which does not dry, retaining its half-fluid consistency for several days. This is a most singular change, and one that is worthy of further investigation.

Change of Air.—When the turpentine solution of the niin is exposed to the air in thin strata for a few days, it acquires the properties of a resinous varnish; in fact, the change is so complete, that when some of the solution is poured on a piece of glass it dries almost equal to fine shellac varnish. This change is due to the absorption of oxygen. If further developed, this property will undoubtedly make the niin of the greatest commercial value. The film of varnish is very elastic, and at the same time hard, which renders it superior to some of the other gums. An alcoholic solution can also be formed, but this is more difficult.

Suggestions as to Use.—The extreme oiliness of the niin will undoubtedly make it very valuable for various purposes in the arts; and its "drying" solution in turpentine has no equal for mixing fine colors for artists. This turpentine solution of the niin produces a remarkable brightness in the colors prepared with it, and they dry rapidly. But the chief value of the niin, which will give it commercial importance, is its property of forming a resinous varnish when treated as before described, rendering it superior to shellac for some purposes. Another valuable application of the niin could be found in the manufacture of water-proof fabrics. A piece of the most porous Swedish filtering paper, saturated with a solution of the niin diluted in turpentine, will not allow a drop of water to pass through, even after standing in it for days. An excellent way of water-proofing would be to saturate the article with melted niin, and then expose it in an oven to considerable heat until the grease gelatinizes. By these means the niin becomes insoluble not only in water, but also in most of its solvents. If the niin can be obtained, as Dr. Schott says, in "unlimited" quantities, it will, doubtless, in time become of great commercial value.

[For the Scientific American.]

## THE COTTON GIN AND ITS INVENTORS.

BY ELZY RAY.

An agricultural article recently published in one of our leading newspapers, contained a casual allusion to Eli Whitney, as the inventor of the modern saw gin for seeding cotton. This was by no means an unnatural or flagrant mistake, as probably not one person in a thousand is aware of the fact that our modern saw gin is not Mr. Whitney's invention, but an improvement upon it. The former, of which I have seen more than one relic, was merely a wooden cylinder with wire teeth or claws running round it in circles. The idea of the saw gin was borrowed from Ohio, as will be related further on. Mr. Whitney sued the earlier inventors and manufacturers for violating his patent, and their defenses were based on the ground that the saw was no infringement of the wire tooth patent. One of Mr. Whitney's original cotton gins, as executed and operated by himself, was in the possession of my father until some fifteen or twenty years ago, when it was lost at an agricultural fair at Augusta, whither it had been sent for exhibition. I remember it well, as among the contents of an attic room where I used sometimes to play in childhood, and a feeling recollection of getting my ears boxed more than once for stealing wire from it to string paper "limber jacks" on.

I have heard my father relate many interesting facts as to the origin and early history of the cotton gin, which he received from persons who were cotemporaries and associates of its inventor. There are probably not a dozen other men living to whom these facts are known, and it may be well to record them here before they are lost in the dim regions of traditionary lore.

Eli Whitney, it is well known, was a tutor in the family of General Greene, of revolutionary memory, at the time he invented the cotton gin; and here are some facts concerning him my father received from a grandson of the General. Whitney's Yankee ingenuity, as exhibited in various amateur tinkerings at refractory door fastenings, broken clocks, etc., inspired the family with such confidence in his skill, that on some occasion, when the watch of Mrs. Miller, a member of General Greene's household, got out of order, she gave it to Mr. Whitney to repair, no professional watchmaker being within reach. He performed the work successfully to the great delight of Mrs. Miller, and the admiration of the whole family.

A short time thereafter, a gentleman called at the general's house to show a fine sample of cotton wool, and remarked while exhibiting it, that there was a fortune in store for somebody who should invent a machine for separating the lint from the seed. Mrs. Miller, who was present, turned to Whitny and said, "You are the very man Mr. Whitney, for since you succeeded so well with my watch, I am sure you have ingenuity enough to make such a machine."

After this conversation Mr. Whitney confined himself very closely to his room for several weeks, at the end of which he invited the family to inspect his model of a cotton gin. It was constructed as I have already described, with wire teeth on a revolving cylinder, but as there was no contrivance for for throwing off the lint after it was separated from the seed, it wrapped round the cylinder, thereby greatly obstructing the operation of the machine. Mrs. Miller, seeing the difficulty, seized a common hair clothes brush, applied it to the teeth, and caught the lint. Whitney with delight exclaimed, "Madame, you have solved the problem, with this suggestion my machine is complete."

The important part thus played by a woman in the history of the cotton gin is unknown, I believe, except as a family tradition, even in her own State. My father was also informed by a gentleman once connected with Whitney in business, that the latter obtained his first idea of the invention from a gin used to prepare rags for making paper, which he saw in a wrecked vessel. Gen. Greene, in whose family he lived at the time, resided in one of the "sea islands" along the Georgia coast.

Unfortunately for Mr. Whitney, the prophecy of the gentleman with regard to the fortune in store for the future inventor of a cotton gin, was never realized in his case, for he was engaged in constant law suits against infringements of his patent right, and lived and died poor. As a Georgian, I regret to say that his adopted State never bestowed any substantial testimonial of appreciation upon the inventor of a machine by which she has profited so largely. Tennessee, Alabama, and South Carolina, it is said, manifested their appreciation of his merits by material and substantial donations; while Georgia, with sorrow I write it, has been worse than silent, for her juries refused him verdicts to which the judges declared he was entitled, against the violators of his patent.

So uncertain was the enforcement of the patent laws in those days, that Whitney resorted to the same expedient for the protection of his right that used to bring upon medieval inventors charges of sorcery and witchcraft. I mean the expedient of secrecy.

About the year 1794 or 1795, he settled in a place some six miles from the quiet little village of Washington, in Wilkes county, and established there one of the first, if not the first cotton gin ever worked in the State. He, and his partner Durkee, erected at this place a large cotton store house, which now does service as a barn, and a gin house at present used as a kitchen by Mrs. Tom Burdett, wife of the present proprietor, and the scene of preparation for dinners and "goodies" generally, that would make appropriate offerings to the memory of him who invented cooking stoves. The gin house had narrow grated windows, so that visitors might stand outside and watch the cotton flying from the gin without observing the operation of the machine, which was concealed behind a low screen. Among other visitors we are informed that on the occasion of a certain militia muster in the neighborhood, the rustic battalion was permitted to file through the house, while Whitney's gin was in operation, and see the flakes of cotton thrown off by the brush, but none were permitted to examine further. What a different errand the grandsons of those rustic militia-men, filing past the first cotton gin, were one day to march forth upon!

Women were permitted by Whitney to enter his gin house, and examine the machinery if they liked, as they were not supposed to be capable of betraying the secret to builders—an opinion for which modern females of the strong-minded school will no doubt bear him a grudge—and not altogether without reason, perhaps, when we consider the material assistance he received from a woman in perfecting his invention. This fact of the free admittance of women, was taken advantage of by Edward Lyon, "a smooth-faced young man" residing in a distant part of the country, to gain admission to Whitney's establishment, disguised in female attire. He communicated the secret to his brother John, who immediately set to work and produced his improvement upon Whitney's invention, in the shape of the modern saw gin. The saws were made for him by "little Billy McFerran," an Irish blacksmith in Wilkes county, who died some 25 or 30 years ago. This was the first saw-gin ever made. The saws were first shaped in semicircles, and fastened round the cylinder in pairs, so as to form complete circles when finished.

As early as 1797, a gin factory was established by a man named McCloud, and all Whitney's suits against him were unsuccessful. An old gentleman, who purchased a saw gin from McCloud, told my father that it worked nearly as well then as now (his *now* was thirty years ago) except that it napped badly. It was propelled by water, and ginned 2,500 pounds of seed cotton per day. Previous to this, the gin in ordinary use, was the simple contrivance of two wooden rollers revolving in opposite directions, which preceded Mr. Whitney's invention. It was worked by hand, and ginned only 75 or 100 pounds a day; and it was necessary, besides, to keep a man all the time employed in turning rollers, the friction burnt them out so fast. This machine is still used in ginning the best qualities of "sea-island" cotton, the advantage being that it does not cut the staple, as the saw-gins do.

The honor of having invented the first cotton gin is sometimes disputed with Eli Whitney in favor of Mr. Bull, a gentleman from Baltimore, who settled in Columbia Co., Ga., and introduced the saw gin there, in the year 1795. He first used perpendicular saws, but afterwards changed them for circular, in imitation, no doubt, of Whitney and Lyon. Mr. Bull was an enterprising and ingenious man, and first introduced iron packing screws into this State. These were so expensive, however, costing no less than $1,500 to $1,800, that they were soon abandoned for the common wooden screw now in general use on plantations. His invention of the perpendicular saw gin, was, there seems no reason to doubt, independent of Whitney's though posterior to it, the latter having come into operation in 1793. The circular saw, as afterwards used by him, was no doubt borrowed from Whitney or Lyon. Thus then, though Eli Whitney never reaped the profits of his great invention, it seems clear that he must be left in undisputed possession at least of the barren honors.

[In the extended litigations to which the infringements on Eli Whitney's patent gave rise, it was finally decided that the use of saws instead of the wire teeth at first employed by Whitney, did not constitute a new invention, and that those who used them without license from Mr. Whitney were infringers upon his rights, as patentee of the original device. The assertion of our contributor that Mr. Whitney was not the inventor of the saw gin, is therefore hardly just to that ingenious and gifted inventor, although full credit is given him for the original invention. The man who, subsequent to Whitney's invention, first employed saws, did not invent a saw gin, he only invented a "dodge" whereby he hoped to be able to reap where Whitney had sown.—Eds.

The Writings of Count Rumford.—The American Academy of Arts and Sciences, through the Rumford Committee, have in preparation for publication in four volumes a complete collection of the writings of Count Rumford, whose works have never yet been brought together and edited, and a biography of the Count, which will fill another volume, and be properly illustrated.

[For the Scientific American.]

## IRON SHIPBUILDING AND AMERICAN COMMERCE.

BY PROF. HENRY E. COLTON.

Whatever force the many reasons assigned for the decline of the American shipping interests may have possessed, there is no doubt that the introduction of iron as a material for the construction of the hulls of vessels has been the great cause Very soon after the discovery of the process of puddling iron and rolling it into plates, we are told that some bold experimenter formed a rude canal boat from those plates; it was not, however, until 1837 that any actual experiment of the new material was made on the ocean. At that time, a vessel of about 270 tuns was built of iron, at Liverpool, and made a trip to Rio de Janeiro, returning with a cargo of coffee dry and safe. Previous to this the possibility of putting together plates of iron into shape for vessels' hulls had been demonstrated on the Thames, on various canals in England, and even for a coasting vessel. The building of the ironsides in 1838 was, however, not the actual commencement of the use of iron, previous operations had been mere experiments. Naturally the innovation met with much opposition. It might do in smooth water but that it would never stand the strain and rough waves of the ocean was the opinion of a large majority. Fairbairn, in 1849, writes that he had up to that time built 100 vessels with iron hulls, which had proven successful, but complains that the British commercial authorities have made no actual recognition of their good qualities and superiority over wooden vessels. It was not until 1854 that the English "Lloyd's" deemed them of sufficient importance and value to merit a rating by rules and regulations. Now it is but rarely a vessel is built of wood in England, and then only some small craft for river or coast service.

In 1838, we have seen that there was only one shipbuilding firm bold enough to build an iron ship for venture on the ocean. Now there are on the Clyde (Glasgow) alone 37 such firms which in 1868 turned out 26 iron paddle steamers, 77 iron screw do., 1 composite do., do., 44 iron sailing vessels, 9 composite do., and 13 wood do., and 61 iron barges, etc.; on Jan. 1, 1868, they had on hand orders for 57 iron screw steamers, 11 paddle do.; and 26 iron sailing vessels, 13 composite do., and 11 wood do. The same year there were 14 firms operating on the Mersey (Liverpool) which, in 1867, launched 32 iron steam and sailing vessels, and had then on the stocks 18 more, also built a number of iron barges, etc. On the Tyne (Newcastle) there were about 20 firms who built, in 1867, 81 iron ships. There are also at Southampton a number of iron shipyards, but not so briskly employed. The London yards are almost deserted.

The greater proportion of steamers in the above is noteworthy, as also the great excess of screw propellers. Of the English tunnage, more than one third is steam. In 1867 it contained 2,808 steamers of which 1,896 were iron, 877 wood, 28 steel, 4 iron and steel, 3 composite. Of these 1,564 were propelled by paddle-wheels, and 1,244 by screws. Exclusive of inland river, and lake craft, the steam tunnage of the United States does not amount to more than about one third that number, and of them hardly 50 are iron, and many of these are old blockade runners captured during the war, built for that purpose and poorly adapted to ordinary traffic.

Without hulls of iron the introduction of the propeller screw would have been of little moment. No such immense lengths of steamers as now cross the Atlantic, in such rapid time, could have been built of wood and driven by the screw. The great advantages of economy of space and fuel which its use gives would have been lost to the commercial world. Hence we now but seldom see any steamer intended for freight or the general passenger traffic constructed with the side paddle wheels, and even the rather aristocratic French line have had all but one of their side-wheel steamers changed to propeller screws. Such having been the perfection acquired in machinery and model that equally as, or more rapid time, is now gotten with them as ever with side-wheels.

The superiority of English vessels of the present day, therefore, exists in the material of construction, the more general use of steam, and the substitution of the propeller screw for the side-paddle-wheel. With our characteristic energy and enterprise we will soon regain all we have lost in the commercial line, and even outstrip our neighbors across the water, if we adopt the improvements which they so forcibly present to us. The English "Lloyd's" has rules for rating and insuring iron vessels dependent upon *thickness* not strength of material, and as the average American iron will bear a strain about one third greater than the average English, in building a ship of iron of the same thickness we are using at least one fourth more weight than necessary to make a vessel of equal strength with one constructed in England. Hence to build a ship by their rules we have a greater expense for material. Some modification of this system is evidently necessary for vessels at least in our own trade. They took the models of our fast clippers from us, and we may by energy and perseverance be able to bring them up to a higher standard of material or different rules for construction.

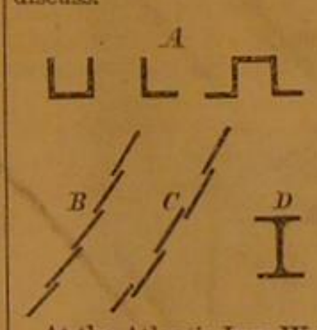
Our registry laws require that all vessels to be capable of registry shall have been built in the United States. These might be modified so that all vessels now owned here be allowed registry, which privilege to end as soon as American ownership ceases; but we are sure no American mechanic, manufacturer, or inventor would be willing that vessels built and owned abroad should be brought in on the same footing and have equal privileges with those the result of our labor and capital.

Another resolution of the N. Y. Chamber of Commerce proposes to admit free of duty all iron and other material used in building ships. We shall not discuss this as it involves the political question of free trade *vs.* protection; but, leaving out of the idea of its injustice to other manufacturers who might claim that they in this dull time were not making as much profit as before the war, we do not believe that in that admission is the radical cure of the diseased commercial interests of our country. The true remedy and that which will enure to the benefit of all Americans is the building of steamers and sailing vessels of iron, on the best models, with the best machinery, of our own material, with our own workmen, and our own capital. Learn all we can from abroad and improve that knowledge. It should not be said that the nation of mechanics which has produced the steamboat, the telegraph, the sewing machine, the reaper, the monitor, and hundreds of other new ideas that have astonished the old world, is behind in the construction of an economical marine engine, the arrangement of a boiler or the model of a ship, and it will not be so said a few years hence. In this nation of active thinkers a want is no sooner stated than hundreds of minds are at work to supply it.

The needs of the shipbuilding interests are the adaptation of machinery, still further if possible, to the construction of iron ships; a boiler and engine which will give a fair average speed with a consumption of 10 to 20 tuns of coal per day; these with the conjunctive use of steam and sail will accomplish all we need to manufacture and run vessels cheaply. Models unsurpassed for beauty or utility we have already. It is evident, however, that in the struggle for economy of construction the future shipyards of the United States will be where there is least freight on coal and iron, and cheapest living expenses. Our observation and experience lead us to believe that outside of Government work, the well paid American laborer does more work, dollar for dollar, than the poorly paid Englishman.

The advantages of an iron vessel are: A greater amount of cargo can be carried on a less draft of water; they will last for 20 years if well made and rate A 1; and so far as any one knows for 50 years, as vessels are now running in good order which were built by Fairbairn in 1840-42. The only deterioration is the oxidation of the metal, and careful painting every six or twelve months will in a measure prevent this. Further, that whether so cheap now the time will come when no wooden vessel can compete with them in any item. Taking into consideration their durability, they are cheaper now. An iron vessel may be beached or sunk and not be materially injured. Two instances of this have lately occurred—the *San Jacinto* beached on Hatteras, and the *Circassian* on Long Island shore. The first is already making her regular trips, the other soon will be. Every reader is acquainted with its advantages as a material for ships of war.

There is a variety of ships now being built in England called composite. The ribs, braces, and all framework are of iron, the sheathing plank of wood. They find great favor with some, as the wood may be sheathed with copper, hence furnishing a bottom better than any paint for a long voyage. They have disadvantages which we shall not here discuss.




The ribs of iron vessels have three shapes, as at A, in the diagram. The standards and bracess are usually shaped as at D. The iron planking is put on, as at B, by some builders, but that is more generally abandoned for this style, shown at C. The last is called gutter built, the former clencher built.

At the Atlantic Iron Works, Boston, a number of iron vessels have been built. The Novelty Works, New York, have built several—two of them good sized ocean propellers. Several yards in this city built monitors during the war. One or more have been built in Buffalo. But the chief iron shipyards of the United States and in fact only those employed extensively for that work, are at Chester, Pa., and Wilmington, Del. There is not a month but one or the other of these yards turn out a steamer, and they claim that they can build vessels within five per cent of the cost in England.

These yards are now very active, several river steamers are on the stocks, the Philadelphia, N. Y. & Boston Nav. Co. have fifteen steam colliers contracted for and being built, a large iron steamer for the Old Dominion Steamship Co., to be finished by spring, several propellers for Mr. Lovillard, a few side-wheel steamer just finished for Mr. Clyde, and others spoken of. These yards have turned out beautiful models, both for river and ocean service.

The day of wooden ships has passed and the present stock must at least be replaced by iron built crafts. Such a course with proper management will give us eventually the supremacy of the seas and add another triumph to the superiority of our material, skill, and labor.

### Two Curious Needles.

The King of Prussia recently visited a needle manufactory in his kingdom in order to see what machinery, combined with the human hand could produce. He was shown a number of superfine needles, thousands of which together did not weigh half an ounce, and marveled how such minute articles could be pierced with an eye. But he was to see that in this respect even something still finer and more perfect could be created. The borer—that is the workman whose business it is to bore the eyes in these needles—asked for a hair from the monarch's head. It was readily given and with a smile. He placed it at once under the boring machine, made a hole in it with the greatest care, furnished it with a thread, and then handed the singular needle to the astonished King.

The second curious needle is in the possession of Queen Victoria. It was made at the celebrated needle manufactory at Redditch, and represents the column Trajan in miniature. This well-known Roman column is adorned with numerous scenes in sculpture, which immortalize Trajan's heroic actions in war. On this diminutive needle, scenes in the life of Queen Victoria are represented in relief, but so finely cut and so small that it requires a magnifying glass to see them. The Victoria needle, moreover, can be opened; it contains a number of needles of smaller size, which are equally adorned with scenes in relief.

[For the Scientific American.]

## ALBUMEN.

BY C. WIDEMANN.

The consumption of albumen as applied to different purposes is enormous; in calico printing alone for fixing on cloth the new aniline colors, Alsace, in France, alone uses 150,000 kilogrammes, or about 330,000 pounds a year of egg albumen, representing 37,500 eggs or the product of 250,000 hens. It is also used extensively in photography; a photographer in this city uses four barrels of eggs a day, the yolks of which are sold to the surrounding hotels for cooking purposes.

It is manufactured thus: The white of the eggs are desiccated to assure their preservation and also to reduce the bulk so as to facilitate their shipment, with little expense, to this country. The process of desiccation is as follows; namely, the egg is broken, the white separated from the yolk; in winter or spring by the cold weather the white is left to remain five or six days in cans, when it is beaten with a wooden "spatula" and filtered through a piece of linen in order to retain the impurities and the sperm, it is then desiccated by pouring the liquid thus prepared in very flat dishes, generally of zinc placed on cast-iron tables, heated by steam to 30° Centigrade. To facilitate the separation of the dry albumen from these dishes they are, before being used, rubbed with a greasy rag.

Every dish generally holds from one to two quarts of egg white, and after two or three days' desiccation the albumen is ready to be packed: 24 dozen eggs yield about 12 quarts egg white, 8 quarts yolk yielding a little over two pounds of dry albumen.

This operation is performed to better advantage, both as to quality and yield in the months of March, April, and May; during the summer months the eggs are more expensive, and the quantity of the albumen less.

A great many substitutes have been employed to take the place of egg albumen, among which I shall mention the serum of the blood and the spawn of fishes—I mean the eggs laid by the female fish in large quantities at a certain time of the year after the process of fecundation.

The albumen is easily obtained from the serum of the blood, and answers very well as a substitute for egg albumen in calico printing.

In separating the liquid in which the clots of blood are seen floating 10 to 15 hours after the animal was killed, a light yellow liquid is obtained, which is then allowed to stand for 6 or 10 hours more. This second liquid is decanted from its precipitate which has been formed during this operation, and is then dried in the same manner as egg albumen at a temperature of 40° Cent.; if the serum had remained colored after the second precipitation it must be treated with a small quantity of isinglass, which has the property of separating all impurities by a veritable coagulation; all these operations are carried on in deep dishes; the clear liquids thus collected are desiccated as above.

The albumen from the spawnings of fishes can be obtained from the dry spawn as it is usually found in the market or from the fresh spawn taken immediately from the fresh fish and from the salted fish.

To use dry spawn, it is first ground into a coarse powder, then washed with water; this water is left to settle so as to allow all the impurities to collect at the bottom of the vessel, decanted and desiccated at 40° Cent. in the usual way.

Generally the albumen obtained from the fresh spawn is of better quality than that obtained from the dry or salted spawn, though it takes more care to separate the blood and certain greasy or oily impurities from it. It is desiccated in the usual way.

In operating with salted spawn it is thoroughly washed to eliminate the salt, then ground and dissolved in water, and treated as above.

A very large quantity of albumen is used in this country; there is a little egg albumen made in the West, but very irregularly; as for the blood albumen it is all imported.

Egg albumen brings in the market from $2·50 to $2·75, gold, the blood albumen from $1·25 to $1·40, gold, per pound.

As a general rule the blood in this country is considered as a waste; even in the large pork slaughter houses of the West it is lost, and very seldom used, even as manure, though being one of the best of fertilizers.

The reason I believe why blood albumen is not manufactured in this country is that there is no regular central slaughter house, every butcher having the right to kill his own meat, and so it has been difficult for those who have thought of establishing an albumen manufactory or Prussiate manufactory to collect a large quantity of blood with little cartage expenses.

But now that New York possess "Communipaw," I do not see, as the expenses of getting up such a manufacture are very small, why the calico printers and others using albumen continue to supply themselves from abroad at such high figures.

THE Amazon River drains 2,500,000 square miles, and is navigable 2,200 miles from its mouth.

### Planing, Tongueing, and Grooving Machine.

Our engraving is an excellent representation of one of the most important and complete machines of its kind now in existence. The amount of careful study and inventive skill which have been expended in bringing it to its present improved form, is indicated by the fact that it has been the subject of no less than nine distinct patents, the earliest bearing date April 13, 1852, and the latest July 24, 1866. Each of these patents covers some important advance on the previous construction of the machine, and as it is now presented to the notice of our mechanical readers, it is perhaps safe to say that its capacity and working efficiency are exceeded by no other planing machine in maket.

A machine of this kind —supposed to be the largest ever made—capable of planing stuff thirty inches in width, is in operation at the piano factory of Steinway & Sons, in this city; and from personal inspection of this machine, and other smaller ones in full operation, we are confident that everything claimed for it is fully justified by facts.

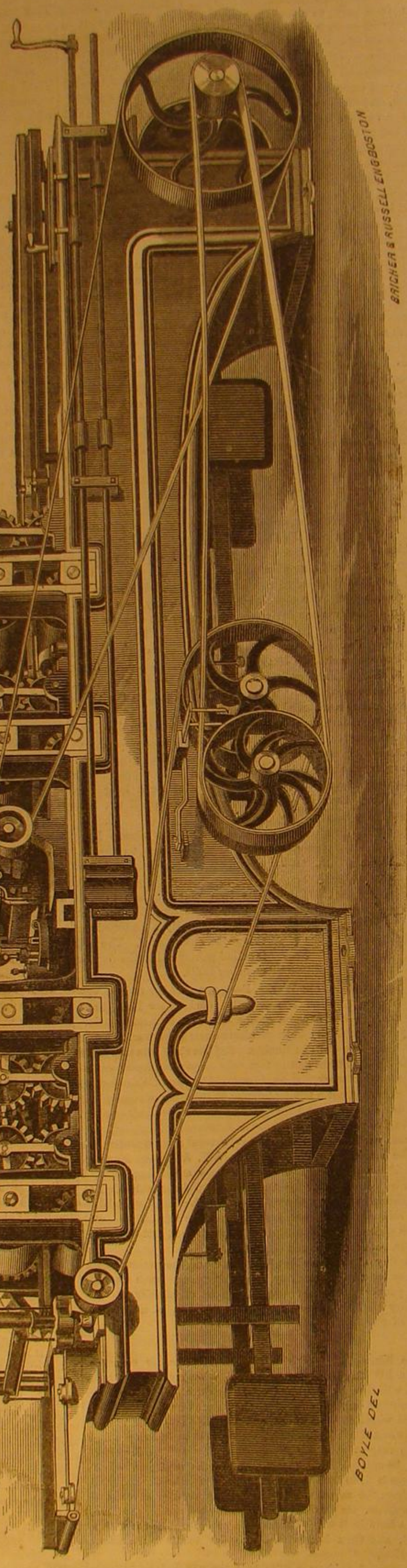
It is claimed that for dressing all kinds of lumber and for performing all the various operations for which it is adapted, this machine stands without a rival in Europe or America. It has been the effort, in perfecting the machine, to construct all parts in the most simple manner, to avoid complications, and to make all parts easy of adjustment. At the same time strength and durability have been constantly kept in mind.

Six sizes are made, with four, six, and eight feed rolls. The lighter machines weigh about 4,000 lbs., the heaviest about 11,000 lbs. This large machine works stuff from 2½ up to 30 inches in width, and from half an inch up to 8 inches in thickness. The engraving is that of the No. 1 machine having eight feed rolls. The frame is 17 feet long.

Among some of the most important improvements on this machine, and exclusively claimed for it, may be mentioned that the feed rolls are geared at both ends (Fig. 2), thereby making a very strong and even working feed, which is very important on machines of this class. The gears at each end of the feed rolls are connected with rails running across the machine, and are also made fast to the frame on both sides; thus preventing any cramping of the gears.

The links connecting the expansion gearing are made of wrought iron instead of malleable iron, as is the case with many other machines.

Where gears are used on only one end, a lifting action is produced which causes the board to be fed through in an oblique direction. This difficulty is avoided by gearing the feed rolls at both ends, causing an equal pressure on both edges of the board, feeding it through straight; the gears wear even, and are more than twice as durable.




WOODBURY'S PLANING, TONGUEING, AND GROOVING MACHINE.

Another improvement is the hinged presser bar (Fig. 3), which works close to and directly in front of the upper cutters, and which prevents the tearing and splitting of the lumber when cross-grained, or when hard wood is worked. This presser bar is provided with suitable weights, so that it readily yields to inequalities in the thickness of lumber.

FIG. 2.

METHOD OF GEARING FEED ROLLS AT BOTH ENDS.

Another improvement is the double adjustment of the "matcher frames" across the machine, which enables the operator to work narrow stuff on either side of the machine or on the center; thus using the full length of the knives. This adjustment is very simple.

The machine is provided with a scale and rails extending from the cross screws to the front end of the machine, so that the operator can adjust the matcher heads anywhere without stepping away from the "work-end" or front of the machine.

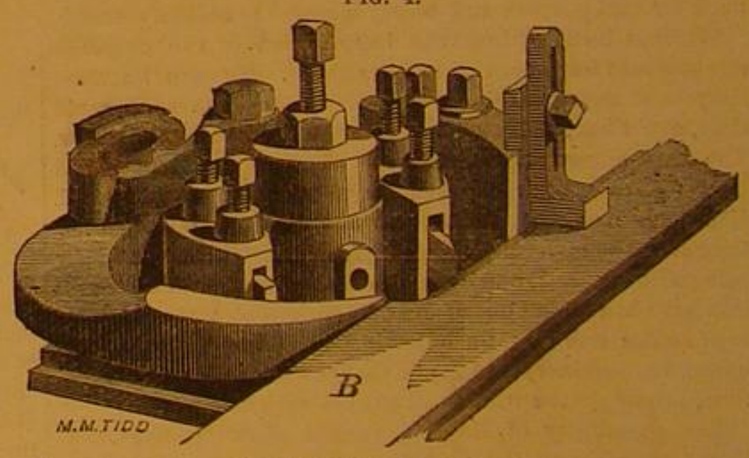
FIG. 3.



SECTION OF TOP PRESSER-BAR.

The "chip-breaker" or "clip," is hinged on the side cutter-head frame (Fig. 4), working on the same principle as the top-presser bar, which prevents all splitting of the edges of boards; and, holding the "stuff" close by the cutters, enables the machine to be fed, it is claimed, twenty per cent faster than any other machine, and at the same time to do its work better.

FIG. 4.

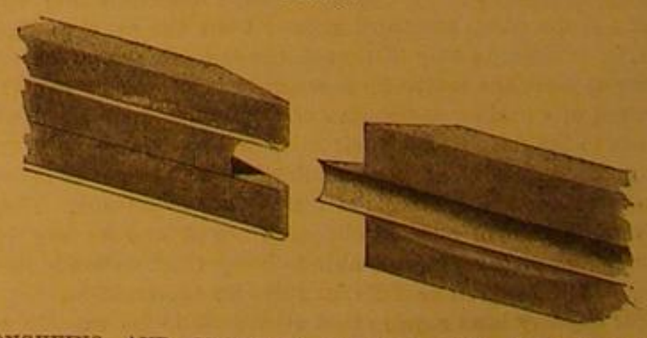



CHIP BREAKER SIDE HEAD.

Fig. 5 represents the tongueing and grooving cutter for the side cutter head.

The under cutter-head is attached near the end of the machine so that it is easily accessible for changing or sharpening. It is also provided with suitable adjustable "rest-bars" or bed plates.

FIG. 5.



TONGUEING AND GROOVING CUTTERS FOR SIDE CUTTER HEADS.

Fast and loose pulleys are used on the feed shaft, being much preferable to a solid clutch on a heavy machine, and much more durable. The feed rolls and presser bars are all weighted, an improvement over the rubber springs used on other machines.

The machine is provided with patent self-oiling boxes on all the journals; the latter being thus fully protected from the dust, and requiring very little attention to keep the machine in perfect order.

The machines have also a swivel guide for matching tapering lumber. This is connected with any sized machine

in a strong, substantial manner; and with this attachment the machine will work stuff tapering six inches or more in a length of ten feet. The bed plate directly under the upper cutter head is a false plate so that it can be easily removed and dressed over in case it becomes worn out of true.

This machine has received first prizes wherever exhibited for competition.

These machines are now running in many of the first class mills in all parts of the country, and the one above mentioned just put up in Steinway & Sons' manufactory will repay a visit to see.

For further particulars address S. A. Woods, sole manufacturer of Woodbury's patent planer and matcher, 91 Liberty street, New York, and 67 Sudbury street, Boston. [See advertisement in another column].

## MANUFACTURE OF COTTON SEED, COTTON SEED CAKES, AND MEAL.

BY O. WIDEMANN, CHEMIST, PARIS, FRANCE.

No. II.

It was at first proposed—and it has been tried by many—to work cotton seed along with linseed, so as to obtain an oil, which, in being boiled with oxidizing agents, would replace for painting purposes the linseed oil, and, being cheaper, would be used extensively. This has been dropped at the present time but will no doubt be taken up again.

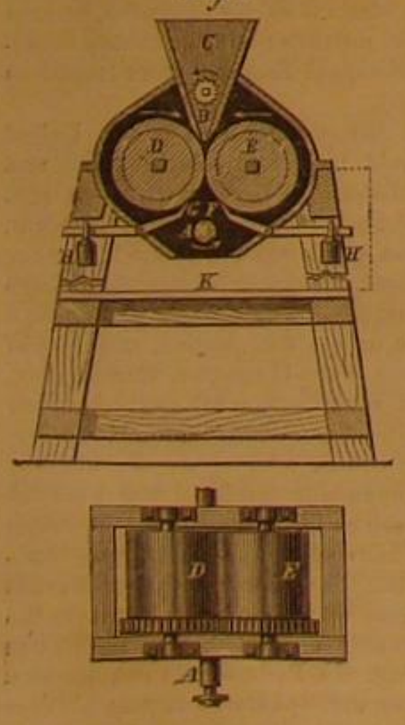
It is very difficult to ascertain the exact yield of oil produced, and this yield varies a great deal according as the seed is of better or poorer quality and richness, according to the weather of the season in which it has been sown, dry weather giving a smaller seed but richer in oil. From my own experience I shall take the following figures:

For 2,000 pounds cotton seed, or 1 tun, cotton from the last ginning, 21 pounds; husks, 979 pounds; meal, yielding from 32 to 36 gallons of oil, 270 pounds; cakes, at 7½ pounds per gallon, 730 pounds. Total, 2,000 pounds.

Let us take now the seed at the entrance of the oil mill. As it arrives in the bags it ought to be immediately unpacked and aired by shoveling it from one place to another, and this should be done very frequently as the fermentation sets in very rapidly. This is known by putting the hand in the seed; if heat is felt the seed has to be worked as quick as possible, and in every case removed and cooled by airing. It therefore requires a large store room to manage it properly. The average weight of one bag is 92 pounds, and the average work done by a good pressman and a Taylor's press, for ten hours' work, is 250 bags or 11½ tuns. Generally oil mills work night and day, as there is a great advantage in not letting the presses and mill cool down.

The cotton seed to be freed from the foreign matters it may contain, is passed in through a screen; a large cylinder made of wire cloth, the holes being sufficient to let the seed escape and retain the foreign substances. It is next carried to the top of the building where it passes through the gins. After this it goes through the huller. The huller generally used is of two sizes; the large size is sufficient for the supply of two presses of three sets for night and day labor. The smallest size is sufficient for one day's work with two presses. From the huller the kernels and husks are passed again through a screen, and then through a blower, which separates entirely the husks from the kernels. The kernels are then carried to the grinding mill and are passed through crushing rollers which I shall now describe. This machine, Fig. 1, is composed of two cylinders in cast iron, D E, covered with steel, hollow, and working at equal speed, with a distance between them which can be regulated at will. One of these cylinders receives motion and transmits it to the other by a pinion. A hopper of wood, C, is kept full of seed, and feeds the rollers by means of a little fluted wooden roller, B, the acceleration of which is regulated at will.

*Fig. 1*




A machine of this description, the cylinders 26 inches in length and 6 inches in diameter, with a speed of 40 to 50 revolutions per minute, crushes per day 12½ bushels of seed and supplies two pairs of mill stones. It is worked by one horse power. I say mill stones, because the seed was formerly passed under double upright millstones so as to grind the kernel thoroughly; but this has been abandoned by most manufacturers as a good crusher answers the purpose sufficiently well, especially if the distance of the two rollers is well regulated. The crushing is then perfect and the meal comes out sufficiently fine. This is tested by grinding it between the teeth. If fine enough it must be perfectly free from perceptible grains. It is next placed in the heaters, and upon this operation depends both the yield of oil and its quality. In Marseilles, where labor is cheap, the meal is first pressed cold, as the oil obtained thus is very fine, possessing a very sweet taste, like olive oil, and may be used like the latter for the table. Oil designed for the table ought to be expressed cold. After the cakes are reground, the meal is heated and repressed. The second yield of oil is of inferior quality to the first yield.

In this country, where labor is high, manufacturers prefer to obtain at first as much oil as they can with the least handling possible. As I said, the meal is placed in the heaters after grinding; these heaters are constructed in different ways. I have seen some made of a large table heated by steam, with iron rings four inches high placed concentric to each other, and a stirrer in the center worked by power from the steam shaft above. Only a small portion of meal is heated at a time, I should say enough to fill a press bag; but I am not satisfied with these heaters as they present too large a cooling surface to the air.

The best heaters are those attached to the presses, and they heat for the 15 boxes of the three sets of presses. They are made of cast iron. The whole apparatus, Fig. 2, is supported by brick work, A, and by a cast iron support on the other side of the frame, B. C is a cast iron basin with a convex bottom, at the middle of which is a receiving hole, E, to receive the stirrer, K. D is a steam jacket. This basin and steam jacket are cast in one piece and fixed on the platform, T, by means of bolts. The steam is admitted to the steam jacket through H, the condensation water escaping through the pipe, I. A sufficient quantity of meal being introduced into C, the stirrer is set in motion and the steam let in; and when the temperature of 82° to 88° Centigrade, or 180° to 190° Fahrenheit is obtained, the gate, F, is opened, a bag placed at the entrance, G, and the meal is then let into the bag.

*Fig. 2*




The bags are made of a certain kind of woolen duck, manufactured expressly for that purpose. The best woolen yarn is used for their manufacture, and only two parties make them in this country. The cloth is about 32 to 34 inches wide, and is sold by the pound at a price running from $1 10 to $1·40. The weight of a yard of the cloth generally used is from 1 pound to 1 pound 4 ounces, and it can be used as well for linseed as for cotton seed. The bags are made in the mills by the pressmen themselves, and sewed on a wooden pattern to fit the squeezers. The old bags are sold at 6 to 8 cents per pound when they are quite out of order, as they can be repaired and are repaired with the same yarn they are made of by the pressmen, or women engaged for that purpose. A great saving could be made in cloth if parties would manufacture them as neatly as other bags, instead of in the coarse way they are now made in the mills.

The bag being properly filled, that is to say, not quite to the top, it must be thrown in double to close it in the squeezer, the meal being well distributed all along it. The squeezer is then introduced in the box of the hydraulic press, Fig. 3. The squeezers, Fig. 4, are made of horse hair cord and covered with leather, to which a handle is riveted. The rivets ought to be of iron, as copper is very soon oxidized by the action of acid fats. These squeezers are quite expensive, and are sold from $26 to $28 a piece. They last one year and a half to two years. They are easily repaired, but have to be kept in good order and cleaned as soon as the dust, or meal, and other impurities have begun to adhere, by hammering them with wooden hammers. I shall not describe the presses as they are nearly like all other hydraulic presses, differing only in some improvements of the packing of the plungers, in the adaptation of check valves, etc. The pressure must be one and one half tuns to obtain a good cake, or 85 pounds per square inch. The cake must not be more than half an inch thick or very little over, and should weigh from 7 to 7½ pounds. The presses, when charged, are left for twenty minutes and then the squeezers are taken out.

*Fig. 3.*

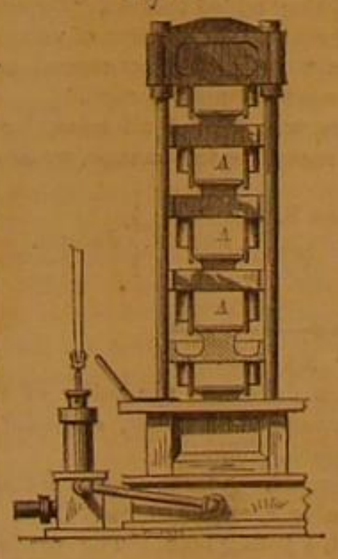
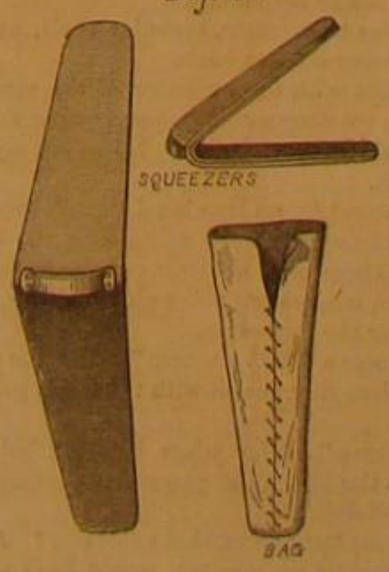



*Fig. 4.*




The cake is taken out of the bag by setting the bottom of the bag against a board and turning it inside out. The cake is carried to a special room, where a man with a kind of half circular knife, Fig. 5, trims the edges and cuts the top and bottom. Sometimes the cuttings are reground and repressed, as these parts have never been as well pressed as the middle part. The trimmed cakes are then placed on frames upon their edges, and left to dry; care being taken not to have them put too close to each other, so that the air may have free circulation all around them. Cakes would soon decay through the action of the moisture remaining in them. It is very important the meal should retain its temperature, and some works to that end have had iron pipes passing behind and between the sets, so as to heat the whole structure. It is always observed that the set near the heater yields a larger quantity of oil than the last set. This is a consequence of the heat communicated to the press from the heater.

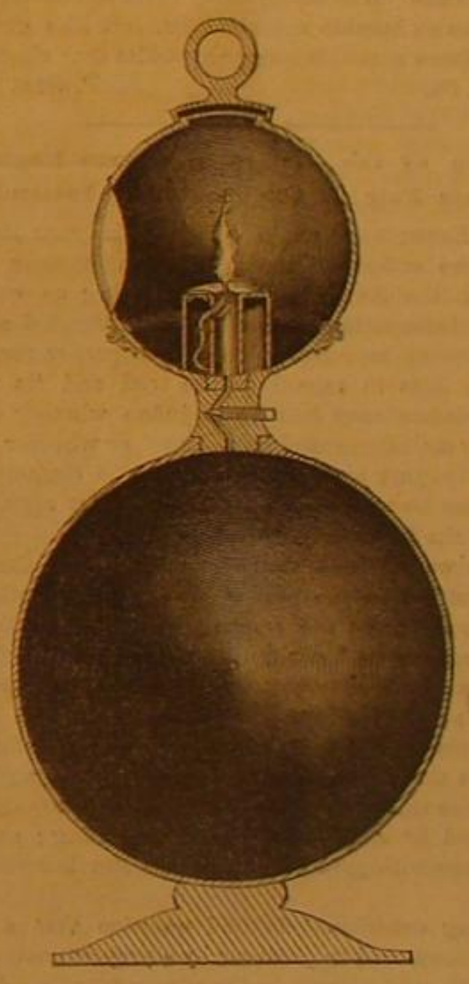
*Fig. 5.*

## Correspondence.

*The Editors are not responsible for the Opinions expressed by their Correspondents.*

### Safety Lamp for Miners.

MESSRS. EDITORS:—The SCIENTIFIC AMERICAN of September 25, 1869, contains an article on the Avondale disaster, and a notice of a lamp recommended by W. H. Bessemer. I inclose a drawing of a lamp made by me as far back as 1829 on the same principle as that recommended by Mr. Bessemer. From my knowledge of miners I have always considered that there could be no safety while they had the control of the



lamps. I therefore made one like the drawing, part of which I still have. The globe containing the condensed air is 10 inches in diameter, the lamp 6 inches, with a joint made tight by leather (better rubber), and locked; the lamp was made to burn the oils common in those days, and would throw the light a great distance, so that it might be placed in safety and yet give a better light to the miner than the Davy. At the top was a piece of wire gauze for the exit of the products of combustion; the whole was made of copper.

The miners of those days thought themselves quite safe with the Davy, and all I got was the name of a schemer, and sundry lectures on my folly, when, soon after, leaving England, I had other things to attend to.

I could never get anybody to see any good in my invention. Perhaps I have been too far ahead of time, as many explosions have been required to prove the Davy not altogether safe. FREDERICK LEAR.

Willsborough, Mo.

### The Wandering Jew, or Cow Killer.

MESSRS. EDITORS:—My attention has been arrested by the article bearing the above title, on page 43, current volume of your journal. Both names are new to me, having never heard them applied to an insect, which, by the description is clearly that of the large red stinging ant, a species of *Mutilla*, a genus among the order of *Hymenoptera*.

Thomas Say describes six species found within the United States, while thirty-eight species are noticed in Rees' Cyclopedia. They are solitary in their habits. The females are always found on the ground, abounding mostly in hot, sandy situations. The males resemble other sand wasps, being pro

vided with wings. The females are destitute of wings and ocelli, but are provided with a powerful sting; and woe to him who may have a demonstration of it on his own person. They are not very common, but I have occasionally met with them on the ground. They are quick in their motions and hide beneath a stone or clod of earth, so that you know not where to look for them.

The following, Fig. 2, is a sketch of a specimen I captured upwards of fifteen years ago near Mount Joy, Lancaster County, Pa. Fig. 3 is one I captured at Cape May, July 1858; Fig. 1 being the head and antennæ.

*Fig. 1*

*Fig. 2*

*Mutilla coccinea:* scarlet, abdomen is marked with a black belt. It inhabits North America. The wings are black, but in general it is an apterous insect.—(*Rees.*)

*Fig. 3*

This accords well with my Fig. 3. Fig. 2 thorax and anterior portion of the abdomen scarlet, with a distinct black cross and the posterior segments black, I cannot find described.

The *M. Bifasciata* of New York State, is black; head and thorax red, abdomen with two red bands; the wings are violet black.—(*Rees.*)

The *M. Vigilans* of Pennsylvania: ♂ black, large abdominal segment, excepting its posterior and anterior margin, rufous.—(*Say.*)

A Mexican species, *M. Erythryna* (*Klug*) is scarlet red, beneath black, wings blackish.

One of this family, I suppose, is the insect that your correspondent calls the "Wandering Jew," from the outline given by him. I, as an humble entomologist, felt like gratifying his wish to know something more about its true character.

Lancaster, Pa. P. STAUFFER.

### Vindication of the Judges on Steam Engines at the Late Fair of the American Institute.

MESSRS. EDITORS:—Certain criticisms, in your last number, upon the action of the judges on engines at the late Fair of the American Institute, being so evidently based upon information derived from interested and unreliable sources, we have deemed it proper for us to state certain facts in regard to the trial and its results, that your readers may be able to judge whether our decision was "stultifying and ridiculous," or whether it was not eminently just and proper under the circumstances. These facts can be verified by the official report upon file at the rooms of the Institute.

1st. There was no test made by coal, nor was there any original intention on the part of the judges, or others, of making such a test, for the reason that the amount of coal burned during the trial could not be ascertained with any reasonable amount of accuracy. There were forty-five square feet of grate surface, and the entire quantity of coal burned during an eight hours' trial, would cover this surface to a depth of less than one foot. As for leveling off a glowing fire of that size to a "line of bricks," the idea is too absurd to be entertained by any one familiar with firing; and that "this was done with great care by all parties interested" is not true.

2d. It being established beyond question that a given quantity of steam will be produced by a proportionate weight of coal, which will always be the same under the same circumstances; the weight of water evaporated being an exact measurement of the steam produced and the coal burned; therefore, *by consent of all parties interested*, the cost of the power was determined by the water used, "measured by a meter open to the inspection of all."

3d. Experiments made with this meter at different velocities of discharge, show a different *rate* of variation with each considerable change in speed, but at the speed used during the trial, and which was practically the same for each of the principal engines, both the rate was *constant and the measurement practically correct*—the possible variation being within a small fraction of one per cent. As a *comparative* measure under such circumstances it was more reliable than any other means of determining the evaporation except by actual weighing of the water.

4th. The difference in the management of the fires on the two days when the Babcock & Wilcox, and the Corliss engines were tested, which was noticed at the time and which has since been fully stated and explained to the judges by by the agent of the boiler used, was sufficient to account for any reported difference in the amount of coal burned, and for the observed difference in the quality of the steam. It would therefore have been imperative upon the judges to have ruled out the coal, had it not been previously excluded by mutual consent.

5th. The cost of the power in coal, allowing the usual estimate of *nine pounds of water to each pound of coal was for indicated power*, for the Babcock & Wilcox engine, 2·831 pounds per hour per horse power, and 2·895 pounds for the Corliss engine, a difference of 2·21 per cent in favor of the Babcock & Wilcox; for *net effective power*, 3·248 pounds for Babcock & Wilcox, and 3·209 for Corliss, a difference of 1·2 per cent in favor of the Corliss engine.

6th. The difference between "indicated" and "net effective" power is due to the power required to drive the engines alone, which was much more for the Babcock & Wilcox than for the Corliss engine; but this was not so much due to the difference in the construction of the engines, as to the fact that the foundations of the Babcock & Wilcox engine were impaired by the overflow from a neighboring drain, thus throwing the engine out of line; and also to a heavier fly-wheel having been placed upon this engine.

7th. The *quality* of the steam was *not* the same for the different days—it being very evident that the steam supplied to the Corliss engine was considerably drier than that furnished to either of the other engines. This was particularly observed by at least one of the judges. The amount of loss from this source was calculated from the quantity of steam shown by the indicator diagrams, as compared to the total weight of water supplied to the boiler, and this calculation shows that the Corliss engine had an accidental advantage in this respect, as compared to the Babcock & Wilcox, of about *thirteen per cent* (90·99 to 79·47). Had allowance been made for this *fact*, the economy of the Babcock & Wilcox engine as compared to the Corliss, would have been *fifteen per cent* on indicated power.

8th. The indicator diagrams taken at the trial show the most rapid opening and closing of the valves, the greatest range of cut-off, and the nearest approximation to boiler pressure (5·542 lbs. to 9·567 lbs.), in the Babcock & Wilcox engine, notwithstanding it took its steam through twenty-two feet more of piping.

9th. The "clearance" in the Babcock & Wilcox engine was 1¼ per cent, and that of the Corliss was 3·1 per cent of space swept through by piston. The former is the least amount ever brought to our knowledge.

10th. The style of valves used in the two engines is distinct, and the flat slide employed in the Babcock & Wilcox engine is not only preferable to the curved slides of the Corliss, but the constant throw of the same is conducive to equal wear and continued tightness, while the varying throw of the Corliss valve has the opposite effect.

11th. The regulation of speed was practically equal in the two engines, being excellent in both cases.

With these facts before them the judges had no difficulty in deciding which was the *best engine*, and they plainly indicated that opinion by awarding the first premium to the Babcock & Wilcox engine "for the *most perfect automatic expansion valve gearing*;" supposing, in their simplicity, that the engineering world at least, would know that this embodied all the difference in the principle of construction of the engines in competition. But they also felt the force of the argument that the trial having been made under certain rules, and the Corliss engine having shown the best results by the strict rendering of those rules, though that result was purely accidental; it, therefore, should have a first premium for those results. In giving this premium, however, it was expressly stated that it was "for best results on net effective power shown at the trial, being from one to two per cent better than any other in competition;" and they added thereto, "for superiority of workmanship, and general arrangement of valves and valve gearing;" it being a very good arrangement as compared to other engines, but not the "most perfect."

Trusting that these statements will correct all misunderstandings which have arisen in regard to this matter, we are

Respectfully yours,

THOMAS S. SLOAN,
HAMILTON E. TOWLE,
ROBT. WEIR,
} Judges.

New York, Jan. 29, 1870.

### Steam Boiler Explosion.

MESSRS. EDITORS:—About ten days ago, the boiler of a donkey engine, on board the steamer *Parthenia*, exploded, while lying at the dock, in Hartford, Conn.

The damage done was considerable. A large portion of the upper deck was blown off, the cabin demolished, etc.

Only one person was on board, a young man. The fire in the boiler was started by him, as the owners say, against orders.

The penalty of disobedience falls severely on him; as he is badly hurt, and is now confined at the hospital. He had the presence of mind to put out the fire, which was scattered in all directions, before help arrived.

The boiler was an upright, turbular shell, about two feet in diameter, five or six feet high.

In conversation with the engineer of the steamer, only a few days before the disaster took place, he expressed his doubts of the safety of this same boiler. He called my attention to its construction.

The head was set in, an iron band shrunk around the outside, the tubes doing the work of holding the head against the pressure. There were no rivets or bolts in the head. This head was blown out, taking tubes along with it, I suppose, as I saw none after the explosion.

Although it was a "*high pressure*" boiler, the engineer said he would not dare stay near it with the steam gage indicating thirty pounds.

It was a "cheap" boiler when bought; but has proved a costly one in the end. The papers say the damage amounts to two thousand dollars.

Is there any mystery about that explosion? A small boiler like that, if properly constructed, would bear a pressure of one hundred pounds with perfect safety. I have seen similar boilers, with riveted heads, tested at one hundred and fifty pounds, with cold water.

Hartford, Conn.

### THE FRENCH SYSTEM OF STORM MAPS.

From the February Number of "Old and New."

Behind, or rather beside, the Pantheon in Paris, at the corner of a street that runs towards the Observatory, at the far end of the Gardens of the Luxembourg, and in the ground floor and corner room, as if it were an American apothecary shop or grocery store, the traveler, curious in such things, will find a woman sitting at the receipt of custom, taking down subscriptions for the daily bulletin of the meteorological observations carried on at the Observatory. I have recently learned, however, that the task of making these observations is now transferred to the new observatory, of which M. St. Claire Deville is the learned and distinguished superintendent.

When we crossed the ocean in October, 1866, from New York to Brest, in the *Ville de Paris*, we knew that the passage would be stormy, for the time of sailing fell on the bad day of the weekly storm system of that year. And so it turned out. We got engaged in the southern rim of a tremendous "northeaster" just departing, like ourselves, from the States for England, and we sailed nine days in its company, sometimes gaining on it, sometimes beaten back by it, until one night, not having seen the sun for six days, we lay to in front of a lighthouse, not knowing where we were, only that we certainly were not where we should have been—off Ushant. When morning broke, the shore appeared. It was the coast of Cornwall. We turned therefore at a right angle, and steamed across the mouth of the English Channel, and arrived at Brest one day later than we should have been had we made Ushant light.

This lost day permitted our disagreeable companion, the northeaster, who seemed utterly indifferent to our society, to go ahead; and then the sun came forth, and the beautiful and curious cliffs and monuments of Brittany, and the rare scenery of the port of Brest, remunerated us for the delay.

Had we been on a voyage from Labrador to Norway, we should have been on the northern rim of the storm instead of the southern; and it would have been a southwester, instead of a northeaster, and have driven us forward, all the way, *pêle mêle*.

I was so curious to follow the subsequent course of this erratic monster, that on my arrival in Paris, I subscribed to the Meteorological Bulletin, and got the back numbers for two weeks.

Looking on the chart for the day before we saw the English light—there, sure enough, was the front rim of our storm drawn in curved lines from north to south, and bellying eastward, over the northwest corner of Europe. The next day's chart showed it further advanced and raging into the North Sea; and each successive daily chart marked its position further and further east-southeast, until its form was broken up and lost between the Black and Caspian Seas.

The winter I spent in part at Pau in the Pyrenees, and every morning I had at my breakfast table the mapped climate of all Europe of the day but one before. And every week I had a new storm to follow, from its first appearance on the west coast of Ireland, to its disappearance three or four days later in the Levant, or across the Ural mountains.

Sometimes there appeared signs of a disturbance in this regular march, which I could not comprehend, and then the order would be resumed and regularity maintained as before.

In St. Petersburg a similar storm map has been published for some years, even better adapted for the student than the French. In England there was until recently a distribution of storm information, in advance of time, to all the seaports of England, by telegraph from Greenwich; but the labor and expense were supposed to be inadequate to the results; the designer of the system, on whom it chiefly depended, became engaged in other scientific pursuits; and the daring fishermen and economical merchants of England were impatient of control. So it has ceased.

Along the stormy and dangerous coasts of the United States such a system would be of incalculable value, and ought to have been established by Government long ago. One wealthy merchant of Boston or New York, however, could by himself keep up an establishment of the kind they have at Paris, until it became self-supporting—and not have to wait long for that to happen. The Bulletin of Paris is a quarto sheet of four pages, on the first, second, and third of which are tables of the state of the barometer, thermometer, and sky, the rain-fall and wind-force, at all the places from which telegraphic dispatches had arrived that day, and lagging dispatches of the day before.

The third page, kept permanently furnished with a map of Europe, printed in blue, shows on this map, but in strong black lines, the curves of barometric pressure, geographically drawn through or near the places from which the telegram of the day has come. These telegrams are studied in the evening, and thrown into curves, printed over night, and distributed in the morning. In Paris, a man can see at a glance the condition of the atmosphere as it was all over Europe the day before.

The lines of barometric pressure are all concentric in a greater or less degree, because they show the sides of the great waves of air which are rolling forward over the surface of the earth, and pressing unequally on the innumerable barometers of Europe. Each curve is marked 760, 765, 710, 715, etc., meaning millimeters of mercury. In America we should mark them tenths and hundredths of an inch. Arrows also appear on the map, showing the direction and force of the winds.

BALLOONS.—This subject has been so thoroughly discussed in our columns that we feel obliged to drop it for the present.

For the Scientific American.

## ON ZINC.

BY PROFESSOR CHARLES A. JOY.

### HISTORY.

Zinc is a metal of the present century. Seventy years ago there were not so many pounds of it required for the wants of the whole world as there are tuns manufactured at the present time. Its production has increased two thousandfold, and we must look upon it as one of the most useful of all the metals in the whole round of chemistry.

It is true that the ancients made brass from copper and calamine; but they were not aware of the existence of metallic zinc in the mineral they employed to combine with the copper. The word zinc itself does not appear to have been used before the year 1540, and by some authorities it is traced to Zincken or Zacken, meaning the chimney stack in which the oxide collected when zinc-bearing ores were roasted. When this flue dust became known as a metal it received opprobrious names, such as "the spurious son of copper," and hence a bastard metal. Some called it coagulated mercury, and the miners thought it was unripe lead ore, and if it were left a few ages longer it would mature to something useful. It appears to have been brought to England from India towards the end of the sixteenth century, and to have received at that time the name of "spelter," which it still bears. That the Germans did not know how to make brass from the ores of zinc is conclusively shown in the history of the mines at Wiesloch, in Baden, which were worked for lead from the eleventh to the fourteenth century, during all which time the zinc ore was thrown away and finally collected in vast heaps about the mouth of the mine. These mines were re-opened in 1850, and an immense amount of zinc was obtained from the refuse that had been previously regarded as worthless.

The first German establishment for the manufacture of brass from copper and calamine, was at Goslar, in the sixteenth century. In England we have the record of all patents issued since the year 1681, and we find that the earliest mention of brass was in 1728, when a patent was granted for "a method for the more advantageous manufacturing copper oares through all the intermediate operations till it be brought into fine copper, and from thence into brasse, to be cast into plates, rodds, kettles, and other utensills in metall moulds." And we read, in 1758, that "spelter and brass might be made from a mineral which had not thentofore been made use of for such purposes. The mineral black-jack, mock-jack, or brazill, can be used to make spelter."

But by far the most important discovery relating to zinc was made by Sylvester and Hobson, in 1805. This was "a method of manufacturing the metal called zinc into wire and vessels. Zinc is made malleable and may be drawn into wire by working it at a proper heat or by annealing: 210° to 300° Fah. is such proper heat." It was in view of this discovery that we called zinc a metal of the present century; for, previous to this period, its applications had been of the most insignificant character as compared to the vast uses of the present time.

Between the years 1728 and 1859, 69 patents were issued in England chiefly relating to zinc furnaces. The SCIENTIFIC AMERICAN, for the last ten years, contains the record of twenty patents granted in the United States involving the manufacture and uses of zinc. It appears from all accounts that the first zinc made in the United States was by John Hitz, in 1838. He prepared it from New Jersey ore for the purpose of manufacturing some brass to be used for the standard weights at Washington. His method was a tedious and expensive one; but since that time great improvements have been made, and the industry has become a very important one in the United States; and as we have extensive deposits of blende and calamine, it is destined to assume still greater proportions.

### OCCURRENCE.

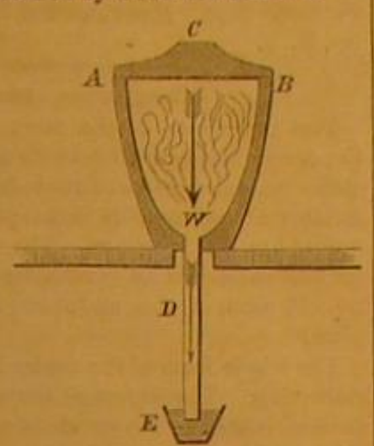
The variety of zinc minerals is not very great, but this is made up by the abundance of the few in which the metal is found.

The most conspicuous ores are blende, commonly called black-jack, which is a compound of sulphur and zinc; calamine, which may be a silicate or carbonate; zincite, an oxide; goslarite, a sulphate; and franklinite, composed of zinc, iron, and manganese, and found in New Jersey. The metal is not found in the animal or vegetable kingdom, as it would be destructive to the growth of vegetables or animals. The Germans call black-jack *blende*, because it used to blend or deceive the early miners. Its beautiful luster led them to expect to find a valuable metal; but, as all of their efforts to obtain anything from it remained fruitless, they looked upon the ore as a cheat, and called it *blende*.

### PREPARATION OF ZINC.

Having sketched the history and occurrence of zinc, we come now to consider the methods of its preparation.

"The process is comparatively simple, and consists in first carefully hand-picking the ore to remove the galena, and then calcining it in a reverberatory furnace or rather oven. The roasted ore, deprived of carbonic acid, water, and sulphur, as the case may be, is then mixed with charcoal alone if prepared from calamine; but if from blende, a certain quantity of roasted calamine is also added, and the whole placed in earthen pots, or crucibles, very much like the pots used at glass works, but provided with a luted cover and also with an opening at the bottom, to which an iron pipe is fitted. After the heat has been applied sufficiently long, the volatile metals —such as arsenic and cadmium—make their way in vapor, *per descensum*, to the end of the iron tube, where they afford a flame, which the workmen distinguish by the name of the *brown blaze*; this is succeeded by a blue flame, called the *blue blaze*, which indicates the distillation of the zinc; and then the metal is condensed in the iron tube, and falls in drops and in a powdery state into a vessel placed to receive it; as may be easily imagined, the iron pipe sometimes becomes stopped, and is occasionally cleaned by a red-hot iron rod.




"A B is a large earthen crucible or pot containing a mixture of roasted zinc ore and coal or charcoal; C is the cover closely luted down; D is the iron pipe in which the zinc vapor condenses and falls into the vessel, E, containing enough water to cover the end of the pipe.

"The pipe is removed after each charge has been exhausted, in order to take out the *caput mortuum* or matter left in the crucible after distillation. The arrows show the direction of the metallic vapor, and the iron pipe is usually plugged with wood, W, which is soon reduced to charcoal, and while preventing the ore from falling out, does not stop the zinc vapor."

The above extract will serve to convey a general idea of the metallurgy of zinc; but the process is capable of important medifications, as the numerous patents on the subject abundantly show, and it is probable that we shall arrive at still simpler methods as the demand for the metal increases.

### PROPERTIES OF ZINC.

Our knowledge of zinc has increased very nearly in the ratio of its employment in the arts, and the one may be said to grow out of the other; for the more we know of its properties the more easily can we imagine its uses. There are certain general facts in reference to its properties that may be found in every chemical treatise, but the recent progress of our knowledge is not contained in any single book, and can only be obtained by searching the journals of various countries. We have performed this search, and propose to give the results of our labor.

Zinc is a bluish white, brilliant metal, crystallizing in hexagonal pyramids with subordinate prismatic faces. The specific gravity of cast zinc varies from 6·8 to 7·1, and of forged from 7·19 to 7·2. It is less flexible than lead or tin when cold, and is very brittle at ordinary temperatures, and also when heated up to 410° Fah. It is malleable between 212° and 300°. Fah., the best temperature for this purpose being 248° Fah. It melts between 752° and 773° Fah, and can be readily distilled with exclusion of air. The metal possesses different properties according to the temperature at which it has been prepared; for example, when heated nearly to its point of ignition it is less flexible than when heated simply to fusion, and the point of fusion and rapidity of cooling affect its solubility in sulphuric acid. It would appear from these and other circumstances that the metal was capable of assuming different allotropic conditions. It expands more by heat than any other metal. In pure dry air or in water free of air, zinc remains perfectly bright, but in moist air or in ordinary water, it is rapidly coated with a film of oxide, which serves to protect it from further destruction. The impure metal is more readily dissolved in acids than the pure, and the evolution of hydrogen takes place very violently when a little bi-chloride of platinum is added. The action of foreign metals is explained on the principle of electric currents. Zinc which has been heated to a high degree and then suddenly cooled, is also more rapidly acted upon by acids.

Silver being taken at 100, the conducting power of zinc for electricity is 27·39; and for heat, silver being taken at 1000, the conductivity of rolled zinc is 641. One of the most important properties of zinc is its highly electro-positive character, which enables us to employ it to precipitate nearly all of the metals from their solutions. It has recently been discovered to possess great reducing power, especially for the chlorides and fluorides of the metals; and it is proposed to employ it to obtain the rare metals aluminum, magnesium, silicium, etc. It has also been found that it will displace phosphorus from bone ash, and a new method for the preparation of phosphorus is thus suggested. It dissolves gold and silver very readily, and it is proposed to substitute it for mercury in the working of the precious metals. Zinc does not alloy with bismuth nor with lead. Lead dissolves 1·6 per cent zinc, and zinc dissolves 1·2 per cent lead; zinc dissolves 2·4 per cent bismuth, and bismuth dissolves 8·6 to 14·3 per cent zinc. Zinc is acted upon by common salt with evolution of hydrogen, and the formation of a double salt of chloride of zinc and sodium and the separation of the oxide.

Zinc in concentrated sulphuric acid evolves sulphurous acid; in sulphuric acid and six parts of water, sulphureted hydrogen is given off, and pure hydrogen is only obtained from very dilute sulphuric acid. Zinc is a violent poison, and hence the action of a certain class of substances upon it ought to be carefully studied. Brandy, wine, vinegar, meat soup, milk, spring water, salt water, sugar sirups, dissolve zinc more or less, and consequently ought not to be stored in it.

Caustic soda, potash, and ammonia act very violently upon zinc, and this explains the reason why petroleum, which has been purified by means of soda, acts so powerfully upon zinc tanks, and often eats through them.

Zinc has great antiseptive properties, and is employed to keep timber from decay. When zinc is dissolved in hydrochloric acid a portion of the chloride is carried over mechanically by the hydrogen, producing a black mirror on porcelain similar to arsenic, thus exposing the chemist to an error that might have serious consequences. The action of hydrochloric acid upon zinc is immediately interrupted by chloride of mercury.

Zinc decomposes in contact with plaster, also in contact with iron. Eaves gutters should be supported by galvanized iron, and no sheet zinc should be laid on oak boards.

Zinc readily combines with phosphorus producing a valuable medicine, and a compound that can be usefully employed in the galvano-plastic art. The property of zinc that enables us to employ it in the construction of the galvanic battery was more particularly studied by Volta, and suggests the possibility of our having recourse to it as a motive power. At present the cost of zinc as an electric motor is 200 times greater than that of coal for the same power, but it does not necessarily follow that we shall never attain practical results in this direction, either by cheaper zinc or more ingeniously contrived machinery. The property of zinc to alloy with other metals, especially copper, is one of its most prized characteristics, and is the one longest known.

We have thus sketched the principal properties of zinc, and may hereafter recur to the applications of which the metal is capable.

## The New "London Times" Printing Machine.

As the construction of the first steam newspaper machine was due to the enterprise of the late Mr. Walter, so the construction of the last and most improved machine is due in like manner to the enterprise of his son. The new "Walter Machine" is not, like Cowper's and Applegarth's, and Hoe's, the improvement of an existing arrangement, but an almost entirely original invention. Its principal merits are its simplicity, its accurate workmanship, its compactness, its speed, and its economy. While each of the ten-feeder Hoe machines occupies a large and lofty room, and requires 18 men to feed and work it, the new Walter machine occupies a space of about 14 feet by 5, or less than any newspaper machine yet introduced, and only requires three lads to take away, with half the attention of an overseer, who easily superintends two of the machines while at work. The Hoe machine turns out 7,000 impressions printed on both sides in the hour; but the Walter machine turns out 11,000 impressions completed in the same time.

The new invention does not in the least resemble any existing printing machine, unless it be the calendering machine, which has possibly furnished the type of it. At the printing end it looks like a collection of small cylinders or rollers. The paper, mounted on a huge reel as it comes from the paper mill, goes in at one end in an endless web, 3,200 yards in length, seems to fly through among the cylinders, and issues forth at the other in two descending torrents of sheets, accurately cut into lengths, and printed on both sides. The rapidity with which it works may be inferred from the fact that the printing cylinders (around which the stereotyped plates are fixed) while making their impressions on the paper, travel at the surprising speed of 200 revolutions a minute.

As the sheet passes inwards, it is first damped on one side by being carried rapidly over a cylinder which revolves in a trough of cold water; it then passes on to the first pair of printing and impression cylinders, where it is printed on one side; it is next reversed and sent through the other pair, where it is printed on the other side; then it passes on to the cutting cylinders, which divide the web of now printed paper into the proper lengths. The sheets are rapidly conducted by tapes in a swing frame, which, as it vibrates, delivers them alternately on either side, in two apparently continuous streams of sheets, which are rapidly thrown forward from the frame by a rocker, and deposited on the tables at which the lads sit to receive them.

The machine is almost entirely self-acting, from the pumping up of the ink into the ink box out of the cistern below stairs, to the registering of the numbers as they are printed, in the manager's room above.

Such, in a few words, is the last great invention made in connection with newspaper printing, which reflects no little credit on the enterprise of Mr. Walter and the inventive skill of the gentlemen of the *Times* staff—for it has been entirely designed and manufactured on the premises—to whom he has intrusted its execution.—*Morgan's British Trade Journal.*

## Test for the Goodness of Glue.

Mr. Alfred Bird, of Birmingham, England, communicates to the *Chemical News* the following test for the goodness of glue, which he states he has found very valuable:

"Assuming that 'that' is the best glue which will take up most water—take 50 grains of the specimen, and dissolve it in 3 ounces of water in a water bath. When dissolved, set it by for 12 hours, to gelatinize; and then take an ounce chip box, place it on the surface of the gelatin and put 'shots' into the box, till it sinks down to a 'mark' on the outside. It will be found that, the stronger the glue the more shots it will take to sink the box down so that the mark shall be be level with the surface of the gelatin.

"In a trial with the finest glue I ever met with, 50 grains of glue, dissolved and gelatinized, with 3 ounces of water, supported, to the mark on the box, 6 ounces of shots, at a temperature of 58° Fah. On trying the same experiment with best Russian isinglass, 50 grains, dissolved in 3 ounces of water, supported 9 ounces of shots, the temperature being the same.

A NEW marble has been discovered in the Giant Mountains of Bôhemia, which is described as in every way equal to Carrara, both in whiteness and fineness of grain, and invaluable for sculpture.

## A NEW ENGLISH OIL TESTING APPARATUS.

A new apparatus for testing the explosive or non-explosive character of petroleum oils as they are used in lamps, has been devised in England, but notwithstanding it seems a good one, no patent has yet been taken out for it. It consists of an ordinary spirit-lamp with small flame, A.

A water vessel, B.

An oil cup, C, two inches of which descends into the water bath, and which is filled with oil up to the rim, which surrounds the oil cup about one inch from the top, and which forms a rest for the cup in the water vessel.

D shows the space which is left for the collection of vapor as it is given off by the oil. This cup is fitted with a brass cover, through which, in a nicely fitted brass slide, the thermometer is passed into the oil. In this cover there are also two small holes, E, and these are covered by two circular pieces of brass, which are raised or lowered simultaneously by a gentle pressure of the thumb, upon the brass lever, F.

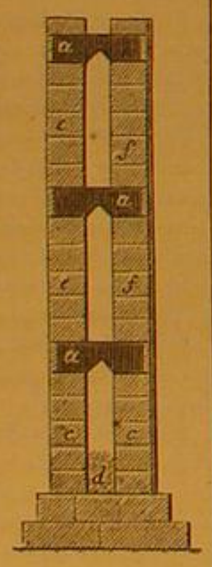
When the oil is under the test the brass caps are supposed to be down to prevent escape of vapor. When it is intended to apply the flame for the flash, the lever is touched, and the two brass caps fly back. A "small flame" is applied to one of the openings, and if no flash is obtained, these openings are again covered up, and the small flame applied again at short intervals until the flash is obtained.

The apparatus appears to meet several objections brought against the present mode of testing. For instance, it may be used anywhere without the fear of the vapor being blown away; and the flash may be applied without the fear of heating the surface of the oil with the flame. It is not open to any of the objections raised against screen or cover, and the warning that "the flat rim be not covered with the liquid" can, in this case, be made no point of dispute.

In order to prove the correctness of any test, it is proposed to place a second thermometer in the water. Should this thermometer indicate the same temperature as the one inserted in the oil, both being correct, and the flash be then obtained, it is said that this demonstrates to a certainty that the real and true flashing point of the oil is that expressed by both thermometers. One objection certainly is met by this process of proving the test. In this case it cannot be said that any portion of the oil is raised by the latent heat of the water to a temperature higher than is indicated by the thermometer.

## CONSTRUCTION OF HOLLOW WALLS.

An invention has been recently patented in England, having for its object an improved construction of hollow walls.




Our engraving is a vertical section of a wall built in this way. The wall ties are flat plates built into the vertical joints of the wall. The ties may be made of cast or wrought iron, zinc, or slate. They are made with notches on their lower edges to prevent water from flowing along them from the outer wall to the inner one. The width of the tie is somewhat more than the thickness of a brick, so that it bears upon the bricks both below and above it, and its length is such that it may be firmly imbedded in both the outer and inner wall. It also has perforated ends to allow the mortar to penetrate it. Walls constructed in this manner always keep dry on the inside and are excellent non-conductors of heat.

### Faraday's Success as a Lecturer.

The *Chemical News* says of Faraday's success, as a lecturer, that it may be attributed to his careful attention to strict rules, of which the following were found among his notes:

Never to repeat a phrase.

Never to go back to amend.

If at a loss for a word, not to ch—ch—ch, or eh—eh—eh—, but to stop and wait for it. It soon comes, and the bad habits are broken, and fluency soon acquired.

Never doubt a correction given to me by another.

In addition to this strict attention to rules, Faraday took lessons in lecturing in 1823, and again in 1825 and 1826, before giving his first course of lectures in the institution.

## DOMESTIC WATER FILTERS.

There are many situations where the blessing of good wells or running streams cannot be enjoyed, where the supply is bad, or the only resource is the roof and the eavestrough. Thanks to the persevering efforts of the inventor, no family need now to suffer from the lack of pure and wholesome water; for the "Family Filter" is a ready and effective apparatus by which rain and other waters may be quickly purified, and the taste of the nicest spring imparted.

For a long time we have had at our country residence the "Kedzie Family Filter," and we regard it as an excellent device. In form and size it resembles an ordinary oak barrel, is bound with iron bands, and contains filtering media of silex and carbon. The cistern or other water, poured in at the top, passes through the filter, and is drawn off, pure and limpid, from a faucet below. This filter is portable, durable, and satisfactory in every respect. Several different sizes are made. Patented 1864. Manufactured by Kedzie & Bunnel, Rochester, N. Y.

### Improved Shovel Plow.

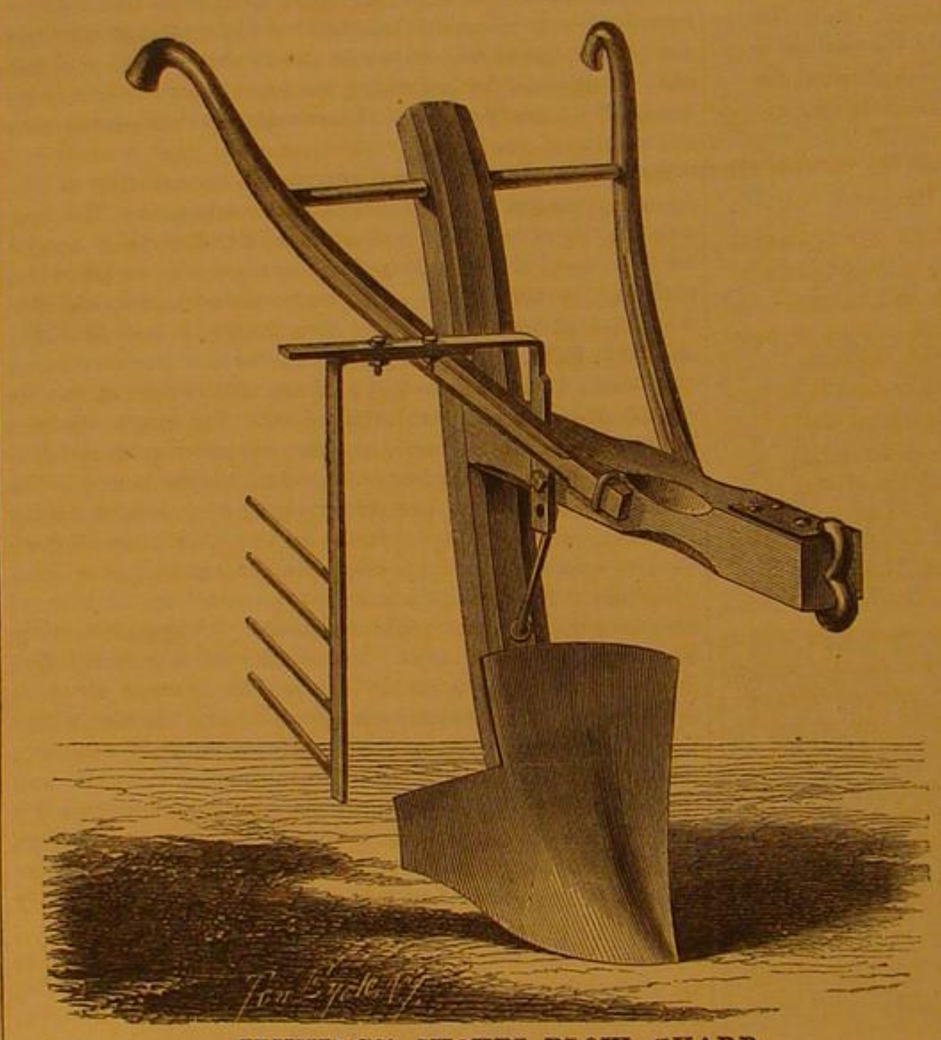
Past experience on the farm in the inconvenience which the device illustrated herewith is designed to obviate, would suffice to convince us of its value without the extraordinary number of testimonials from practical men, which the inventor has laid before us. There is no doubt that the inventor has succeeded in producing a decided improvement on the old form of the useful implement known as the shovel plow.

The whole form of the device is perfectly delineated in the engraving. The object of the device is to prevent the deposit of stones or heavy clods upon the young plants when cultivating, while the fine dirt shall be thrown up along the side of the hills, and thus approximate in effect, hand hoeing.

For this purpose he attaches an iron or steel arm to the beam of the plow, from which depends a grid, which, while it prevents the lateral throw of the large clods or stones, freely permits the passage of the fine loose earth. As the arm is jointed, as shown, the grid or guard may be laterally adjusted to suit the width of rows, etc.

The draft strain upon the lower part of the guard arm may be supported by a rod, one end of which hooks into a hole in the grid, and the other to the framework of the plow.

The guard-arm may also be adjusted to any hight to suit any depth it may be desired to plow. The forward part of the descending bar should be sharpened so as to pass readily through grass, weeds, and other obstructions. The improvement may be attached either to single or double shovel plows with equal advantage and facility.



JENNINGS' SHOVEL PLOW GUARD.

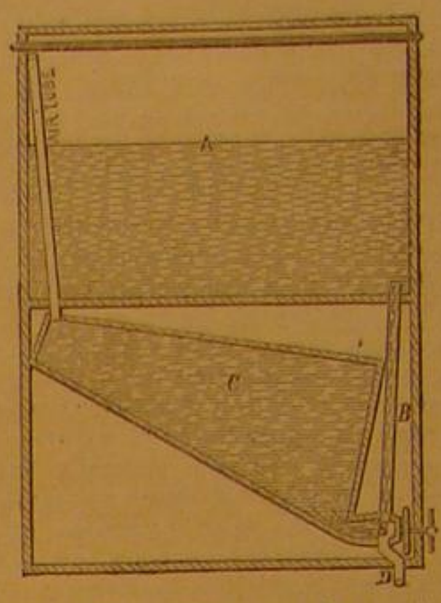
By the use of this improvement all injury to young and tender plants, by the falling thereon of heavy clods or stones, is obviated; and we should think that in many kinds of soils, there would be no need to follow it either with a hand hoe, or to straighten up plants.

The device was patented August 24, 1869, through the Scientific American Patent Agency, by Gregory Jennings, of West Cairo, Ohio, whom address for further information.

## NEW APPARATUS FOR MEASURING OIL.

A new apparatus for measuring oil, an engraving of which we give, has been recently patented in England, which seems ingenious and effective, while it is at the same time safe and cleanly. Our engraving is a section of this ingenious device. It consists of an upper cistern, beneath which are placed one or more measures of different capacity, according to the requirements of the shopkeeper. The measures are self-filling.

The measure is supplied by the inlet, B, which conducts the liquid to the measure, C, but when the handle of the tap, E, is turned, the inlet is shut off, and the liquid allowed to run out of the measure into the vessel placed for its reception. Now, when the measure is emptied, of course it must be filled again before another measure of liquid can be drawn from it; so, to prevent waiting for the measure refilling, or the chance of making a mistake by turning the tap before the measure is refilled, and thus giving short measure, two measures of equal capacity are placed together, and the taps connected by means of two cog wheels, so arranged that when one measure is emptying the other is filling, and as the outlet pipes of both measures are conducted into one, another quantity can be measured as soon as the preceding one has run off, and can be continued as long as the supply is kept up in the cistern, which can be connected by means of a pipe to any cistern, cask, or reservoir, situated either in the same room or any place outside. Measures of any number or capacity can be fixed




to one machine. Each measure may be examined and adjusted, and the legal stamp affixed by the official sealer and stamper of weights and measures, and as the measures are all incased they cannot be tampered with, so that the purchaser may be sure of full measure, and the seller will not be liable to suffer by waste.

The advantages claimed for this instrument are accuracy, cleanliness, economy of space, and a saving of time in attending to customers; for instance, a person possessing a machine with half pint, pint, quart, and two quart measures, having customers in the shop requiring one of each quantity, their vessels can be putunder the measures and will fill at one and the same time, and as the liquid will stop running as soon as the exact quantity has run out, the attendant has no need to watch it, but can be helping his customers to something else in the meantime.

### Manufacture of Tracing Paper With Petroleum.

Mr. Häusel, architect at Neustadt, Grand Duchy of Hessen, being once in need of tracing paper in a small village, where none could be obtained, thought of using, as a substitute, ordinary writing paper saturated with petroleum by means of a brush. The effect was a surprising success. It did not take him more than four or five minutes to paint a sheet of writing paper with petroleum and to wipe it off till it was dry. He thus obtained an excellent tracing paper, on which he could write and print just as easily as if it had not been treated with petroleum. Also drawing paper, when impregnated with petroleum, becomes sufficiently transparent to be used for tracings. Since Mr. Häusel made this discovery, he has never used any manufactured tracing paper, but has always preferred to use petroleum paper, which he can make himself at any time. He strongly recommends his method to all who can make use of it.

## STEAM ENGINES AT THE AMERICAN INSTITUTE.

The Self-vindication of the judges on steam engines at the late fair of the American Institute, which appears in another column, is simply a reiteration of the apologies made in their published report for their very eccentric action in the awards of prizes. The committee seem to felicitate themselves upon the happy idea that our criticisms were based upon information obtained from interested parties. Unless the judges themselves wish to be understood as interested parties, we deny the impeachment. Our criticism has been based upon the report of the judges themselves; and our convictions are strengthened by the attempted vindication which they have felt compelled to make. They are entitled to a respectful hearing; but we are still of the opinion that the less they say upon the subject the better it will be for their reputation.

Mr. T. Lidstone writes to the *Builder* that having examined the gravestones of the family of Newcomen, the inventor of the steam engine which bears his name, he finds his name is spelled Newcom*in* instead of Newcom*en* as is the modern usage.

THE LECLANCHE BATTERY.—We would say to the numerous correspondents inquiring in regard to the Leclanche Battery, that we have given all the information we possess, and can answer no further inquiries in regard to it.

IT is stated that the action of the voltaic current for a month upon wine greatly improves it.

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## THE RUMFORD MEDALS.

The recent presentation of the Rumford medals to an eminent American engineer and inventor, has excited much attention in scientific and mechanical circles, and it seems appropriate to give a brief history of the origin of these medals and the nature of the honor conferred by their award.

Benjamin Thompson, Count Rumford, was born in Woburn, Mass., in 1753. He received only a common-school education, and entered a country store as a clerk at the age of 13. During his clerkship, which lasted some four years, he employed his leisure time in study (more particularly of medicine and physics) to such good purpose that in 1770 he was qualified to teach an academy in the town of Rumford, N. H., now Concord, the capital of the State. Two years later he married a wealthy widow, and also received a commission from the Governor of New Hampshire creating him major in the militia. Through personal jealousy on the part of older officers, he was charged with disaffection to the cause of the American colonies which resulted in his leaving Rumford for Woburn, and soon after the latter place for Boston.

He was subsequently tried at Woburn, and although not fully condemned, was neither fully acquitted. He finally left the American lines, and when Boston fell into the hands of the British, he became the bearer of dispatches to England containing the announcement of that event.

Remaining in England he became the secretary of Lord George Germain, at that time Secretary of State for the Department of the Colonies. He subsequently returned to America and raised a regiment of dragoons, receiving the rank of lieutenant-colonel. Again visiting England, and hostilities being at an end, he obtained leave of absence and traveled in Europe. Finally, settling in Munich, he interested himself in military and social improvements and reforms, performing important services, in consideration of which he received his title of Count Rumford, the latter part of the title being chosen by himself. Shortly after, his health being impaired, he traveled in Italy, and finding that he did not improve he visited England.

For a long time previous he had made the subject of heat a special study; and while he remained in England he continued his investigations with highly practical and beneficial results.

Returning to Bavaria, and finding that the climate still disagreed with him, he ultimately settled in Paris, where he spent the remainder of his life. He died Aug. 21, 1814.

His time in Paris was mostly devoted to scientific and philosophical inquiries and investigations. The most important of his investigations were upon the relation of heat to friction, and the experiments he performed were among the most remarkable of all those from which the basis of the modern theory of heat has been derived.

Some time previous to his death he instituted prizes for discoveries in heat and light. These prizes, consisting of a gold and a silver medal, were to be awarded by the Royal Society of London and the American Academy of Sciences. Their intrinsic value is $300, and they are only to be given by the American Academy of Sciences to authors of improvements or discoveries in heat and light, in any part of the continent of America or of the islands of America—preference always being given to such discoveries as shall, in the opinion of the Academy, tend most to promote the good of mankind. To this end Rumford donated the sum of $5,000 to this institution July 12, 1796.

At a late meeting of the Academy this prize was bestowed upon Mr. G. H. Corliss of Providence, R. I., for his improvements in the steam engine. The award was made by Dr. Asa Gray, in a very appropriate address in which the merits of Mr. Corliss' improvements and inventions were ably stated and which was very briefly, but gracefully replied to by Mr. Corliss, in accepting the medals.

This is the fifth medal awarded by the Academy, the recipients, and their discoveries and inventions being as follows, in the order stated:

1. Professor Hare, for his oxy-hydrogen blowpipe.
2. Capt. John Ericsson, for his hot-air engine.
3. Professor Treadwell, for his improvements in the construction of ordnance.
4. Mr. Alvan Clark, for his new mode of grinding and perfecting large lenses.
5. Mr. George H. Corliss for his improvements in steam engines.

We congratulate Mr. Corliss on the receipt of this high and well-deserved honor. He has long been widely and favorably known through his inventions, and the appropriateness of the honor conferred will be recognized by all acquainted with his improvements.

## SOLUTIONS FOR HARDENING STEEL.

Of all the departments of the mechanic arts probably none is so completely enveloped in superstition and bigotry as that of hardening and tempering steel tools. We have scarcely ever met a man claiming skill in the art who had not some notion upon the subject which *his* experience seemed fully to confirm, or who did not advocate some practice for which he could assign no solid reason. Moreover we never recollect hearing anything recommended as more efficacious than simple water, that some one else would not be found to scout as utter nonsense, but who, at the same time, was a firm believer in something else perhaps even more absurd.

A certain individual, who shall be nameless, tempered stonecutters' implements in cow's urine, and expressed himself as perfectly able to change the character of the steel by using instead the urine of a calf. To our query whether he had ever tried the urine of a jackass, he replied that he had no doubt it had peculiar virtues; and we left him to pursue his experiments "on this line" feeling that many a shining light is hidden by the prejudices of an unbelieving world.

A page might be filled with the record of all the preparations, mixtures, charms, etc., by the use of which success in the tempering of steel has been attempted, and each of which has had its admirers.

A certain virtue has been, by many, supposed to reside in leather shavings, by which, if a tempering fire *be kindled* with them, immunity from cracking is secured; and Byrne states that a man who had tried it told him that, although before its use he was greatly troubled by cracking while tempering, since he had found out the virtues of leather as a preventive, not a single case of cracking had occurred, though he had used it for years.

Argument, of course, would be useless with such an individual; his experience (sic) would weigh with him more than anything that could be said by any one else, though the experience of the latter might have shown the utter worthlessness of the article in which the former placed blind and implicit faith.

The state of things which we have described is scarcely to be wondered at, when we reflect that all knowledge on the subject of hardening and tempering steel is empirical. Nothing is accurately known about it except that when steel is heated and suddenly cooled it becomes hard and brittle, and that by heating it again its hardeness and brittleness may be reduced to the degree required, and that this change of character is a molecular change of some kind yet to be determined.

The suddenness of the cooling is of course affected by the rapidity with which the cooling medium conducts or conveys away heat; and any change in the character of the medium which does not increase or diminish its conducting power would certainly seem to have little to support it. Of course the character of the objects to be tempered will indicate in some measure the mode employed. The watchmaker often heats his tiny drills in the flame of a candle, hardens them by sticking them into the cold tallow, and draws the temper by the same flame.

A little salt thrown into the water employed for tempering is quite generally supposed to add to its virtues, but a competent experimenter informs us that in a large number of experiments instituted to test the truth or falsehood of this notion he found nothing to support it.

Thin and small objects, which only need a small degree of hardness, may be advantageously hardened in oil for the reason that it cools them less suddenly, and therefore does not make them so hard as water would, while for large articles requiring to be very hard, quicksilver has been employed with success for precisely the opposite reason.

A recipe for hardening mill picks, which, slightly varied in its proportions, has quite a reputation, is as follows: Two gallons rain water, one ounce corrosive sublimate, one ounce sal-ammoniac, one ounce saltpeter, and one and one half pints of rock salt. The picks to be heated to a cherry red and hardened, and the temper not to be drawn. It is claimed that the salt gives hardness, and the other ingredients toughness to the picks; but no reason why they should do so seems tenable, as there certainly is no chemical reaction in the bath by which these results can be accounted for.

We hazard the opinion that simple water would be just as good, and that for all moderately-sized articles it is just as good as any solution that can be made, though of course in a matter depending so much upon personal judgment as the hardening and tempering of steel, we should not expect any man to succeed perfectly at first with any bath to which he had not become accustomed.

Correspondents frequently ask us to recommend to their use solutions for tempering; but with the views we have stated it will be seen we cannot conscientiously indorse anything of the kind; if given at all it has therefore been generally upon the recommendation of others rather than upon any convictions of our own in regard to the merits of such preparations.

## STUDY OF FIRST PRINCIPLES BY INVENTORS.

Let us suppose a man skilled in the use of tools and able to construct what his brain conceives; or at least able to superintend its construction, and get it properly done. Let us further suppose our mechanic to have an inventive mind, capable of striking out new and useful methods of accomplishing work by machinery. Suppose this talent to be so great that its employment in invention is very desirable, and if properly directed, more likely to prove profitable than any other business in which he can engage. Now what kind of knowledge will this man need, in order that his native talent and acquired skill may work untrammeled? We answer he will need first a sufficient knowledge of mathematics to be able to gain a knowledge of first principles; and second, he will need to know the first principles of physics, as well as the first principles upon which modern methods of changing crude materials into finished fabrics are based.

The knowledge of the first principles of physics is necessary not only to render comprehensible the means of transmitting motion and its conversion into work, but also to prevent errors in conclusions in regard to proportions of the parts of machines, and the results which will follow combinations of parts. The knowledge of the first principles upon which modern industries are based is necessary; for, in most cases, these principles must underlie any new method he may be able to devise. Peculiarities of cotton, wool, silk, or linen machinery, originate in the different nature of fibers. Cotton fibers may be readily drawn longitudinally in either direction; wool fibers draw only one way, and need oiling or lubricating in order to be worked; flax fibers will not draw unless wetted; silk fibers are spun to hand by the worms, and are simple threads needing only to be wound, doubled and twisted previous to weaving.

We might go on through all the category of modern industries, and find in each an illustration of the truth that the principles upon which they are based are really first principles, which must be observed in any process designed to supersede them.

Thus the principle upon which sulphur and phosphorus are removed from iron is a fundamental one connected with the very nature of those impurities; namely, their greed for oxygen. And all the methods, from puddling up to the Bessemer, Heaton, and Ellershausen processes, devised to eliminate sulphur and phosphorus from iron, have been based upon the property mentioned. Bessemer puts in oxygen by pumping air into the molten mass; Heaton puts in oxygen chemically combined in nitrate of soda, which, decomposing by heat, liberates its oxygen to combine with the sulphur and phosphorus; Ellershausen puts in the oxygen combined with iron, as found in certain ores; while the old method of puddling consists in stirring the partially melted ore and exposing it to the free oxygen of the air. All these processes rest on a common basis.

The knowledge of first principles comprises what is generally understood by the term theory; and while we are ready to admit that theory alone cannot subserve the purposes of the inventor or the mechanic, we maintain that practice alone will not answer. The truly great inventor gets as much of both as he can.

The inventor should therefore familiarize himself with processes of all kinds, and should first seek to learn the general and fundamental principles which underlie the details, rather than the details themselves; as the details will be far more readily understood and retained in the memory by adopting this method of study, while an intelligent conception of the purpose of each will also be gained by subsequent study.

## PUMPING DOWN BUILDINGS.—FALL OF THE DINING HALL OF KING'S COLLEGE, LONDON.

In a recent article entitled pumping down buildings, we alluded to the fall of King's College, London, as an instance of the results to be expected from tapping water bearing strata underlying heavy structures. We have received through our European exchanges further particulars in regard to this event and the causes which led to it, and they strikingly confirm all that we have said in our previous article.

It seems that the cast-iron girders of the building had been weakened by the cutting out of the top flange for convenience in fixing them. This flange, therefore, instead of constituting about half of the whole strength of the girder, became only an additional burden to be supported.

These girders had, however, withstood all strains brought to bear upon them some thirty years, yet when they broke, it was found they cracked at the points where the flange had been cut out, the fracture indicating that the metal was sound up to the time of the building. With the same usage the structure had ordinarily been subjected to, previous to the catastrophe, the building would undoubtedly have stood a century longer.

The prime cause of the fall was, without any doubt, what we stated in our former article. The surface upon which the

building stood, and upon which other important and massive buildings now stand, including the massive cathedral of St. Paul's, consists of beds of brick clay of various depths under which lies a stratum of gravel also of varying thickness; and underneath this gravel lies a stratum of stiff blue clay.

The *Builder* states that "through the bed of gravel or beach, penetrated as it is everywhere by water, the engineer of the Thames Embankment has cut a broad and deep trench to the clay below. The foundations of the granite quay wall rest on this geological rock, at the depth of 32 feet 6 inches below Trinity high water mark. To excavate and to keep clear these foundations, a steam engine of fourteen-horse power was in each section constantly at work, and the chain pump which it propelled, discharged a perfect river from the subterranean source. The flow of water thus caused would not desist from exerting its own mechanical influences, out of respect for the Lord Mayor, or for any of the officers, institutions, or buildings of the city of London. What the natural effect of this mighty pumping would be in theory, we all know. Gradual loosening of the permeable stratum, displacement of the smaller particles, consequent tendency of the larger ones to come down together, disposition of the whole water supplying area to move microscopically, infinitesimally it may be, but still with mathematical certitude. As to this there could be no doubt, although we had small thanks for saying so fourteen months ago.

"One point might have been considered doubtful, and that was how far the weight of any massive building compressing and consolidating this adjacent gravel, might have prevented the mischievous action of the infiltration (or rather, if there were such a word, exfiltration) of the water. On this point we have now not only information, but a flood of light, and a very unpleasant flood into the bargain."

How far the same cause which produced the disaster alluded to will affect other more important structures remains to be shown. Certain it is that eminent architectural authorities have predicted further calamity unless the most prompt and skillful measures are applied to their prevention. The embankment has stopped where it is, and precautionary measures in the provision of tie-rods, etc., have been made to such structures as show signs of having been injured.

## TEST OF TURBINE WATER WHEELS AT LOWELL, MASS.

Whether a competitive test of anything can at this day be conducted anywhere under the shadow of the wings of the American Eagle in such a manner as to enlighten the public as to the merits of the thing tested, becomes annually more and more doubtful. To implicitly cling to such a faith in the face of two events of this kind which graced, or disgraced—which you will—the year 1869, argues such a trustful spirit on the part of the possessor of such a blind faith, as must certainly render him the most unsophisticated of mankind.

The two events referred to are the tests of steam-engines at the late fair of the American Institute, and the test of turbine water wheels at Lowell, Mass. The announcement of the latter in this journal last June, aroused more attention in the American mechanical public than any other event of the year. Not only ourselves, but Mr. James Emerson, whose dynamometer was employed to test the power of the wheels, were flooded with inquiries concerning it. Mr. Emerson states that the publication of this announcement "decided two points conclusively: first, the extensive circulation of the Scientific American, and second, the immense interest felt throughout the country in regard to the test." He says: "I have received letters of inquiry from the most out-of-the-way, unheard-of nooks and corners, from every State and Territory in this country, also from the British Provinces."

We wish that we could now say that the test had proved something as well as the announcement. The latter it seems proved two interesting and important facts; but, so far as we can learn, the test either has proved nothing, or it has proved what the parties interested do not care to publish.

The public was invited to attend this trial, and it was generally understood that it was to be conducted in an open and fair manner, and a report made in detail describing the construction and peculiarities of each wheel; if they were made of metal, and if so what kind; if they were finished better than those ordinarily made and sold, or if taken promiscuously out of the stock of the manufacturer. In short, to render the publication of a test of this kind of any practical use or interest to the public, all the conditions under which it is conducted must be known. We have received from Mr. Emerson a report of the result obtained by each wheel, but it is very meager and not by any means complete. Simultaneously with its receipt, our editorial mouth is stopped by the receipt of letters from different exhibitors, warning us against its publication, and stating that it is unauthorized. Writing in this dilemma to Mr. H. F. Mills, of Lawrence, Mass., who conducted the tests, and has, we believe, some reputation as an hydraulic engineer, and who is stated to be the only person authorized to make a report, we learn from him that the public were only invited to witness the test of a *single wheel*, and that a full report upon all the wheels tested will not probably be given.

This being the case, we find ourselves sufficiently human to rejoice in the statement of Mr. Emerson to the effect that, before the Lowell test closed, he went West to test a new wheel, which gave better results than any wheel tested at Lowell, and which will be brought to the East next season to compete with any or all of them. We hope this may be so; but really we find it a difficult matter to believe reliable tests will be made, or that if the tests should be reliable, that the reports will be. We wait with some curiosity to see how the new-comer will come out.

## BLACK RIVER FLOOD CASE.

A case of more than usual interest to civil engineers, involving important hydraulic questions, has been pending before the State Board of Canal Appraisers for several months, and is now completed, as to the testimony, and the issues of claim and defense.

In April, 1869, a large reservoir, built by the State in 1856, at the head sources of the Black River, as a feeder to the Black River Canal, was carried away during a spring freshet. A large amount of property was injured by it, along the upper portion of the river; and claims for damage have been made along its whole line, or about 100 miles. The case is tried under a special law of the last session, and involves about $750,000 aggregate damages.

The theory of the claim is, that the State has been negligent in the construction and superintendence of the reservoir, and in consequence of this negligence the damages occurred; for that portion of the damages at and below Carthage, a point about 73 miles below the reservoir, the claim identifies the reservoir rupture as the cause.

On the other hand, the Counsel for the State aver that the rupture occurred during an unprecedented flood, which no engineering skill could have provided for, and that the reservoir rupture did not have sufficient time and power to cause the damages claimed below Carthage.

The Counsel more directly engaged were the Hon. C. H. Doolittle, of Utica, with Messrs. C. A. Sherman and J. T. Starbuck, of Watertown, for the claimants; and Messrs. L. H. Brown, of Watertown, Samuel Earl, of Syracuse, and Chas. Rhodes, of Oswego, for the State. The issue having been mainly dependent upon hydraulic principles of construction and action, the expert witnesses were Hon. W. J. McAlpine and Chas. H. Haswell, Esq., associated with Samuel McElroy, Esq., by whom the case was specially investigated on the part of the claimants; and Messrs. D. Greene, and L. L. Nichols on the part of the State, the latter having been more particularly identified with the case.

As part of the testimony, Mr. McElroy submitted an elaborate analysis of the case, discussing the questions at issue as to the construction and care of the reservoir, the theory of its rupture, and the descent of its flood to Lake Ontario. In this paper the several elements which control the action of the freshet and the descending flood, the topography of the river, drainage area, history and several states of the freshets, testimony as to times and extent of damage, and principles of flood-flow are fully treated, and furnish a large amount of information on a subject not often presented.

The point, however, in the case, which is the most prominent, is the development here on a large scale, of the theory and action of the "wave of translation," which has been the subject of much elaborate investigation by scientific men, but is, so far as now known, first introduced here in a legal case, as a direct cause of serious damage. During the trial, the theory presented by Mr. McElroy and fully indorsed by his associates, was emphatically confirmed by the celebrated English engineer, J. Scott Russell, Esq., who was consulted at Paris, and who is identified with various elaborate investigations of this hydraulic law.

It appears that for nearly one third the length of the river and about its center, there exists a long, wide, deep basin, which in powerful freshets is filled to a great depth, averaging in this instance, about 24 feet, three fourths of a mile wide, and thirty miles long, on a central line.

At the head of this basin or "pool" there is a high fall, called Lyon's Falls, of 70 feet in low water, and about 54 feet in freshets; the hydraulic slope to the Carthage dam being about 26 feet, on the 30 miles.

The theory of these experts is, that the main portion of the reservoir flood plunging over this fall, into a deep basin, discharging, as estimated, about two thirds of 560,000,000 cubic feet of water in six hours, and capable, in all, of displacing about 4½ miles of the upper section, displaced at the lower end of the basin an equivalent body of water, some time before its actual particles could reach Carthage, in the time determined by the laws of the "wave of translation" or "displacement swell," as Mr. McElroy here designates it.

This analysis, in discussing the "principles of flow," shows that, while certain laws of hydraulic motion have been so thoroughly investigated, as to be "implicitly trusted," circumstances occur in flood movements which modify these laws. This general theory is then illustrated by examples from "confluent streams," "overfall weirs," and "submerged weirs," and the experience on the large aqueducts of the country. The paper then proceeds:

"In the upper valley of the Black River, we find the wave traveling with an advance 'bore,' which may or may not have been preceded by a more quiet sheet of water, the rush being distinctly marked at various points; from Dawson's to Bellingertown, and from Forestport to the Lee Bridge, the observed speed approximates to about one half the calculated central velocity; in the lower valley, similar phenomena of action were observed, the 'bore' being distinctly defined on the Carthage dam, at Rason's, Great Bend, and other points.

"In the long reaches, however, and the pool, the descending wave could not take possession of the channel, from the mass of more quiet water it successively encountered, and a different principle of relief is brought into action, by which mechanical impulse is transmitted in advance of actual molecular movement.

"The investigations of science have determined that all liquids and fluids have certain analogous laws of motion and action, and in the movement of light, sound, electrical currents, as also in water, action is frequently most perfect where actual movement of particles is impossible in the same degree. Nature has provided this wave action as a means of communication, which does not involve actual molecular delivery, in those cases where such delivery is inadmissible."

* * * * * *

Various examples are then cited; the experiments and deductions of Scott Russell are given; and the remarkable confirmations of the Hudson River and Long Island Sound tidal waves are described, with this application:

"Now this flood-wave mass was entirely able to sweep down the River Channels of Lyon's Falls, because it found a comparatively free path to travel in, and its whole body in the main, did so pass down; but when the 15,654,000 gross tuns of water, which represent it, plunged over the Lyon's Falls' dam with an impinging velocity of 58 feet per second, a comparatively quiescent body of water, more than seven times its weight, was interposed against its free progress further. According to the laws and examples we have cited, two distinct results followed: one, the displacement of a portion of the pool, equivalent to this falling body, at the other end, by the action of the "displacement swell;" and another, following as an inevitable sequence, was the increase of the former current of the pool towards Carthage."

It is then shown by applying D'Aubuisson's formula to this case, that the time of transmission of motion to Carthage through a basin of this depth is two hours, and the observed accelerated current is between six and eight miles per hour. Various phenomena which corroborate this action, are also cited.

The conclusion, identifying the reservoir flood with the progress of damages along the river, and confirming these calculations by a series of observed facts, is thus given:

"At Dexter (the river mouth), Parker, by 7 A.M., the 22d (April), records accumulated damages; at Watertown, shortly after 5 A.M., serious damages occurred; at Great Bend, by 2 A.M., there was a rise, 3 feet to 3 feet 9 inches, above level of 1862; at Carthage, about 1 A.M., the rush over the dam had swept away a stone wall, and other damages were done that night, doubtless by the same means; at Lyon's Falls, the great reservoir wave struck the pool, then at a stand, certainly by 10 P.M., with a probable advance before this; at Port Lyden (3½ miles above) the corrected testimony makes it plain that this advance may have passed at 7, that the 'bore' passed about 9, and that the full crest swept through at midnight. This forms a chain of evidence which fully accords with the deductions of science, with observations of the highest importance in other localities, and the testimony of localities all along these 70 miles, which differs only in minor details. It is impossible to escape from the conclusion which identifies these events with the same powerful cause, all the more destructive as riding down its successive descents on the fully prepared water way of a powerful freshet, without which it would have been shorn of a great part of its power and swiftness, and whose volume it gathered up and hurled along on its resistless path."

During the trial, an experiment was given by Mr. McAlpine, with a narrow trough about 8 feet long, filled with clear water, the lower part being then charged with blue coloring, and the upper part supplied with red colored water. This illustrated with great exactness, the law of displacement, long before the upper supply reached the lower ledge, and also illustrated the relation between the power of the upper supply and the lower delivery.

All the details of this case involve important principles, which will make a precedent for similar issues hereafter.

## FOREMEN AND SUPERINTENDENTS.

The qualities which are essential to a good foreman or superintendent of a manufacturing establishment are rarely all combined in a single individual. When they are not naturally possessed in a high degree, they may, however, be so developed by education and self-discipline as to, in a great measure, supply natural defects. Such education and discipline, however, must, to be successful, be early commenced; and as doubtless many young mechanics who peruse these columns are aiming to qualify themselves for positions of trust and command, it may not be amiss to discuss briefly the qualifications of a first-class foreman and superintendent.

We do not regard it as absolutely essential, though, if possible, desirable, that the foreman of an establishment should be able to perform himself all the various operations, as conducted in it. It would be in many cases almost impossible that should be able to do this, but he ought to be able to determine when these operations are performed unskillfully, so that he may himself instruct, or select subordinates who are competent to instruct operatives how to do their work in the best manner.

In many large manufacturing establishments, and in all large manufactories of textile fabrics, the general supervision is vested in a manager or superintendent, while the different departments are supervised by foremen acting under, and by the authority of the general manager. It is impossible that all the operatives in such establishments should be skilled in their work. Many of them will be of necessity apprentices or learners, and as such will stand in need of direction and instruction. One of the duties of a foreman must therefore be that of an instructor, and an important and responsible duty it is, requiring for its proper execution, patience, power of imparting information with clearness, perception, not only of defects in work, but in the peculiar deficiencies of hand or mind which are primary causes of unskillfulness. And he must not only be able to detect, but to devise readily remedies for such defects where remedies are possible.

Of all the means by which instruction can be readily imparted, especially in those departments of the mechanic arts where skill is required to fashion crude materials into a great variety of forms, there is none of greater value than free-

hand drawing. A few strokes with a piece of chalk or a lead pencil, performed by a trained hand will often do more towards imparting a clear idea of what is desired than an hour's talk; and a sketch of this kind has moreover the advantage that it can be left as a permanent guide, when mere oral instruction would be forgotten, and require repetition. Such sketches are for many purposes as good as more elaborate drawings; but the good foreman ought also to be able to prepare these when required. Without more or less skill in drawing there will always be more or less difficulty in the interpretation of drawings, and a good foreman ought never to be at a loss to do this readily and accurately when drawings are properly prepared.

We cannot too emphatically urge upon all young mechanics the importance of the early study of drawing, if they are ambitious to rise in their profession.

A foreman should be able to systematize labor and distribute it to the best advantage, so that the largest results shall be obtained at a minimum cost to his employer; and while able to enforce discipline, he should also have the faculty of conciliating and commanding the respect and good-will of those under his charge. To do this, he must cultivate habits of self-restraint, a love for justice, and due regard for individual rights. He must be firm without being obstinate, decided without arrogance, and capable of administering reproof without loosing control of his temper.

Finally, he should be well informed in all facts immediately or remotely pertaining to the industry which he assumes to direct, and should keep himself thoroughly posted in current information pertaining to it. With such qualifications success cannot fail to attend the efforts of any superintendent or foreman who possesses the other essential of a business man—industry and integrity.

## DIVING AND DIVING APPARATUS.

No operation in submarine engineering is more important or attended with greater personal risk than diving. This art has, however, been so far advanced, and apparatus for diving has been so far perfected, that divers now descend to depths of over one hundred feet, and not only remain there with impunity, but actually perform work. It seems sufficiently marvelous that human beings can, without performing any useful work, remain at such extraordinary depths, not only carrying upon their persons an armor which weighs one hundred and forty pounds, but subjected to a pressure of nearly nine atmospheres; but when we reflect that under such trying circumstances, the diver is frequently called upon to perform operations of considerable nicety—as, for example, leveling—the feat becomes one far more wonderful than an ascent into the air by the most daring aeronaut.

In an aerial voyage the passage is made through an element congenial to animal life, and in the broad light of heaven. The body is unencumbered, and perfect freedom of movement exists in an emergency. In diving all these conditions are reversed. The descent is made into an element inimical to life; into isolated depths where the light of day does not penetrate, and where the mighty weight of water grips as in a vise, frequently benumbs, and renders more difficult the use of the already encumbered limbs.

Only individuals of peculiar temperaments can withstand the effects of great pressure in diving. A person of full habit would generally be attacked with bleeding from the lungs. His head would snap and ring with strange noises, and his copper helmet, with its little plate-glass windows, would be illuminated with more stars than Lord Ross' telescope reveals in the milky way. Individuals of the lean and hungry kind, provided their viscera are all sound, can undergo such compression with the least risk.

There are about thirty professional divers in the United States, and the annual mortality has been on the average about four of this number.

Such risks are, of course, taken only under the stimulus of high wages. The compensation of expert hands is four or five times that obtained by the same class of men in other occupations. The necessary risks are, however, sometimes increased by the reckless habits of some divers. The gang of men employed by Mr. Geo. W. Fuller, of Norwich, Conn.—one of the most scientific and accomplished divers in this country—which has been selected with great care, has never met with any fatal accident.

This is not, however, to be wholly attributed to the careful selection of men, but is also, in great measure, to be ascribed to the extreme perfection which Mr. Fuller's experience and skill have imparted to the apparatus employed by him. This gentleman has made diving a special study for years, and being gifted with great inventive talent as well as superior mechanical skill in executing his designs, he has yearly applied the experience of a large practice, in submarine engineering, recovery of property from wrecks, surveys of marine bottoms, etc., to the improvement of his apparatus.

He now employs a four-cylinder air-pumping engine to supply air to the submerged divers, which in beauty of finish, accuracy of workmanship, and perfect freedom from all possibility of leakage, we have never seen equaled. The packing of the plungers, while pressing against the walls of the pump cylinders so lightly that any plunger will descend by its own weight, is still so absolutely tight that not the slightest leak can be detected under the heaviest pressures.

This packing is the invention of Mr. Fuller, who has also made great improvements in the shoes worn by divers. These he now makes with toe caps of bell-metal, and the edges of the soles and sides of the shoes are also protected by the same material. The soles are weighted with lead, the bottoms being also armed with the bell-metal to protect them from wear. These improvements render the shoes far more durable and serviceable than the old style.

The attachments of the weights to the back and front of the armor have also received their share of improvement, which renders them much more secure and more quickly performed.

The lantern is a beautiful piece of workmanship, and we shall not attempt a minute description of it. It is fed by air from the surface precisely as the diver's lungs are supplied by an air tube from the pumping engine above. In descending its flame becomes brighter and brighter, until at the depth of a hundred feet it glows with the whiteness and brilliancy of the calcium light. This result is attributable to the condensation of the air, which increases the amount of oxygen contained in a given volume.

The hoisting apparatus has also been so far perfected by the efforts of Mr. Fuller that it is now generally adopted by all the heavy wrecking companies in the country. The Coast Wrecking Company assert that this machine has never yet found its equal.

It is safe to say that the advancement in the art of diving achieved by Mr. Fuller could only have been accomplished by a man combining the practical experience of the diver, with intelligence and skill as a practical mechanic.

So far as we are aware, he is the only man in the country who combines these requisites. Every part of the apparatus employed by him has received the closest study, and a minute of any suggestion arising from new exigencies or requirements in practice is always made on the spot where it occurs for future careful consideration. In this way Mr. Fuller has accumulated a large mass of interesting information upon which we have liberally drawn for the substance of this article. At some future time we may return to the subject, which cannot by any means be exhausted in a single article.

## TUNNELS VS. BRIDGES.

The East London Underground Railway is now running its trains regularly under the Thames river through the celebrated Thames Tunnel. This gigantic work was constructed at an expense of $4,000,000, greenbacks; and although originally designed for an ordinary carriage way, such is its massive character that it was found strong enough to support the heaviest locomotives. The length of this tunnel is 1,200 feet; the hight of exterior walls, 38 feet; width, 22½ feet. Two tracks are laid, and the running of the trains gives great public satisfaction.

In the face of such a successful example of subaqueous railway, which is an improvement of the most unquestionable character, always solid and secure, we behold the public spirited men of New York and Brooklyn at this moment engaged in trying to establish communication between these great cities by means of a single span suspension bridge, which, to say nothing of the immense cost and years of labor involved, will never be free from danger of falling, and can never satisfy the public wants. Every storm that blows will try its foundations; every change of temperature will weaken its wires.

The tunneling of the East River is just as practicable as the Thames. A strong and capacious tunnel can be built between New York and Brooklyn for less money, and in less time, than the suspension bridge; and when the tunnel is complete, nothing short of an earthquake can impair its safety.

Gentlemen of the bridge, we advise you to get an amendment to your charter; convert your caisson excavation into a well, from which to bore a tunnel under the river. Your bridge, if ever built, will be a monument of your stupidity in adopting the poorest method of communication, when you might just as well have selected the best—to wit, the tunnel.

## WHAT IS SAID OF OUR PRIZE ENGRAVING.

We have sent out large numbers of premium engravings to those who have succeeded in getting up clubs in accordance with our terms; and it is gratifying to us to receive so many testimonials of its high quality as a work of art. We make a few extracts from letters of our correspondents, showing how they appreciate the picture.

E. L. Keeler, of Allegheny, Pa., writes as follows:

"With the greatest thanks, I take the earliest opportunity to inform you that I have received the beautiful engraving you sent me. I and my family prize it very highly. It is an engraving that every American citizen should have. It should adorn the walls of the most humble cottage. Such a group of benefactors cannot be too highly prized. Think of the thought, meditation, trials, and privations that most of these men have passed through, and the thousands now blessing what their genius has given to the world; then say who would not be proud of such a prize. I received my papers; the members of my club are highly pleased with them also. I enjoy reading them very much."

J. S. Atkinson, of Ormsby, Pa., who has already received four copies of the engraving, writes as follows:

"Please inform me how many further additions to our list would entitle us to another copy of 'The American Inventors,' and further, how many additional would entitle us to two copies? We admire them so much that we desire to procure one or two for complimentary presentation."

Henry Wheeler, of Silver Creek, N. Y., says: "'Men of Progress' reached me safely. It is a beautiful picture." Alonzo D. Lamson, of Shelburne Falls, Mass., acknowledges the safe arrival of the picture, and says "I am much pleased with the picture." F. W. Sinclair, of Mottville, N. Y., says: "The premium picture reached me in perfect order, and fully repays me for the time spent in getting a club, to say nothing of the satisfaction of introducing your valuable journal to so many of my neighbors."

We shall continue to offer this splendid engraving as a premium for clubs, at our publication rates, or if any single person wishes to procure a copy, he can do so by remitting $10, which will also entitle him to a year's subscription to the SCIENTIFIC AMERICAN.

### The Atmospheric Germ Theory.

In a lecture upon the above subject by Joseph Liston, F. R. S., Professor of Surgery in the University of Edinburgh, he gives the following interesting account of one of M. Pasteur's experiments, which proves that the gases of the air cannot of themselves occasion the growth of organisms even in a very favorable nidus for their development; and also that, in the regions inhabited by plants or animals, whether in cities or in the country, each cubic inch of atmosphere really does contain living germs floating in it. "A flask was prepared having its neck not only drawn out into a pretty narrow tube, but bent at various angles. The fluid is then boiled as in the former experiments; but the end of the neck, instead of being sealed, is left open, so that air passes into the flask on withdrawal of the lamp. The vessel being then left undisturbed, the diurnal changes of temperature, involving alternate expansion by day and condensation at night of the gases in the flask, necessitate a daily interchange between the air in the body of the flask and the external atmosphere. Yet the fluid, though exposed in this way to air perpetually changed, remains for an indefinite period quite transparent, without trace of organic development. There can be but one interpretation of this fact. The oxygen, whether in its ordinary condition or that of ozone, with all the other atmospheric gases, including many which may exist in such small quantities as to be undiscoverable by the chemist, must pass, each in its own proportion, unchanged into the body of the flask. It is impossible that a dry glass tube, can stop any gas. For, though the tube is moist from condensation of aqueous vapor in the first instance, it is soon dried by the air that passes in and out through it. It is therefore inconceivable that any atmospheric gas can have been arrested by the tube. But it is conceivable, considering the very gradual character of the movements of the air in consequence of the diurnal changes, that dust, even though very fine, may be arrested by the angles. We may perhaps wonder that particles of such extreme minuteness as the germs of atmospheric organisms should be so detained; but no one can say it is impossible, and no other possible explanation presents itself. The experiment proves with certainty that the gases of the air, however abundantly supplied, are of themselves unable to originate the growth of torulæ and other minute organisms which appear in a decotion of yeast freely exposed to the atmosphere, and also that the essential source of such development must be suspended particles or germs. But in order to render the experiment, if possible, still more conclusive, the committee of the Academy completed it by sealing the end of the flask after the fluid had remained clear for a sufficient length of time to show that no organism could grow in it, and, inverting the flask, shook it until some of the liquid passed into the angles of the bent tube, after which the vessel was again left to itself. And now, occurred something which you may perhaps be disposed to regard as too good to be true, but which is true nevertheless. In the course of no long time, the fluid in the angles of the tube exhibited indications of organic growth, demonstrating that the sources or germs of of such development had, as a matter of fact, been arrested there."

### Successful Experiments With a New Explosive at the Hoosac Tunnel.

Capt. Von Schelika and Lieut. Von Dittmar, both of the Prussian army, and the latter the inventor of the explosive known as "dualin," have been giving a practical illustration of its quality at the Hoosac tunnel, which has proved very successful. The experiments included trials of its power upon rocks, simply placing a few ounces on the surface and covering it with dirt—upon a boulder in the open field, the hole being drilled in the usual way and the dualin lightly "tamped" in, and in the regular work of the tunnel, at the west and central shafts. In every instance the explosive did all that is claimed for it, and proved itself a most powerful agent for breaking things. The same weight of the dualin is more effective than nitro-glycerin, while it is also considerably cheaper, and absolutely safe in the handling. Its obvious advantages over nitro-glycerin are so great that a considerable quantity of it has been ordered already, and it is probable that it will soon be exclusively used by the Messrs. Shanly in their work on the tunnel. Its great advantage is in the safety with which it can be used, even allowing for accident or carelessness. While possessing many of the properties of nitro-glycerin, it is so prepared and combined with other substances as not to be exploded by concussion—indeed, when not confined and fire is applied to it, it does not explode, but simply burns. Lieutenant Dittmar brought over with him, from Germany, 100 pounds of dualin in a carpet-bag, and we are sure he would not have treated nitro-glycerin in that confident manner. There have already been numerous fatal accidents from nitro-glycerin, at the tunnel, and any explosive that will be equally effectual, and yet safe to handle, will be a real boon to the workmen, if to no one else.—*Springfield Republican.*

COFFEE HULLING.—H. H. Houghton, U. S. Consul at Lahainee, Sandwich Islands, wishes to obtain some information about machinery for taking off the outside pulp from coffee, and also for taking the inside hull from the berry.

[For the Scientific American.]

## ON REFRIGERATING MIXTURES AND THE DEPRESSION OF TEMPERATURE PRODUCED BY DISSOLVING SALTS IN WATER.

New and very thorough experiments have been made on this subject by Mr. F. Rüdorff, who has published the results obtained in the reports of the German Chemical Society.

Mr. R. there announces the following considerations and conclusions:

The depression of temperature produced by the dissolution of salts in water will generally be the more considerable the more salt is dissolved. But as a certain quantity of water does not at a certain temperature dissolve any more than a well-defined quantity of salt, the lowest temperature will be obtained by mixing salt and water in such proportions that they will form a saturated solution at that low temperature which is expected to be thereby produced. Any amount of water or salt in excess of this proportion will only increase the quantity of matter which has to be cooled down, and therefore prevent the mixture from attaining the lowest possible temperature. This circumstance has been disregarded in all previous experiments made on this subject, and it is owing to this neglect that the results obtained by different experimentalists did not perfectly agree.

If, on the other hand, salt and water are used exactly in the proportion necessary to produce a saturated solution, it lasts very long till the whole of the salt is dissolved, and the influence of the higher temperature of the surrounding air becomes then perceptible, depressing the cooling effect of the mixture. This shows how important it is to effect the solution in as short a time as possible. It is therefore advantageous to use the salt in the shape of an extremely fine powder, to stir the mixture and to have a little more salt in it than is required for saturation, a small excess of salt being less injurious than an excessive prolongation of this dissolving process.

The table given below shows for a number of different salts the most favorable percentages to be used. It also contains the general results of the experiments made by Mr. Rüdorff. These experiments were conducted in the following manner:

The finely-powdered salts and the necessary quantity of water were kept for 12 to 18 hours in a room of even and constant temperature, and before being mixed. The water was then poured over the salt and stirred with a sensitive thermometer. The mixture reached its lowest temperature in less than one minute.

The results given in the table are averages from several experiments, the results of which did not vary over two tenths of one degree Cels.

The quantity of water used was from 250 to 500 grams. The influence of the mixing vase and of the air on smaller quantities of solution is quite marked, and is always perceptible when less than 300 grams of water are used. All experiments made with more than 300 grams of water were not perceptibly influenced by the surrounding temperature; their results agreed perfectly with each other.

| NAMES OF SALTS. | Quantity soluble in 100 parts of water. | Quantity mixed with 100 parts of water in the experiment. | Temperature in degrees Cels. | | |
|---|---|---|---|---|---|
| | | | Before mixing. | After mixing. | Difference. |
| Alum | 10° | 14 | 10·8° | 9·4° | 1·4° |
| Chloride of sodium (common salt) | 35·8 | 37 | 12·6 | 10·1 | 2·5 |
| Sulphate of potassa | 9·9 | 12 | 14·4 | 11·4 | 3·0 |
| Phosphate of soda, crystalline | 9·9 | 14 | 10·8 | 7·1 | 3·7 |
| Sulphate of ammonia | 72·3 | 75 | 13·2 | 6·8 | 6·4 |
| Sulphate of soda crystalline | 16·8 | 20 | 12·5 | 5·7 | 6·8 |
| Sulphate of magnesia, crystalline | 80° | 85 | 11·1 | 3·1 | 8·0 |
| Carbonate of soda, crystalline | 30° | 40 | 10·7 | 1·6 | 9·1 |
| Nitrate of potassa | 15·5 | 16 | 13·2 | 3·0 | 10·2 |
| Chloride of potassium | 28·6 | 30 | 13·2 | 0·6 | 12·6 |
| Carbonate of ammonia | 25° | 30 | 15·3 | 3·2 | 12·1 |
| Acetate of soda, crystalline | 80° | 85 | 19·7 | — 4·7 | 15·4 |
| Chloride of ammonium | 28·2 | 30 | 13·3 | — 5·1 | 18·4 |
| Nitrate of soda | 60° | 75 | 13·2 | — 5·3 | 18·5 |
| Hyposulphite of soda | 98° | 110 | 10·7 | — 8·0 | 18·7 |
| Iodide of potassium | 120° | 140 | 10·8 | —11·7 | 22·5 |
| Chloride of calcium crystalline | 320° | 250 | 16·8 | —12·4 | 23·2 |
| Nitrate of ammonia | 55° | 60 | 12·6 | —13·6 | 26·2 |
| Sulpho-cyanide of ammonium | 165° | 133 | 13·2 | —18·0 | 31·2 |
| Sulpho-cyanide of potassium | 135° | 150 | 10·8 | —23·7 | 34·5 |

Mr. Rüdorff found, by special experiments, that the depression of temperature created in the mixture is less whenever a larger proportion of salt is used than that given for each kind in the above table. He also found that the depression of temperature was more variable when the salt had not been pulverized very fine.

As the solubility of some of the salts mentioned in the table rises considerably with the temperature; and as the cold produced by a refrigerating mixture depends on the solubility, or rather on the easiness and quickness with which the salt is dissolved, different results will be obtained with a different initial temperature of the mixing materials. For example, in dissolving a proper percentage of saltpeter in water the temperature sunk in one case from 23·0° to 10·2°—12·8°; in another case from 13·2° to 3°—10·2° only. It may be seen from this that a difference in the initial temperature of the material used in such experiments must produce a difference in the results finally obtained.

The low temperature created by the dissolution of a salt in water can never be below the freezing point of the solution, but it may reach that point under favorable circumstances.

| In dissolving. | The temperature decreased. | Freezing point of the saturated solution. |
|---|---|---|
| Saltpeter | from 0° to — 2·7° | — 2·8° |
| Carbonate of soda | " 0° to — 3·0° | — 3·0° |
| Nitrate of ammonium | " 0° to —16·7° | —16·7° |

Among the substances named above the sulpho-cyanide of potassium is particularly adapted to show the depression of temperature produced by the dissolution of a solid substance. When 500 grams of sulpho-cyanide of potassium are dissolved in 400 cubic centimeters of water and stirred with a large glass half filled with water, the latter will be converted into a solid cylinder of ice within two or three minutes. Sulpho-cyanide of potassium would therefore be very useful in the manufacture of ice.

The numbers contained in the first column of the above table are those found by Mr. Mulder, with the exception of the two last ones, which Mr. Rüdorff determined by special experiments. He found that 100 parts of water dissolve at a temperature of 0° Cels. 177·2 parts, and at 20° Cels. 217·0 parts of sulpho-cyanide of potassium; and that 100 parts of water dissolve at 0°, 122·1 parts, and at 20°, 162·2 parts of sulpho-cyanide of ammonium.

### How Gems are Cut in Ceylon.

A writer in *Once a Week* gives the following description of the fabrication of imitative gems and the cutting of gems in Ceylon:

"The Moor traders are very expert in the manufacture of false gems. On the occasion of the building of a church in Kandy, a Moorman bought up all the broken colored glass from the painted windows; and on being asked for what purpose, confessed that it was 'to make precious shtone for English steamer-passenger at Galle.'

"They also imitate the rough stones, and occasionally even deceive the more experienced. They are sometimes themselves taken in. On one occasion a Moorman endeavored to induce one of a party of native diggers to sell him a sapphire surreptitiously, to which the Cingalese agreed; and the next day the Moorman came prowling about and watching the digging and sifting, till a beautiful rounded blue stone appeared shining among the wet gravel; a bargain was struck by a few signs, and the money and stone exchanged with the utmost secrecy. The Moorman disappeared to gloat over his knavery and his gains; but to his dismay, found that his beautiful gem was a piece of roughed glass, which the Cingalese had provided himself with and quietly slipped into his basket.

"The Ceylon ruby is seldom free from a tint of blue; and it is a remarkable fact that while the blue color can be expelled from such stones by heat, the red color is indelible, and the native jewelers avail themselves of this peculiarity to improve the color of their rubies.

"It is very common to find stones one half blue and the other half colorless, and some have merely a crust of blue on one or more sides. The native lapidaries take advantage of this in cutting, and by leaving the colored part on the under surface, form a foil which gives a fine blue to an otherwise valueless stone.

"The opalescence above mentioned is found in rubies and sapphires as well as in topaz; it is worse than any flaw in depreciating their value; a crack or cavity can be cut out, but opalescence, which is most difficult to detect in an uncut stone, reveals itself in the cutting, and often runs in a pencil through the whole breadth or length of a gem, destroying its clearness and color, and rendering it comparatively worthless. When such stones are cut hemispherical *en cabochon* at a certain angle to the axis, they form the star stone, showing a star of six rays in a strong light. This is very pretty as a fancy stone, but is of no value as a gem.

"We will now take a look at the proceedings of the native lapidary. His means and appliances are few, consisting of a pair of laps attached to spindles by a composition of resin and sand melted together. One lap is of lead, on which pounded corundum or adamantine spar is used for reducing the stones and shaping them in the rough. The other is of copper, for polishing the facets. Instead of diamond powder they use for this purpose a fine silex extracted from the calcined husks of rice. The laps are lodged in a frame and worked by a bow. The native lapidaries use no gem pegs or mechanical instruments for regulating the angles, but work entirely by eye and touch, and it is wonderful the precision they attain, although it is difficult for them to bring the gems to a perfect level by hand, and consequently all native-cut stones are known by a slight beveling of the facets. In the towns they have now adopted the European horizontal laps and fittings. The stone to be cut is fixed on the end of a stick with the same luting of resin and sand, and applied by the left hand to the vertical plate, while the right hand works the bow.

"In cutting a stone, the natives sacrifice everything to size. Gems, to show their most beautiful light and color, should be cut across the axis; but as in most cases the stones are longest in the direction of the prism and pyramid, they cut them parallel to the axis, and their brilliancy is lost. They rarely use a slicer, and the waste of gems is consequently great—the whole mass being ground away to form the end, which is largest and clearest.

"I have before noticed the combination of colors in sapphire—the Ceylon ruby being never found without a tint of blue. To expel this, when the stone is formed or polishing, it is rolled in a ball of wet lime, and placed in a pan of charcoal, which is gradually raised to a white heat with a primitive bellows or blowpipe made of a tube of bamboo; after being kept at a white heat for about twenty minutes or half an hour, the ball is taken out and allowed to cool, and when broken open, the stone will have lost the blue tint without injuring the crimson. By the same process, the tint of blue can be expelled from a stone which is nearly white; if, however, there is any crack or flaw in the stone, it is liable to fly to pieces. I should imagine that the natives discovered this evanescent quality of the blue color by accident. I knew a gentleman who had been very successful in digging, and had a number of fine blue sapphires; unfortunately his bungalow was burnt down, and among the ashes of his furniture he found many of his gems, but all as white as glass.

### Manufacture of Elastic Sponge.

We extract from the *Hub* some particulars of the manufacture of elastic sponge for upholstering purposes.

"The raw sponge is received in hard dirty masses, filled with sand and bits of shell. Being soaked in a large tank of water, it expands into such condition that its quality may be determined, and it is sorted into two kinds; the "soft" for mattress stock, and the "hard" for cushions. The cleansing process, which is an exceedingly important one, then begins in another room. In order to effect this, the sponge is first cut and washed, by passing for an hour through a huge tub, in which there is a series of knives through which the sponge is made to pass by means of the movement given to the water by a wheel. The water, too, is constantly changing, so by this process the sponge is nicely cut, and its filth separated in part. It is next soaked for twenty minutes in a tank of water, containing two degrees (hydrometer) of soda ash, and heated to 150°. It is next passed into a tank containing a hot solution of very strong detergent soap, where it is soaked for half an hour with constant and violent agitation. It then returns to the first tub, where it is washed another hour and cut more finely.

"The cleansing process is then complete, and after the water has been pressed out by a passage through rollers, it is carried by the elevator to the "drying room," two stories above, where a high degree of temperature is maintained, and it is dried in large revolving cylinders. It is then clean and without smell, but hard and inelastic in character, and in its present condition, totally valueless for the purpose of stuffing. It was at this point that the inventor's skill was necessary. The pores of the sponge closed when the water had evaporated, and no permanent elasticity could be had unless these could be held open permanently. Glycerin, being a non-evaporative substance, was found to answer the purpose. The remainder of the process is then as follows:

"The dry hard sponge is placed in a solution of glycerin and water, in the proportion of about half and half, and after passing through heavy rollers it is again dried in the cylinders. The aqueous portion then evaporates, and leaves the bits of sponge dry and sweet, and so permeated with the glycerin, that a permanent elasticity is maintained. It is then at last taken to the packing room, highly compressed into bales of about forty pounds each, and is ready for market. It will be seen upon examination that the principle of the manufacture is very simple; it is necessary only *to cleanse and saturate with glycerin*, but the working out of the details, by which these two ends have been performed satisfactorily, has been the work of years. Elastic sponge, like all novelties, has had its lessons to learn and its drawbacks. These were natural consequences of its novelty, and were necessities. An invention is never born perfect. Just as a child must grow from infancy to maturity, so an invention of novel character must improve by age and experience, before it can succeed to perfection. But the days of its experiments seem to be over, and it has settled down into a standard article, upon which reliance can be placed."

### The Diameter of one Pulley, the Length of Belt, and Distance between Centers of Pulleys being Given, to Find the Diameter of the Other Pulley.

Mr. John Mersom, of Charleston, S. C., sends us the following method for solving the above problem, which we place before our readers for criticism, as we have not found time to determine its truth or falsity. He says:

"The question divides itself into two parts, as the pulley whose diameter is required is greater or less than that of a pulley which is known. When this point is uncertain, multiply the radius of the known pulley by 3·1416, and increase the product by the distance between the centers of shafts. If this sum is greater than half the length of the belt, the required pulley is less than the given one; but if less, than the required pulley is the greater. In both cases divide the difference between the trial number and half the length of the belt by the distance between the centers of the shafts. In the first case call the quotient, A, and the second, B, and apply the following rules:

"1st. Take double the number A from 2·4674011 and subtract the square root of the remainder from 1·5708, and call the difference D.

"2d. Multiply the number D by the distance between the centers of shafts, and the remainder taken from the radius of the large pulley will give the radius of the less one.

"3d. When the required pulley is greater than the given one, add double the number B to 2·4674011, from the square root of the sum, subtract 1·5708, and call the remainder E.

"4th. Multiply the number E by the distance between the centers of shafts, and the product added to the radius of the given or less pulley, will give the radius of the required or greater pulley."

## APPLICATIONS FOR EXTENSION OF PATENTS.

Head and Tail Blocks for Saw Mills.—E. H. Stearns, of Erie, Pa., has petitioned for an extension of the above patent. Day of hearing March 30, 1870.

Hat and Cotton Press.—Simon Ingersoll, of Brooklyn, N. Y., has applied for an extension of the above patent. Day of hearing March 30, 1870

Machine for Sowing Fertilizers.—Warren S. Bartle, of Newark, N.Y., has petitioned for an extension of the above patent. Day of hearing April 6, 1870.

Machine for Tunneling and Quarrying.—George G. Merrill, of Shelburne Falls, Mass., has petitioned for the extension of the above patent. Day of hearing April 6, 1870.

Furnace for Smelting Iron.—Thomas H. Powers, Milwaukee, Wis., has applied for an extension of the above patent. Day of hearing April 20, 1870.

## Business and Personal.

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


The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, $3 00 a year. Advertisements 10c. a line.

Peck's patent drop press. For circulars, address the sole manufacturers, Mills Peck & Co., New Haven, Ct.

For Sale—Three valuable patents. Ed. Fitzki, 1783 Penn. ave., Washington, D. C.

Wanted—A good patent-right salesman. Address Box 144, Cuba, N. Y.

Notice—For Sale or Rent—Machine shop (established forty years since) together with 40-horse engine and boiler, and shafting. Direct communication with an Iron Foundery. Terms liberal. Address Postoffice Box 285, New Haven, Conn.

Manufactors of Watchmakers' Tools, or of small cast steel castings, not to weigh over 2 lbs., and tempered, send business card to M. D. Kelly, Cadiz, Ky.

Wanted—A Mechanical Draftsman in machine works. Send working sketch, terms, and reference. G. C. Howard, 17 S. 18th st., Phila.

Manufacturers having a good business, and otherwise responsible, can obtain real estate, with water front, on Norwalk harbor, on easy terms. Apply to Geo. S. Bell, South Norwalk, Conn.

For Hub-mortising Machines, address Exeter Machine Works, Exeter, N. H.

Hackle, Gill Pins, etc., at Bartlett's, 569 Broadway, New York.

Steam Crane Cars, or Derrick Cars, wanted by Baltimore Bridge Co., 49 Lexington st., Baltimore, Md.

Wanted to manufacture on Royalty or Contract—Light but useful articles in cast or sheet metal, or wood. City Novelty Co., 404 Library st., Philadelphia, Pa.

Cold Rolled—Shafting, piston rods, pump rods, Collins pat. double compression couplings, manufactured by Jones & Laughlins, Pittsburgh, Pa.

Kilns for drying Corn Meal.—Makers will please correspond with A. Moffitt, Ashburn Mills, St. John, N. B., describing the kind, and stating how many bushels of corn they are calculated to dry in twelve hours, price, etc.

Needles for all sewing machines at Bartlett's, 569 Broadway, N Y.

An Experienced Mechanical Draftsman desires a situation. Address R. F. Thomas, 513 Brown street, Philadelphia, Pa.

Wanted—One Stationary Steam Engine complete, 30 to 60-horse power—a second-hand one, if in perfect order, will answer. Address F. M. Stearns, Grindstone and Scythe Stone Manufacturer, Berea, Ohio.

Round and Square decarbonized bar and sheet steel, in lots to suit, 11c. per pound. Philip S. Justice, 42 Cliff st., N.Y.; 14 N. 5th st., Phil'a.

G. W. Lord's Boiler Powder, 107 W. Girard ave. Phila, Pa., for the removal of scale in steam boilers is reliable. We sell on condition.

Aneroid Barometers made to order, repaired, rated, for sale and exchange, by C. Grieshaber, 107 Clinton st., New York.

For best quality Gray Iron Small Castings, plain and fancy Apply to the Whitneyville Foundery, near New Haven, Conn.

Keuffel & Esser, 71 Nassau st., N.Y., the best place to get 1st-class Drawing Materials, Swiss Instruments, and Rubber Triangles and Curves

Foot Lathes—E. P. Ryder's improved—220 Center st., N. Y.

Those wanting latest improved Hub and Spoke Machinery, address Kettenring, Strong & Lauster Defiance Ohio.

For tinmans' tools, presses, etc., apply to Mays & Bliss, Brooklyn, N. Y.

Mill-stone dressing diamond machine, simple, effective, durable. Also, Glazier's diamonds. John Dickinson, 64 Nassau st., New York.

Glynn's Anti-Incrustator for Steam Boiler—The only reliable preventative. No foaming, and does not attack metals of boiler. Liberal terms to Agents. C. D. Fredricks, 587 Broadway, New York.

For solid wrought-iron beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Machinists, boiler makers, tinners, and workers of sheet metals read advertisement of the Parker Power Presses.

Diamond carbon, formed into wedge or other shapes for pointing and edging tools or cutters for drilling and working stone, etc. Send stamp for circular. John Dickinson, 64 Nassau st., New York.

To ascertain where there will be a demand for new machinery or manufacturers' supplies read Boston Commercial Bulletin's manufacturing news of the United States. Terms $4 00 a year.

Winans' boiler powder, 11 Wall st., N. Y., removes Incrustations without injury or foaming; 12 years in use. Beware of Imitations.


## Answers to Correspondents.

*CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; besides, as sometimes happens, we may prefer to address correspondents by mail.*

*SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however, when paid for as advertisements at $1 00 a line, under the head of "Business and Personal."*

*All reference to back numbers should be by volume and page.*

N. P., of Ohio.—It is not necessary to success in an invention of the kind of which you write, that it should be superior in convenience and utility to all similar inventions to insure its success. If equally useful its chance is as good as the others, and if with equal convenience and utility it has superior grace of design, being highly ornamental, it has elements of success, which, coupled with good business management, will make it surely profitable. The same is true of all fancy articles, such as paper holders, paper knives, ornamented inkstands, curtain fixtures, and other things which combine ornament with use.

T. C. K., of Pa., writes us an interesting letter on shooting of fish under water, which we cannot make room for. He recommends the use of round shot, and thinks they are not so liable to diverge from a straight line as long shot. In shooting at fish he maintains it is necessary to make the proper allowance for the refraction of light, but also as much more for divergence. He also recommends the use of balls made of lead with one fifth part zinc to harden them. These balls will, he says, not flatten when shot into water with any strength of charge or at any angle.

S. B., of Pa.—You are right in supposing that the drawings of machinery in our paper are done by the aid of the camera lucida.

Wm. R. B., of Ind.—The white enamel used on the dials of watches, clocks, meters, etc., is a sort of glass rendered milky and opaque by an admixture of the oxide of tin. You will find very copious information on the preparation and application of various colored enamels in Dr. Ure's "Dictionary of Arts, Manufactures, and Mines." The process cannot be adequately described in a brief article. It is one in which many nice points are to be observed and somewhat extensive apparatus employed, and to reach success in which requires much experience and judgment.

L. J. C., of Ky.—You can find out all about rain gages in text books on natural philosophy and meteorology. The depth of water collected in a tub with straight and vertical sides, would be a fair indicator of the amount of rain falling at that point, minus the amount evaporated. Instruments are constructed to prevent evaporation. The mean amount of rain falling over the entire surface of the earth is not known. You will find an article on the subject on page 345 Vol. XIX of the SCIENTIFIC AMERICAN.

J. L., of R. I.—Cast iron is made malleable by annealing in ovens constructed specially for the purpose, with certain decarbonizing materials, hematite being a common material for this purpose. The time required varies greatly, according to the size of the articles, etc. You will find full information on this subject in the "Practical Metal-worker's Assistant." Published by Henry Carey Baird, Philadelphia, Pa.

W. A. C., of N. H.—The appearance of something in motion along heated pipes, etc., is caused by the refraction of light as it passes into and out of the heated column of air surrounding the pipe. The surface of this refracting medium being broken up into waves and ripples, produces the same effect upon the light as would be produced by a running stream of water, only in a less degree. Neither of the explanations you describe is correct.

J. C. L., of Cal.—Copper makes an excellent steam boiler but a very expensive one. It may be used with iron in the same boiler, but it expands more than iron, and allowance must be made for this in construction. The expansion of copper is 1 in 582 in length, and 1 in 194 in bulk. That of iron is 1 in 846 in length and 1 in 282 in bulk.

H. H., of New York.—What is called marine glue will probably answer your purpose. It is quick-drying and water-proof. This is made by dissolving by heat 1 part india-rubber in naphtha, and when it is dissolved, adding two parts of gum shellac. Pour it while hot on metal plates to cool. To use, melt and apply with a brush.

H. B. D., of Miss.—You can obtain a temperature of about ten degrees Fahrenheit, without the use of ice and salt, by dissolving in water an admixture of equal parts of niter and sal ammoniac, provided the water is not warmer than fifty degrees and not too much of it is used.

W. W. B., of La.—We know of no better or cheaper plan of cutting out burnt places in boilers than the use of the cold chisel and hammer.

A. C. P., of N. Y.—We copied the article, word for word, from the *Chemical News*, and cannot add anything to the description of the "Leclanche Battery."

## Recent American and Foreign Patents.

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

MODE OF PREPARING SEED FOR PLANTING.—Henry Lassing, New York city.—This invention relates to a new and useful improvement in preparing and protecting seed for planting, whereby the seeds of all kinds of cereals, as well as potatoes and other similar roots and bulbs, are protected from vermin and fertilized after planting.

PROCESS OF RECTIFYING WHISKY DURING DISTILLATION.—Henry Fake, Williamsburgh, N. Y.—This invention relates to a new method of withdrawing the fusel oils from their intimate combination with whisky, while the same is in the process of distillation. The separate process of rectification is thereby avoided, and whisky without any traces of fusel is produced.

VELOCIPEDE.—Jesse A. Crandall, Brooklyn, N. Y.—This invention relates to certain improvements in the construction of velocipede frames, and also in the arrangement of a convenient steering apparatus.

FOUNTAIN PEN.—G. A. Becker, Seymour, Conn.—This invention relates to improvements in fountain pens, and consists in an arrangement of the piston, whereby the ink is drawn into the barrel, so that a passage may be readily opened after the ink is drawn in, to admit atmospheric pressure from the top to cause the ink to feed. It also consists in an improved arrangement in connection with the delivery passage, of a cut-off plug or valve, for regulating the feed or stopping it entirely when required.

SPINDLE LOCK.—Rudolph S. Foster, Madison, N. J.—This invention relates to improvements in locks, and consists of a new and peculiar construction of locks for application to the shanks or spindles of knob, latch, or other bolts, under an arrangement whereby the knob spindles may be arranged to work the said bolts on the inside, either as common latch bolts, or as locking bolts, working a guard to secure the bolt in the locked position, at the same time maintaining the bolt in a locked condition as to the outside. The invention also comprises an improved mode of securing the knob shanks to the spindles.

DASH-BOARD—John Bland, Thomaston, Ga.—This invention relates to improvements in dash-boards for buggies and other wagons, and consists in an improved construction of the same in sheet metal, in substitution of the parts commonly made of leather, whereby it is designed to provide much cheaper dash-boards in first cost, and much more durable ones.

CAN OPENER.—H. C. Alexander, New York city.—This invention has for its object to improve the construction of the improved can opener, patented by the same inventor, Nov. 16, 1869, and numbered 96,761, so as to make it simpler in construction, cheaper, and more convenient in manufacture.

SAWING MACHINE.—Charles F. Rice, Brookfield, Mass.—This invention has for its object to furnish an improved machine, designed especially for sawing shingles, but equally applicable to other sawing, which shall be simple in construction and convenient and effective in operation.

PULVERIZING ATTACHMENT FOR PLOWS.—Anthony A. Rhoads and Wiley Tash, Berlin Ill.—This invention has for its object to furnish an improved attachment for ordinary turn plows, by means of which the soil may be pulverized as it is turned by the plow and while it is still moist.

JOURNAL BOXES AND JOURNALS.—Jeremiah McIlvain, Churchville, Md.—This invention relates to new and useful improvements in boxes for shaft journals, and in the journals themselves, whereby the journals are kept cool and properly lubricated.

GRAVEL HEATER.—William A. Gay, Newark, N. J.—This invention relates to a new and useful improvement in apparatus for heating gravel for roofing, concrete pavements, and for all the purposes to which it is adapted.

AUTOMATIC LIGHTING ATTACHMENT FOR LAMP AND TAPER BURNERS.—William H. Weeks, New York city.—This invention has for its object to furnish an improved lighting attachment for taper and lamp burners, by means of which the wick or taper may be instantly and conveniently lighted, and which shall, at the same time, be so constructed as to raise the taper or wick by the same operation.

COMBINED PLOW, PLANTER, AND CULTIVATOR.—Thomas J. Smith, Holly Springs, Mich.—This invention has for its object to furnish a simple and convenient machine for preparing the ground, planting corn, peas, cotton, etc., and cultivating the plants, and which shall be so constructed that it can be readily adjusted for these different purposes.

WAGON BRAKE.—Charles M. Howell, Andover, N. J.—This invention relates to improvements in brakes for wagons and other articles, and consists in the arrangement with a pair of brake shoes suspended on crank shafts from the bottom of the wagon box of a pair of operating levers pivoted on the hind axle and connected by rods to arms on the shafts, also connected by rods to an evener connected to the arm of an oscillating shaft near the front of the box and worked by a hand lever rising up at the side.

LIFTER FOR KITCHEN USE.—T. S. Coffin, Harrington, Me.—This invention relates to improvements in lifters for kitchen use, and consists of a pair of lifting jaws, with handles crossing each other and pivoted together, the said jaws being arranged in a peculiar way for use as a stove cover lifter, a hook for lifting lids taking hold of bails, or for use as clamps for holding rods, pipes, or other articles for filing, and other like operations.

TENSION WHEEL FOR SEWING MACHINES.—J. S. Warner, Ogdensburg, N. Y.—This invention relates to improvements in the construction of tension wheels for sewing machines, and consists in making them of two disks of metal having hubs or projections, and small grooves on one side the latter being near the periphery, and another disk of thin metal having radial slits extending from the periphery to a circle of about the same diameter as the hubs of the other disks, and the parts between these slots curved alternately in opposite directions, all clamped together by screws, or otherwise, with the thin slitted disk between the hubs of the other two and the edges of the projecting parts fitting the grooves in the sides of the other disks.

ANIMAL TRAP.—H. Seehausen, Memphis, Tenn.—This invention relates to a new and useful improvement in traps for catching animals, and consists in arranging a drop door in a suitably constructed cage or box, which door is elevated, when the trap is set and held in position by means of a rod attached to an apron, which apron is raised by the animal and the trap sprung.

BALE TIE.—James W. Hogan, Memphis, Tenn.—This invention relates to a new and useful improvement in ties for baling cotton and other articles.

MORTISING MACHINE.—John Cox, Portland, Oregon.—This invention consists of two metallic standards, set each on a pair of curved legs, and at a sufficient distance from each other to admit of placing between them a metallic frame in the form of the arc of a circle, which frame has sockets on its sides large enough to inclose the said standards, and has a longitudinal slot of sufficient width to receive a lever which is provided at the extreme lower end with a set of cog teeth gearing with a toothed comb rising from the upper side of the cutter, so that when the lever is moved to and fro upon its pivot the cutter will receive an oscillating movement sufficient to cause it to enter the wood to be mortised.

AUTOMATIC BARREL FILLER.—S. C. Catlin, Cleveland, Ohio.—This invention relates to a new and improved apparatus for filling barrels and other vessels with oil or other liquids, and consists in providing certain mechanical devices, and arranging them in such a manner that the flow of oil or liquid into the barrel shall be automatically stopped when the barrel is filled or nearly filled.

BURGLAR-PROOF SAFE.—E. M. Hendrickson, Brooklyn, N.Y.—The object of this invention is to prevent safes for banks, insurance companies, and other institutions, as well as for private individuals, and for all purposes for which safes are used, from being blown open by means of powder, nitroglycerin, or other explosive material or compound, and the invention consists in forming perforations or apertures in and through some portions of the safe for the escape of the gas generated by such explosive material without injuring the safe.

PROCESS OF EXTRACTING, MANUFACTURING, AND REFINING SUGAR.—Jules Emile Boivin and D. Loiseau, Paris, France.—This invention relates to the application and preparation of a new compound for extracting or manufacturing sugar from cane juice, beet juice, sirup, molasses, or other saccharine solution, and for refining or purifying raw cane, beet, or other sugar, or substance containing sugar, or of sirup, molasses, or other saccharine solution. The invention consists in the new composition employed and in the novel method of applying the same.

WATER WHEEL.—John Zimmerman, Owatonna, Minn.—This invention relates to improvements in that class of water wheels consisting of spiral vanes attached to a shaft, and working in a hollow cylinder. The invention consists in an improved form of the said spiral vane and mode of attaching it to the shaft.

SLOTTING TOOL.—William Seaton, Putnam, Conn.—This invention consists in the attachment of a tool holder to the ordinary tool-carrying device of a planer, to project therefrom parallel with the planer bed, so as to work through the eye of a wheel standing on its face on the planer bed, and carrying a tool at the projecting end transversely thereto, and so attached to the planer as to be readily adjusted around its axis for cutting at any part of the eye of the wheel.

PRESSES.—I. N. Patton and D. G. Marden, Memphis, Tenn.—This invention relates to new and useful improvements in presses for hay, cotton, and other like substances, and consists of improvements in the means for working and holding the follower. The said means consisting of clamping or holdfast blocks, working on rods standing parallel with the line of movement of the follower, and eccentric rollers, worked by hand levers, so arranged that one set of the clamping or holdfast blocks connected to the follower will engage the rods and hold the follower, while the other set connected to the eccentric rollers are adjusted along the rods for a new hold; the rollers are connected by links to the follower in a way to force it down as the rollers are turned.

### Inventions Patented in England by Americans.

[Compiled from the "Journal of the Commissioners of Patents."]

PROVISIONAL PROTECTION FOR SIX MONTHS.

3,634.—APPARATUS TO PROMOTE CIRCULATION IN STEAM BOILERS.—R. Sinclair and W. B. Mack, Detroit, Mich. Dec. 18, 1869.

3,686.—BOXES OR CASES FOR PACKING AND CARRYING EGGS.—J. B. White, Buffalo, N. Y. December 20, 1869.

3,687.—PLOW AND CULTIVATOR.—J. S. Godfrey, Leslie, Mich. December 20, 1869.

3,697.—MANUFACTURE OF STEEL.—John Absterdam, New York city Dec. 21, 1869.

3,719.—PNEUMATIC ENGINE.—R. Spear, New Haven, Conn. December 23 1869.

3,720.—GOVERNOR.—R. Spear, New Haven, Conn. December 23, 1869.

3,736.—METAL TUBING.—S. P. M. Tasker, Philadelphia, Pa. December 24, 1869.

3,735.—COMBUSTION OF SMOKE AND GASES IN FURNACES.—G. W. Rawson —; Mass. December 28, 1869.

3,651.—APPARATUS FOR HEATING FEED-WATER HEATERS.—W. B. Mack Detroit, Mich. December 17, 1869.

3,672.—COMPOSITE PAVEMENT.—D. W. Bailey, Chelsea, Mass. December 18, 1869.

3,711.—APPARATUS FOR SHAPENING THE CUTTERS OF MOWING MACHINES.—Messrs. La Due, Bliss & Co., Chicago, Ill. Dec. 22, 1869.

3,734.—TRACTION ENGINE.—C. Merriman and Owen Redmond, Rochester N. Y. December 23, 1869.

3,737.—APPARATUS FOR, AND METHOD OF HEATING WATER, AND PURIFYING THE SAME FOR USE IN STEAM BOILERS, ETC.—E. R. Stillwell, Dayton, Ohio. December 24, 1869.

3,756.—SECTIONAL STEAM BOILER.—P. Abendroth, J. Griffith, G. W. Wundram, and T. H. Muller, New York city. Dec. 28, 1869.

3,762.—TILTING VESSELS AND STANDS.—J. Gibson, Albany, N. Y. Dec. 29 1869.

3,772.—HARNESS-OPERATING MECHANISM FOR POWER LOOMS.—E. B. Bigelow, Boston, Mass. December 30, 18 9.


**Caveats** are desirable if an inventor is not fully prepared to apply for patent. A Caveat affords protection for one year against the issue of a patent to another for the same invention. Patent Office fee on filing a Caveat, $10. Agency charge for preparing and filing the documents from $10 to $12. Address MUNN & CO., 37 Park Row, New York.

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# U. S. Patent Office.

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FOR
## NEW INVENTIONS.

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For a period of nearly twenty-five years, MUNN & CO. have occupied the position of leading Solicitors of American and European Patents, and during this extended experience of nearly a quarter of a century, they have examined not less than fifty thousand alleged new inventions, and have prosecuted upward of thirty thousand applications for patents, and, in addition to this, they have made, at the Patent Office, over twenty thousand preliminary examinations into the novelty of inventions, with a careful report on the same.

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Those who have made inventions and desire a consultation are cordially invited to advise with MUNN & CO. who will be happy to see them in person at the office, or to advise them by letter. In all cases, they may expect an HONEST OPINION. For such consultations, opinion, and advice, NO CHARGE is made. A pen-and-ink sketch and a description of the invention should be sent.

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Is made into the patentability of an invention by persons search at the Patent Office, among the models of the patents pertaining to the class to which the improvement relates. For this special search, and a report in writing, a fee of $5 is charged. This search is made by a corps of examiner of long experience.

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### CAVEATS

Are desirable if an inventor is not fully prepared to apply for a Patent. A Caveat affords protection, for one year, against the issue of a patent to another for the same invention. Caveat papers should be carefully prepared.

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Can be patented for a term of years, also, new medicines or medical compounds, and useful mixtures of all kinds. When the invention consists of a medicine or compound, or a new article of manufacture, or a new composition, samples of the article must be furnished, neatly put up. Also, send a full statement of the ingredients, proportions, mode of preparation, uses, and merits.

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## Official List of Patents.

**Issued by the United States Patent Office.**

FOR THE WEEK ENDING JAN. 25, 1870.

*Reported Officially for the Scientific American*

SCHEDULE OF PATENT OFFICE FEES:

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| On issuing each original Patent | $20 |
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MUNN & CO.,
*Patent Solicitors, No. 37 Park Row, New York*

99,046.—CAN OPENER.—H. C. Alexander, New York city.

99,047.—PRINTING TELEGRAPH.—M. F. Adams, Boston, assignor to E. B. Welch, Cambridge, Mass.

99,048.—STOVEPIPE DAMPER.—Henry Baker (assignor to himself and C. G. Kerr), Lancaster, Pa.

99,049.—ELEVATOR FOR HOISTING HUMAN BEINGS, MERCHANDISE, ETC.—C. W. Baldwin, Boston, Mass.

99,050.—INSTRUMENT FOR PLUGGING TEETH.—M. L. Battle, Bainbridge, Ga.

99,051.—POCKET FLASK.—Arthur Tappan Becker, Cohoes, N. Y.

99,052.—VARIABLE VALVE GEAR.—George M. Bird, Dedham, Mass.

99,053.—MILKING APPARATUS.—A. C. Black, Kaukauna, Wis. Antedated Jan. 16, 1870.

99,054.—DEVICE FOR APPLYING BRAID TO FABRICS IN SEWING MACHINES.—Eloi Bouscay, Jr., Norwalk, Ohio. Antedated Jan. 14, 1870.

99,055.—SPINNING MACHINE.—Paul Bramwell, Arrow Rock, and W. C. Bramwell, Independence, Mo.

99,056.—BED BOTTOM.—W. R. Briggs, Boston, Mass.

99,057.—CUTTING PINCERS.—Peter Broadbooks, Batavia, N. Y.

99,058.—SPRIND-BED BOTTOM.—A. H. Ceiley (assignor to J. B. Gardiner), Springfield, Mass.

99,059.—MILLING MACHINE.—Luke Chapman (assignor to the Collins Co.), Collinsville, Conn.

99,060.—WASHING MACHINE.—S. W. Clarke, New Milford, Conn.

99,061.—LIFTER FOR KITCHEN USE.—T. S. Coffin, Harrington, Me.

99,062.—MANUFACTURE OF ARTIFICIAL STONE.—François Coignet, Paris, France, assignor to Coignet Agglomerate Company, Richmond, Ind.

99,063.—PROPELLER.—Aaron Colton, Sycamore, Ill. Antedated Jan. 12, 1870.

99,064.—MORTISING MACHINE.—John Cox, Portland, Oregon.

99,065.—PUNCHING AND SHEARING MACHINE.—Wm. Culver, Vineland, N. J.

99,066.—HORSE HAY RAKE.—N. W. Curtis, Johnsburg, N. Y.

99,067.—SEWING MACHINE.—J. A. Davis, Watertown, N. Y. Antedated Jan. 22, 1870.

99,068.—COFFEEPOT ATTACHMENT.—Marinus De Graff, Chicago, Ill.

99,069.—EXPLOSIVE AGENT CALLED "XYLOGLODINE."—Carl Dittmar, Charlottenburg, Prussia.

99,070.—MANUFACTURE OF XYLOGLODINE AND OTHER EXPLOSIVE AGENTS.—Carl Dittmar, Charlottenburg, Prussia.

99,071.—MACHINE FOR DISINTEGRATING WOOD FOR PAPER PULP.—Hezekiah Dodge, Albany, N. Y.

99,072.—SHOE FOR HORSES.—Hay Downie, Corstophine, and I. B. Harris, Edinburgh, Scotland.

99,073.—CARPET-CLEANING MACHINE.—D. A. Drew, Philadelphia, Pa.

99,074.—CLIP FOR ELLIPTIC SPRINGS.—Wm. Evans (assignor to himself and Wm. Coleman), Pittsburgh, Pa.

99,075.—EXTENSION-TABLE SLIDE.—Michael Fleck, Milwaukee, Wis.

99,076.—NIGHT LATCH.—R. S. Foster, Madison, N. J.

99,077.—GRAVEL HEATER.—W. A. Gay, Newark, N. J.

99,078.—CARTRIDGE.—Edwin Gomez, New York city.

99,079.—CARTRIDGE.—Edwin Gomez, New York city.

99,080.—CORK EXTRACTOR.—Charles Gooch, Cincinnati, Ohio. Antedated Jan. 17, 1870.

99,081.—STILL FOR HYDROCARBONS AND OTHER SUBSTANCES.—John Gracie, Pittsburgh, Pa.

99,082.—PORTABLE LUBRICATOR.—Henry Hammond, Hartford, Conn.

99,083.—MOLDING AND GLAZING FORMS MADE OF PLASTIC MATERIAL.—Samuel Hart, Marietta, Ohio.

99,084.—BOOT STRETCHER.—John Harwood, Albany, N. Y.

99,085.—BURGLAR-PROOF SAFE.—E. M. Hendrickson, Brooklyn, N. Y.

99,086.—COMBINED BASE KNOB AND DOOR FASTENER.—H. H. Heskett and M. E. Ferguson, McLean county, Ill.

99,087.—STEP FOR SPINDLE TO SPINNING MACHINES.—J. P. Hillard, Fall River, Mass.

99,088.—MANUFACTURE OF COMPOSITION ROOFS.—C. F. Hinman, Chicago, Ill.

99,089.—COMBINED HARVESTER AND THRASHER.—David Howell, St. Helena, assignor to himself and Charles A. Lowe, San Francisco, Cal.

99,090.—CARRIAGE JACK.—Thomas W. Johnston, Richmond, Me.

99,091.—BASE-BURNING STOVE.—John H. Keyser, New York city.

99,092.—COAL STOVE.—J. H. Keyser, New York city.

99,093.—GRAIN SEPARATOR.—Dennis Ladd, Chicago, Ill.

99,094.—MODE OF PREPARING SEED FOR PLANTING.—Henry Lassing, New York city.

99,095.—BLACKING BRUSH.—George W. Lishawa, Cincinnati, Ohio.

99,096.—VELOCIPEDE.—R. E. Lowe, Upper Alton, Ill. Antedated Jan. 9, 1870.

99,097.—HYDRANT.—J. R. Manny, Chicago, Ill. Antedated Jan. 15, 1870.

99,098.—MILKING STOOL.—Ephraim Martin and Samuel M. Chittenden (assignors to Daniel D. Chittenden), Baldwinsville, N. Y.

99,099.—CORD-MAKING MACHINE.—James McIntire, Hopewell Cotton Works, Pa., assignor to W. C. Dickey. Antedated January 14, 1870.

99,100.—COAL STOVE.—George Rodney Moore, Philadelphia, Pa.

99,101.—PRINTING PRESS.—William T. Morgans, Youngsville, N. Y., assignor to himself, G. J. Goleman, and C. H. Sedgwick & Son.

99,102.—DITCHING MACHINE.—G. W. Nevill, Richmond, Va.

99,103.—SOLDERING MACHINE.—D. P. Newell (assignor to himself, Solomon Washburn, and C. R. Otis), Chicago, Ill.

99,104.—TABLE CUTLERY.—J. H. Nichols and W. Bower (assignors to Beaver Falls Cutlery Company), Beaver Falls, Pa.

99,105.—METHOD OF FIXING PIGMENTS TO FIBROUS AND TEXTILE MATERIALS.—Alfred Paraf, New York city.

99,106.—CORN SHELLER.—William P. Patton and William A. Middleton, Harrisburg, Pa.; said Patton assigns his right to said Middleton.

99,107.—COOLING APPARATUS.—Charles F. Pike, Providence R. I.

99,108.—HARVESTER RAKE.—William Pimlott, Springfield, Ohio.

99,109.—DEVICE FOR BAKING BREAD.—A. I. Quackenbush and Guilford Hawn, Fort Plain, N. Y.

99,110.—SAW HANDLE.—William W. Richardson, Chicago Ill.

99,111.—BOBBIN HOLDER.—John Salisbury, Scituate, R. I. Antedated Jan. 14, 1870.

99,112.—FIELD FENCE.—David Sattler, Mifflin, Ohio.

99,113.—SLOTTING TOOL HOLDER.—William Seaton, Putnam, Conn.

99,114.—ONE-WHEEL SULKY.—James A. Sinclair, Woodsfield, Ohio, assignor to himself and Charles Messerly.

99,115.—PADLOCK.—F. W. Smith, Jr., Bridgeport, Conn.

99,116.—PADLOCK.—F. W. Smith, Jr., Bridgeport, Conn.

99,117.—SAFETY STOP FOR WATCHES.—S. C. Smith, Boston, Mass.

99,118.—COMBINED PLOW, PLANTER, AND CULTIVATOR.—T. J. Smith, Holly Springs, Miss.

99,119.—VEGETABLE AND FRUIT-PARING KNIFE.—Henry Soggs, Columbus, Pa.

99,120.—HORSE HAY FORK.—George N. Stearns, Syracuse, N. Y.

99,121.—HEDGE TRIMMER.—J. M. Van Nosdall and O. W. Van Nosdall, Newark, Ill.

99,122.—DEVICE FOR SEWING MACHINE.—J. S. Warner, Ogdensburg, N. Y.

99,123.—AUTOMATIC LIGHTING ATTACHMENT FOR LAMPS AND TAPER BURNERS.—Wm. H. Weeks, New York city.

99,124.—COMPOSITION FOR LINING ALE AND BEER CASKS.—John Werner, Mannheim, Baden.

99,125.—RAILROAD TICKET.—J. P. Whitehead, Chicago, Ill. Antedated Jan. 16, 1870.

99,126.—TREADLE FOR SEWING MACHINES.—Charles H. Wilcox, New York city, assignor to the Wilcox & Gibbs Sewing Machine Company.

99,127.—TOY PROPELLER.—Arthur M. Allen, New York city.

99,128.—APPARATUS FOR PULVERIZING PORCELAIN PASTE.—J. R. Alsing, Newcastle-upon-Tyne, England. Patented in Sweden, April, 20, 1867.

99,129.—PEAT AUGUR.—Aime Nicholas Napoleon Aubin, Montreal, Canada.

99,130.—PEAT-MOLDING MACHINE.—A. N. N. Aubin, Montreal, Canada.

99,131.—SAWING MACHINE.—Louis Bach and L. C. Christlip, Tiffin, Ohio.

99,132.—CHEESE PRESS.—Albert G. Bagg, Holland Patent, N. Y.

99,133.—SHEET GAGE FOR PRINTING PRESS.—Henry Barth, Cincinnati, Ohio.

99,134.—FOUNTAIN PEN.—G. A. Becker, Seymour, Conn.

99,135.—REVOLVING STEREOSCOPE.—Alexander Beckers, New York city.

99,136.—STEREOSCOPE.—Alexander Beckers, New York city.

99,137.—JOINERS' PLANE.—George Cyrus Beckwith, Boston, Mass.

99,138.—SEWING MACHINE.—Joseph Bennor (assignor to himself and Abraham Rex), Philadelphia, Pa.

99,139.—STONE-CHANNELING MACHINE.—V. W. Blanchard, Bridport, assignor to himself and A. J. Severance, Middlebury, Vt.

99,140.—DASH BOARD FOR CARRIAGES.—J. Bland, Thomaston, Ga.

99,141.—PROCESS OF EXTRACTING, MANUFACTURING, AND REFINING SUGAR.—J. E. Bolvin and D. Loiseau, Paris, France, assignor to C. F. Chandler, New York city.

99,142.—RAILROAD TIE LIFTER.—Elijah Bomar (assignor to to himself and Wm. Young), Wartrace, Tenn.

99,143.—DESULPHURIZING OVEN.—J. C. Brewster, New York city.

99,144.—CASTING HOLLOW CYLINDERS.—J. W. Brittin, Black Rock, Conn.

99,145.—MANUFACTURE OF INSULATORS FOR TELEGRAPH POLES.—Homer Brooke, New York city.

99,146.—CORSET SKIRT SUPPORTER.—J. W. Brooks, Boston, Mass.

99,147.—INK-RETAINING ATTACHMENT FOR PENS.—Albert G. Brown, Hartford, Conn.

99,148.—WEIGHING SCALE.—Dennis Buoy, Danville, Pa.

99,149.—DIE PRESS.—Wm. Burke, Brooklyn, N. Y.

99,150.—MILK PAN.—N. C. Burnap, Argusville, N. Y.

99,151.—CURTAIN AND MAP FIXTURE.—J. W. Burns, Medway, Ohio.

99,152.—SHUTTLE FOR LOOMS.—W. H. Burns, Grafton, assignor to Jonathan Luther, Worcester, Mass.

99,153.—STEAM GENERATING HEATER.—C. A. Buttles, Milwaukee, Wis.

99,154.—IMPLEMENT FOR SLITTING AND JOINING RAGS FOR CARPETS.—B. F. Cady, Chittenango, N. Y.

99,155.—MORTISING MACHINE.—M. E. Campfield, Newark, N. J.

99,156.—HANGER FOR SHAFTING.—W. W. Carey and G. W. Harris, Lowell, Mass.

99,157.—PLANING MACHINE.—W. W. Carey and G. W. Harris, Lowell, Mass.

99,158.—NEEDLE AND ARM FOR SEWING MACHINE.—Mary P. Carpenter, San Francisco, Cal.

99,159.—AUTOMATIC BARREL FILLER.—S. C. Catlin, Cleveland, Ohio.

99,160.—MACHINE FOR REMOVING THE "BLOW OVER" ON GLASS JARS, ETC.—John Chambers (assignor to himself and D. Chambers), Birmingham, Pa.

99,161.—TOOTH BRUSH.—R. K. Chandler, Ruther Glen, Va. Antedated Jan. 17, 1870.

99,162.—CHIMNEY COWL.—L. N. Chapin, New Lisbon township, N. Y.

99,163.—SHOEMAKERS' TOOL.—J. A. Clippinger, Newtown, Iowa. Antedated Jan. 12, 1867.

99,164.—BIRD CAGE.—G. F. J. Colburn, Newark, N. J.

99,165.—RAILROAD RAIL AND BASE PLATE.—Watts Cooke, Peterson, N. J.

99,166.—VELOCIPEDE.—J. A. Crandall, Brooklyn, N. Y.

99,167.—SHEET GAGE FOR PRINTING PRESSES.—G. B. Cummings, Cambridge, Mass.

99,168.—CHEESE CUTTER.—G. W. Cushman, Aiken, S. C.

99,169.—PLATFORM SCALE FOR HAY OR CATTLE.—Daniel H. Dewey, Canton, Ill.

99,170.—SODA FOUNTAIN.—G. D. Dows (assignor to himself and C. Dows), Boston, and G. S. Cushing, Lowell, Mass. Antedated Jan. 12, 1870.

99,171.—WATER-PROOF FABRIC.—T. M. Drown (assignor to W. A. Drown), Philadelphia, Pa.

99,172.—FLEXIBLE JOINTS FOR WATER PIPES.—M. C. Duffey, Washington, D. C.

99,173.—EGG BEATER.—Timothy Earle, Valley Falls, R. I.

99,174.—BRICK KILN.—Wm. Ennis, Philadelphia, Pa.

99,175.—RECTIFYING WHISKY DURING DISTILLATION.—H. Fake, Williamsburgh, N. Y., assignor to himself and C. A. Todd, New York city.

99,176.—HARNESS-OPERATING MECHANISM FOR LOOMS.—G. S. Faulkner, Indianapolis, Ind.

99,177.—LOOM.—G. S. Faulkner, Indianapolis, Ind.

99,178.—KEY-HOLE GUARD AND PROTECTOR.—H. M. Flanagin (assignor to himself and J. R. Elkinton), Penn's Grove, N. J.

99,179.—LEVER AND STUMP PULLER.—J. G. Fox, Oregon, Wis.

99,180.—PRESERVING MEAT.—Henrik Gahn, Upsala, Sweden.

99,181.—HAY LOADER.—C. B. Garlinghouse (assignor to himself, S. F. Bateman, and Byrdine Harris), Carpentersville, Ind.

99,182.—DRYER.—Henry Garrett, Linneus, Mo.

99,183.—MACHINE FOR GRINDING PEARL BUTTON-BLANKS.—J. D. Hall (assignor to J. A. Gargay), Philadelphia, Pa.

99,184.—LIGHTNING ROD AND CONDUCTOR.—J. W. Hankenson (assignor to himself and Winslow Baker), Minneapolis, Minn.

99,185.—HARNESS SADDLE HOOK.—Robert Hart, Dunkirk, N. Y.

99,186.—DRYING, PRESERVING, AND COLORING WOOD OR OTHER FIBROUS MATERIAL.—Herman Haupt, Philadelphia, Pa.

99,187.—SLATE FRAME.—Wm. Hersee, Buffalo, N. Y.

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MACHINE FOR HEADING BOLTS.—William S. Booth, New Britain, Conn., administrator of H. M. Clark, deceased.—Letters Patent No. 14,086, dated January 15, 1856.

PLOW.—Benjamin F. Avery, Louisville, Ky.—Letters Patent No. 14,044, dated January 8, 1856.

HORSE HAY RAKES.—Mary G. Pratt, administratrix of Randal Pratt, deceased, late of Marple township, Pa.—Letters Patent No. 40,067, dated January 8, 1856; reissue No. 1,893, Dated February 28, 1865.

HORSE HAY RAKES.—Mary G. Pratt, administratrix of Randal Pratt, deceased, late of Marple township, Pa.—Letters Patent No. 40,067, dated January 8, 1856; reissue No. 1,894, dated February 28, 1865.

HORSE HAY RAKES.—Mary G. Pratt, administratrix of Randal Pratt, deceased, late of Marple, township, Pa.—Letters Patent No. 40,067, dated January 8, 1856; reissue No. 1,895, dated February 28, 1865.

APPARATUS FOR HEATING BUILDINGS BY STEAM.—Stephen J. Gold, West Cornwallis, Conn.—Letters Patent No. 14,128, dated January 29, 1856.

VALVE GEAR FOR STEAM ENGINES.—Charles H. Brown and Charles Burleigh, Fitchburg, Mass.—Letters Patent No. 14,125, dated January 15, 1856; reissue No. 2,754, dated August 27, 1867.


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# SCIENTIFIC AMERICAN

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

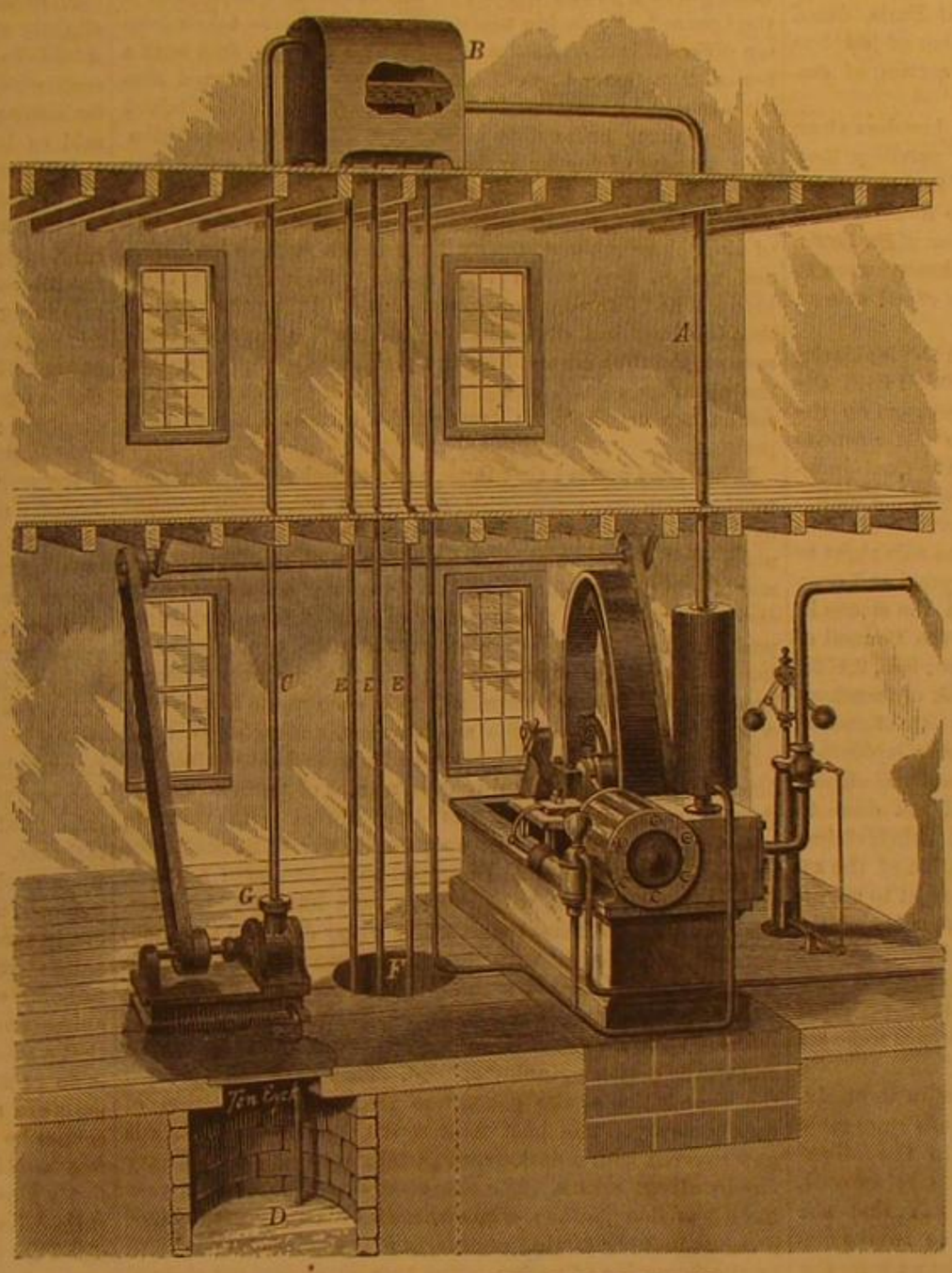
Vol. XXII.—No. 7. [NEW SERIES.] NEW YORK, FEBRUARY 12, 1870. $3 per Annum. [IN ADVANCE.]


### The Ransom Siphon Condenser.

The accompanying engraving represents Ransom's siphon condenser, as it has been in use in the Buffalo City Flouring Mills, the past year, in connection with an engine, cylinder 18 inches diameter, 36 inches stroke, making 100 revolutions per minute, with 50 pounds steam boiler pressure. It is the invention of Franklin Ransom ,who has been several years engaged in perfecting it. It is intended to perform the service and duty of the air pump in perfecting and maintaining a vacuum, which it is claimed it does in a cheaper, easier, and simpler manner, and at a much reduced cost of construction and expenditure of power, besides which, it can be operated by any one who can run a high pressure engine.

In the accompanying engraving A represents the steam exhaust pipe from the engine carrying the steam to the condenser, B, which is placed at the hight of 32 feet above the water in the overflow. C is the water injection pipe, connected with a pump, G, of ordinary construction, which is fed from a well, D, or, in case of a natural head of water, the pump can be dispensed with. The condenser, B, is provided with a perforated plate upon which the injection water is thrown, and under which the steam is admitted. To the bottom of the condenser are attached the outlet pipes, E, through which the water, injected by the pipe, C, and resulting from the condensation of the steam, flows out and is discharged from the reservoir and overflow, F. It will be observed that advantage is taken of siphonic action set in motion by the water pump, G, and afterwards maintained by it and the action of the vacuum.

When the engine is started, the exhaust steam passes into the condenser under the perforated plate, and at the same time the pump throws water upon it. The steam being condensed, a partial vacuum is formed, and after a few strokes it becomes more and more perfect, thelabor of the pump decreasing in proportion as the vacuum increases until it reaches the minimum. The water injected and from the condensed steam, falls through the condenser, enters the outlet pipes, and as it passes out carries the air and any incondensable gas with it ; thus by the action of the siphon keeping up the circulation and maintaining the vacuum. It has also been found that where an independent pump is used, as is preferred on large engines, the vacuum will be perfected and maintained by the siphonic action alone without the steam.




THE RANSOM SIPHON CONDENSER.

With a vacuum of 13 pounds per square inch and the condenser at the hight of 32 feet, the water will stand in both legs of the siphon 29 feet, and it will then require the labor of the pump to lift the water 3 feet, for at that point it will be taken by the vacuum and passed into the condenser, and out of it by the long leg of the siphon. In actual practice on an engine where the water has been lifted 12 feet at a cost of one third of 1-horse power, the vacuum has been equal to 24-horse power. Thus only about one third of one per cent of the power gained is used in lifting the water.

It will be seen that this condenser costs much less than the usual air pump and condenser, and that it weighs much less, a fact of great value on marine engines ; also, that it is less liable to derangement, and that it will admit muddy water, which allows its use on our western rivers, where the mud and sand soon destroy the usual vacuum apparatus. It is also applicable to all engines now in use requiring no change in them, or in feed water heaters, or in cut-offs ; and first-class, high-pressure engines with this condenser will show a better result than any engine using the air pump.

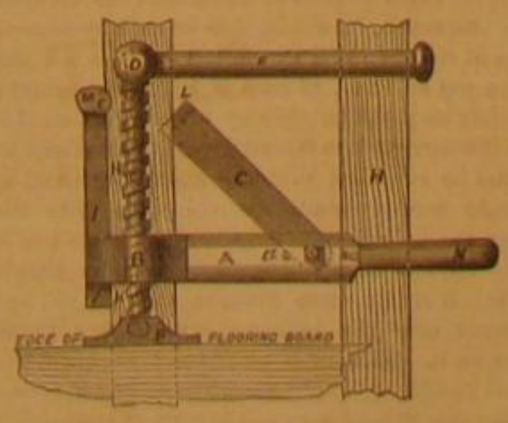
For vacuum sugar pans, surface condensers, and oil still condensers, it is equally applicable, as the water now used in condensing will also maintain the vacuum and condense the vapor. In oil stills the vapor can be admitted directly into the condenser, the oil separating easily by gravity from the water. Certificates have been shown us from several well known firms in Buffalo showing the gain to have been from 25 to 42 per cent of the fuel formerly used.

The invention is secured by letters patent, which have been assigned to the Ransom Siphon Condenser Co.—J. L. Alberger, Treasurer—at Buffalo, N. Y., to whom application for licenses or further information can be made.

6,900 workmen at the iron and steel works of Krupp, in Germany, produced 125,000,000 lbs. of steel last year.

### FLOORING CLAMP.

A very handy flooring clamp, an English device—applicable moreover to other purposes—is here illustrated. It is composed of a metal plate, A, having a boss, B, pierced with a slightly inclined screw-tapped hole, through which passes a screw C, the head of which is perforated at D to receive the end of a lever, E, and the opposite end socketed in a foot plate, F. The metal plate traversed by the screw also carries a gripping lever, G, bolted loosely on its under side, the plate being pierced with several holes, *a a*, so that the pivoting of the gripper may be shifted at pleasure. The action is as follows : The plate is laid flat on the joists H H, so that the gripper, G, lies between the joists, the end coming against the joist, and the foot-plate, F, against the edge of the outer flooring board. The clamp being in this position the screw, C, is turned by the lever, E, so that the foot plate begins to press against the edge of the flooring board, and the main plate, A, to recede from it ; this backward motion of the plate,




A, along the screw, C, causes the end of the gripper, G, to nip against the side of the joist, H, forming a bearing which becomes firmer the more the screw, C, is turned in the same direction and the greater the pressure brought on the flooring. By turning the screw in the opposite direction the plate, A, advances along the screw, the pressure is taken off the edge of the flooring board, and the clamp may be immediately removed by unscrewing about two inches and striking a blow with the hammer, at M. It may also be used as a lifting jack and as a carpenter's bench clamp.

### Stump Drawing by Steam.

In the neighborhood of Tattershall, in Lincolnshire, are some hundreds of acres of waste land, of a light, sandy, and gravelly nature, incumbered by the stumps of Scotch fir trees cut down some years ago, and only growing wild grass and ling. It has been proved, however, by experiments made in a small way, that this land, if properly cleared, drained, and clayed, is capable of bearing good root crops; but, until lately, the great expenditure of labor incidental to extracting the stumps and roots of the fir trees has prevented the work of reclamation from being carried out to any great extent. A short time ago, however, Mr. John Robert Bankes, the agent and steward to Lord Fortescue, to whom the land belongs, determined to attempt drawing the stumps by means of steam plowing engines, and, eventually, after a consultation on the subject with Mr. Toepffer, of the North Lincolnshire Steam Cultivating Co., a contract was entered into by this company to perform the work.

The stumps are from 12 in. to 20 in. in diameter at the base and stand from about 8 ft. to 10 ft. apart, and the operation of drawing them, which has now been going on successfully for some weeks past, is performed as follows : Two of Messrs. John Fowler & Co..'s 20-horse steam plowing engines are placed about 200 yards apart, with a row of the tree stumps between them, and, in commencing, the wire rope from the drum of one engine is led across to the second engine, passed round a snatch block there, and led back and attached to the engine,from the drum of whichit was uncoiled. The snatch block just mentioned is connected by a strong chain to a two-fluked anchor of a form suitable for taking hold of the stumps, and to a chain at the back of the anchor is attached the rope of the second engine. Things being thus arranged, the anchor which is, as it were, suspended between the engines, is raised by four men and placed about 2 ft. in the rear of the first stump to be extracted. The engine connected with the snatch block is then made to haul upon its rope when the anchor is drawn into the ground, takes hold of the stump, and extracts it with the utmost ease. As soon as the root is clearly pulled up, the second engine hauls back the anchor to clear it, and all is then ready for acting on another stump. When fairly at work, the drawing of the stumps is performed at the rate of one per minute.

The pull which each engine is capable of exerting on the rope is about 8 tuns,so that by the aid of a single snatch block a pull of 16 tuns can be exerted, or by means of a double snatch block,a pull of over 30 tuns. The double snatch block, however, is only required for the largest stumps. Besides the two 20-horse engines, two others, of less power, are engaged in drawing the extracted stumps into heaps, and thus clearing the land for plowing. The whole operation has, as we have said, been thoroughly successful, and all parties concerned are to be congratulated on opening up a new and useful field for the employment of steam plowing engines.—*Engineering.*

NEW APPLICATIONS OF BARYTA.—The sulphate of baryta is said to possess many advantages over lime as a material for whitewashing walls—4 ozs. of glue is soaked for twelve hours in tepid water, and then placed until it boils, in a tin vessel, with a quart of water—the vessel being placed in water, as in the usual process of melting glue ; the whole is then stirred until dissolved. Six or eight pounds of sulphate of baryta, reduced to an impalpable powder, is put into another vessel ; hot water is added, and the whole stirred until it has the appearance of milk of lime. The sizing is then added, and the whole stirred well together, and applied in the ordinary way while still warm.

VERY valuable mines of silver, lead, antimony, zinc-blende, copper, and gold, have lately been discovered in the Himalayas. One mine at Shigri, on the old boundary of Northern India, is described as an enormous lode, in which the ore is several feet thick and solid. The others are principally in the Vazeeri Rupi (the silver country of the Vazeers)—a name it was long known by, being so described in the maps as part of Kirloo.

## LAPIDARY WORK.

Translated from the French

There were, in 1860, 146 establishments engaged in this branch of industry in Paris, of which 5 employed over 10 hands, 39 from two to ten, and 102 but one each. The total number of hands employed was 317, there being 148 men paid by the day, and 105 by the piece; 6 women paid by the day, and 58 apprentices, who were boys under sixteen years of age. The total value of the annual production was 3,849,120 frs.

The lapidary's art is very ancient, but the method of cutting diamonds with their own dust was scarcely known before the thirteenth or fourteenth century. This discovery has for a long time been attributed to Louis de Berquem, of Bruges, who lived in 1746, and it is only within a short time that new researches have proved that the art of cutting diamonds was known before that period. It is known, for instance, that, early in the fifteenth century, princes and lords owned and made presents of diamonds, and that there was in Paris, in 1407, a diamond cutter named Herrmann, who had the reputation of being very skillful in his art. It is proper, also, to add, that the jewelers, in an act of 1750, against lapidaries, quote an ordinance of the Provost of Paris, dated Nov. 18th, 1387, according to which the number of jewelers who devoted themselves particularly to the cutting of diamonds and precious stones was about 15 or 16.

In the Middle Ages, as has been shown, the jewelers alone practiced the cutting of precious stones; this privilege they preserved without opposition until the year 1584, when some of their members associated themselves with the masters of an old society of crystal cutters, founded in the time of St. Louis, and obtained from the former a number of workmen sworn to cut precious stones for them, to the exclusion of all others, even the jewelers themselves.

Dissentions immediately sprang up between the lapidaries and the jewelers. The former, not being satisfied with the power which they had obtained, began to encroach on the privileges reserved to the jewelers; while the latter continued to practice gem cutting, while awaiting the final judgment of the trial pending before the Parliament. Finally, on the 6th of September, 1631, the court rendered a decision by which the lapidaries were maintained in the sole right to cut all kinds of precious stones, and to work in pearl and crystal, but they were expressly forbidden to set the stones in gold or silver. Two decrees, one rendered by the Council of State, Jan. 28, 1673, the other by the Parliament, Feb. 9, 1740, prohibited the lapidaries from assuming the rank of merchant jewelers, and from giving to their workmen the title of guards and allowed them only to call themselves master lapidaries, engravers, and workers in all kinds of precious natural stones. In spite of these decisions, the lapidaries did not cease to claim the right to sell mounted gems, and asserted their claims with such persistence that, after the reorganization of the society, in 1776, they were allotted the exclusive right to set artificial stones, and authority to set natural stones conjointly with the manufacturing jewelers.

At the time of the Renaissance, lapidaries often cut precious stones in the form of vases and cups, but their principal work has always been the cutting of precious stones to be set in rings, necklaces, etc.

The art of cutting diamonds has been very slow in attaining perfection. In the fifteenth century, diamonds were table cut, and cut in the form of shields and stars; in the following century, the cutting of rose diamonds was introduced, and it was only under the reign of Louis XIV. that the method of cutting brilliants was discovered; the twelve diamonds to which Cardinal Mazarin has left his name were the first in France that were cut in this way.

During the latter part of the eighteenth century, diamond cutting was practiced on a great scale in the city of Amsterdam, and the minister Calonne, wishing to establish a diamond-cutting establishment in the Faubourg Saint Antoine, was obliged to call a master and some workmen from Holland. The Revolution finally dispersed the Parisian lapidaries, and, since that time, Amsterdam has exclusively practiced the art of cutting diamonds.

The work of cutting is performed in the same way as in former times, the only modifications in the art arise from the substitution of steam engines for the old motors. The cutting of diamonds is divided into three operations: the cleavage, which is designed to remove the defective parts of the stone, consists in breaking the diamond by means of the blade of a chisel placed in a groove made with another diamond; the blocking out or reducing it to its first rough form, which is done by rubbing together two diamonds fixed by means of mastic to the ends of two wooden handles; and finally the polishing, by means of which the diamond receives its smooth and brilliant surface and its regular facets, which is done on a horizontal wheel covered with diamond dust soaked with olive oil. The workman fastens the diamond to the end of the cement rod by pouring lead around it and then applies it to the mill. He is the sole judge of the best form to be given to the diamond, and has no guide but his own experience.

Formerly, the cutting of diamonds caused a loss of from 50 to 60 per cent of their weight, but by the present methods of cutting, the loss is not more than from 40 to 50 per cent. The diamonds do not appear as well, but as they are sold by weight the merchant obtains a better price.

Diamond lapidaries cut diamonds only. The other precious stones, such as rubies, emeralds, sapphires, topazes, amethysts, garnets, etc., are cut, in Paris, by special workmen, who also cut jasper, onyx, agate, cornelian, turquoise, etc.; still, merchants, when they have large quantities of stone to cut, apply to the lapidaries in the Jura, and even to those of Germany and Switzerland, where hand labor is much cheaper than in Paris.

Hard stones are cut in the same style as diamonds, and are polished with tripoli and water. The hardest are cut with emery on lead wheels, or with tripoli on wooden wheels.

The average wages received by the hands employed in this branch were: men, 6·37 fr.; women, 2·54 fr.; and apprentices receiving pay, 1·5 fr.

The amount exported was 257,000 fr., of which 48,000 was to America, 35,000 to England, and 30,000 to Russia.—*Industrial American.*

## HOW TO OBTAIN A FINE PATINA ON BRONZE STATUES.

Translated for the Scientific American from the Polytechnic Journal.

It has been experienced in most large cities, especially in those where mineral coal is used as fuel, that bronze statues erected in public places do not obtain a fine patina, but become dark-colored and unsightly. The desire to find a means for obviating this, induced the Berlin Society for the Promotion of Industry to make careful experiments on this subject. The first question to be answered was this: Does the existence of a patina depend on the chemical composition of the bronze? To decide this query, samples were taken from ten different bronze statues, all of which were covered with a beautiful patina. Each of these samples was analyzed simultaneously, by two reliable chemists. The results obtained showed these bronzes to be of very different composition The amount of copper varied from 77 to 94 per cent. One sample contained as much as 9 per cent of tin, others 4 per cent, and some only 0·8 per cent of tin, but up to 19 per cent of zinc. The other accessory ingredients, such as lead, iron, and nickel, also varied very much. However, all these bronzes had formed a fine green patina. It is quite possible that the chemical composition of the bronzes has some influence on the time required for the production of a patina. But the above-mentioned analyses undoubtedly prove that a fine patina can originate on bronzes of the most different composition.

It has been noticed that those parts of public bronze monuments which were accessible, and which were often touched by the hands of visitors, were covered with a fine, though not a green patina; all the other parts of the same monuments being dark-colored, and of a very unfavorable appearance. This fact led the investigating committee to the supposition that the presence of greasy matter might be of importance in the formation of patina. Some experimental bronze busts were therefore set up in such parts of the city where impure exhalations are frequent, and where several public statues previously erected had assumed a dirty-looking black color, without forming even a trace of patina. One of these experimental busts was daily rinsed with water to keep it clean, and was besides painted over with neat's-foot oil once a month; the oil being put on by means of a brush, and rubbed off again with woolen rags immediately after. Another bust was rinsed with water every day like the first; but was not treated with oil. A third was also rinsed with water daily, and treated with oil twice a year. A fourth was set up and left entirely untouched.

The 1st and the 4th of these busts were put up in 1864, the 2d and the 3d in the beginning of 1866. They have fully verified the supposition of the committee regarding the action of greasy matter. The bust treated with oil once a month is now covered with a dark-green patina, which is declared very fine by all art critics. The one treated with oil twice a year has a less fine patina; while that cleaned only with water, presents nothing of that peculiarly fine appearance produced by the formation of patina. The bust which was not cleaned at all looks black and dull, making a highly disagreeable impression on the observer.

It may be safely inferred from these experiments that a bronze monument erected in a public place can be made to obtain a fine patina, if the bronze is kept clean and rubbed with oil once a month. If the frequency of this operation can be reduced, and to what extent, can only be decided by future experiments. The operation presents some practical difficulties with many large monuments.

The committee has put up two more bronze busts which had been artificially patinated by chemicals; and it now remains to be seen how these will stand, when subjected to similar treatment. It has not as yet been explained in what way the oil takes part in or influences the formation of the patina. So much, however, has been ascertained that any surplus of oil has to be avoided, and that all the oil that has been put on, must at once be removed as carefully and as completely as possible. If any oil remains on the bronze, it makes the dirt stick to it, and gives it an unclean appearance. It cannot be supposed that the remaining small quantity of oil would form a chemical combination with the layer of oxide on the bronze, especially because neat's-foot oil, as well as olive oil, has been found to be equally adapted for the purpose. It seems more probable that the oil, by forming a thin layer over the bronze, prevents any moisture from settling on it. This moisture, if not kept off, would cause the dust to adhere, would absorb gases and vapors, and would favor the growth of a vegetation of microscopic plants, by which the appearance of the surface of the metal would inevitably be slighted. However this may be, it is an established fact that grease is an important agent in the formation of patina. It is to be expected that the treatment with oil will also be advantageous in another respect. It has been noticed that bronzes which are covered by a fine patina get a white, opaque, chalk-like surface in those places over which the rain-water is chiefly running. A proper treatment with oil will doubtless prevent this. At any rate it may be expected that through the use of oils, finely patinated bronze monuments will in future be seen in large cities where mineral coal is used as fuel, and that these monuments will not appear light-green, but dark, perhaps even black, but they will have the peculiar luster and other fine qualities of patina. S.

## SCIENTIFIC INTELLIGENCE.

BISMUTH.—The increased demand for this metal has occasioned the examination of new localities, and the search has, in several instances, been attended with success. A remarkably pure ore has been found in Peru, which, on analysis, gave: Bismuth, 93·372; antimony (with trace of tin), 4·570; copper (with a little iron), 2·058—total, 100. The absence of arsenic and sulphur is noteworthy, and distinguishes this ore from the Saxon variety. Also, in South Australia, seams of bismuth have been found associated with copper.

NAPHTHALIN RED.—This coloring matter is called in England, "Magdala Red," in honor of Lord Napier, the hero of Abyssinia, in imitation of the French names of Magenta and Solferino for aniline colors. It is prepared by the action of nitrous acid on naphthylamin, and is manufactured in large quantities in France and England. It is a dark brown powder, soluble with deep red color in boiling alcohol; only slightly soluble in cold water, but largely in hot water; not soluble in ether. The solution in alcohol is highly fluorescent, which reaction affords, according to Hoffman, a method for distinguishing it from aniline red. In depth of color it is said to be equal to aniline, while it is superior to that dye in permanency; but it loses luster on dark tints, and hence its use is limited to light shades.

ARTIFICIAL ALIZARIN.—At a recent meeting of the Chemical Society of Berlin, Messrs. Graebe and Liebermann made the interesting communication that they had succeeded in preparing artificially the beautiful red principle of madder from anthracen, one of the waste products of the distillation of coal oil. They exhibited specimens of the color and some cloths dyed with it. The process of the manufacture is not divulged; but if it proves to be practicable it will be one of the most important contributions yet made by organic chemistry.

RECENT EXPLORATIONS OF DEEP-SEA FAUNA.—In the January number of the *American Journal of Science and Arts*, Professor A. E. Verrill gives an interesting summary of recent investigations on life at great depths. The first observations were made by Dr. Wallich, in 1860, when worms, crustacea, bryozoa, and echinoderms were found at depths varying from 445 to 1,913 fathoms. This was deeper than life had previously been supposed to be possible. Similar observations were made by Milne Edwards, by the discovery of living mollusca or corals adhering to the telegraph cable between Algiers and Sardinia, when taken up for repairs, on portions that had been sunk to depths of 1,093 to 1,577 fathoms. Later, G. O. Sars found nine fishes living at 200 to 450 fathoms. These discoveries have very important bearings upon geological science and physical geography, as well as geology, and will occasion important changes in many generally accepted theories. The following are some of the results already obtained. (1). Life does not disappear at 300 fathoms, as supposed by Forbes and others, but shallow-water animals are found at much greater depths. (2). It follows that a great abundance of fossils, in a geological formation, is no proof of shallow-water origin. (3). Bright colored animals are also found at great depths, so that this peculiarity cannot be assumed as evidence of shallow-water origin in fossils. (4). Several species of deep-sea crustacea have perfectly developed eyes, which would seem to show that light penetrates to greater depths than is commonly supposed. (5). That the temperature of the water at great depths is not everywhere the same, but is often far below the freezing point, as shown by Carpenter at 700 fathoms. (6). Finally, the investigations throw new light on the manner of the deposition of rocks, and modifies the doctrine of natural selection.

## WHAT GEORGE STEPHENSON ACCOMPLISHED.

At the banquet given by the manufacturers of Pittsburgh to the American Railway Master Mechanics' Association on the occasion of its last convention, which was held in that city, Hon. J. Tyng Brooks, in response to the toast, "George Stephenson, the Great Master Mechanic," made an eloquent speech, from which, as published in the Second Annual Report of the Association we make the following extract:

"How marked is the change in the public sentiment respecting railroads now and forty years ago, when George Stephenson, whose name and deeds we would recall to-night, was reasoning, pleading, coaxing, and fighting, for it took all of these to persuade England into having a railroad. Far different from this scene of splendor which is spread before us to-night were the associations of his early life; no banquets were given to him when he was unfolding the properties of the locomotive and studying how he might make it useful to his fellow-men. Instead of plaudits from the press, encouragement from the Government and men of science, the unlettered Northumbrian miner had to fight his way in the face of them all until he planted his railroad and locomotive in their midst and justly won a place among the benefactors of his race.

"Go to the mining districts of your own State, to the Lehigh valley, the Westmoreland or the Youghiogheny mines, and you cannot find so humble an abode as that in which George Stephenson was born and reared. One single room in a house of four rooms, each occupied by a family, was for years the home of his father, mother, and six brothers and sisters. Away from schools, books, and educated companions, his toil at the mines began when he was big enough to lead a horse, his comrades, the rough uncultivated miners and

drivers, his leisure time employed in such diversions only as his own ingenuity or fancy could devise. And yet from such a beginning and such surroundings, grew the world-renowned Master Mechanic, the accomplished engineer, the opulent railroad and locomotive builder, the companion of scholars, statesmen, and princes. His life, while full of interest to the casual reader, and especially to those who are interested in the history and progress of railroads, is the most instructive example I could name for those to imitate, who, in youth and poverty, aspire to excellence and fortune. For George Stephenson was not wafted by fortunate winds nor lifted by powerful friends to the eminence he attained. At every step in his inventions he was stubbornly opposed by the ignorant, the selfish, the prejudiced, and sometimes even by the educated, until at length he triumphed over every obstacle, and by his individual exertions raised himself to the proud position he finally occupied. His success was due to patient industry, careful study, frugal habits, and above all a spirit that was ever undaunted and invincible. When quite a boy his enthusiasm was centered on the stationary engine, and hours that were given by his companions to play, he spent in taking the engine to pieces, examining carefully its separate parts, learning the purposes of each, and when at an unusually early age he had mastered its details, he began to suggest and make improvements. Evenings he devoted to make shoe lasts, mending clocks and shoes, and cutting out garments for the miners, and at eighteen years of age he began to learn the mysteries of the alphabet and try to read, write, and cypher. And now behold the work he accomplished and the results he achieved. When he came to the Killingworth mines he found them embarrassed by defective machinery for hoisting, pumping, and ventilating, and the product of the mines was drawn in carts by horses down to the sea. He left them with improved engines, with improved methods of pumping and draining, a safety lamp of his own invention, to protect miners from their stealthy and dreaded foe, fire damp, and two locomotive engines and a railway by which to transport coal to the shipping port. He appeared before societies of learned men, before parliamentary committees, and with earnest Northumbrian dialect asserted the utility of traveling engines and iron tracks.

"And so slow was England to believe him, so blind to the value of railroads that her House of Commons rejected the first bill to allow one to be built, because the proposed route lay through a certain nobleman's fox cover. Even his own friends and supporters were incredulous of the power and speed he predicted of his locomotive, and when he declared it could be made to travel twenty miles an hour, they begged him to speak within bounds, for he would certainly ruin their prospects if he talked of so insane a project as a train moving at twenty miles an hour. And when a new survey was made to avoid the nobleman's hunting ground, when Stephenson's tongue was bridled so that it would speak of eight or nine miles an hour instead of twenty, it still took lawyers, lobbyists, and thousands of pounds sterling to convince the Solons of England that a railroad would be a useful institution. And the bill for the second railroad in England could only be carried through Parliament on condition that the cars should be moved by horses and not by traveling engines. People everywhere cried that railroads would ruin the country. Catholic priests in a neighboring county denounced them as the beginning of the reign of Antichrist. Men claimed that they would destroy canals and stage lines; horses would become worthless; half the men in England would be forced to idleness and poverty; cattle and sheep in pasture would be terrified to death at the sight of a locomotive flying through the air, breathing fire and smoke, and unearthly noises in its mad career; gardens and strawberry patches would be ruthlessly invaded; game preserves would be destroyed; women would be brought to premature confinement, and universal disquiet, disorder, and calamity, would follow the establishment of railroads. Such objections as these were urged sincerely and persistently by all classes of people forty years ago. But when permission was finally given by Parliament to build a railroad, new and more formidable obstacles were encountered. Land owners stood at their boundaries and forbid the engineers to enter and make the surveys, and the latter were forced to all manner of expedients to out-wit them and accomplish their work. They surveyed at meal time when the farmer was at dinner, by moonlight when he was asleep, and on Sunday when he was at church. Sometimes they were mobbed by superior numbers, their instruments smashed to pieces, and their very lives put in jeopardy. But when all these obstacles were surmounted, when the route was surveyed and a track laid, a holiday was appointed by the directors, and a free ride promised to all who should come and be present at the joyful occasion of opening the road. The people came by thousands in Sunday attire from every direction to witness the novel sight. And a novel sight it must have been. The procession was headed by a man on horseback, carrying a flag, behind him stood the low, uncouth little engine, the smoke streaming lazily from its stack, and George Stephenson, with his hand on the lever, waiting for the signal to start. A long train of coal cars was attached, and into them a few—the more courageous of the spectators—ventured, while hundreds upon foot and in vehicles waited in suspense the result of the enterprise. Soon the signal was given, the man on horseback started, waved his flag, the engine began to puff and the train to move, and amid music from the bands and shouts from the multitude that pressed eagerly behind and followed for miles, the procession moved off at about six miles an hour, and the railroad was voted a complete success. From that day George Stephenson's name and fortune were made. A few years passed and he was the proprietor of locomotive works at Newcastle employing nearly a thousand men, and the engineer of thirty different railways. Soon the golden stream, whose current had been against him, turned in his favor, and he became a millionaire. Railway companies voted him medals and placed his bust in their offices and public stations. He was consulted by statesmen and capitalists at home, and became the honored guest of kings abroad.

"He found the locomotive a loose, disjointed machine, running by cog wheels on a tooth track, without symmetry, power, or speed; he left it the grandest production of human skill, a magnificent monster, instinct with life, terrible as a fiend, docile as a lamb, a perfect model of grace, majesty, and power. Forty years ago, his two little engines doing drudgery at the Killingworth mines, were the only locomotives in Europe. To-day more than eight thousand are harnessed to trains of people and freight in Great Britain alone, drawing people by the thousand, and freight by the hundred tun at ten to sixty miles an hour. Then the only use conjectured of railroads was to carry coal and heavy merchandise, and no one but Stephenson believed that passengers would trust themselves behind an explosive machine going at twenty miles an hour. Now more than three hundred and fourteen million passengers are annually carried on the railroads of Great Britain, and find it not only convenient and pleasant, but cheap and safe in the highest degree. For, in England, to-day it is cheaper to ride in cars than to walk, and the victims of lightning and the gallows are far more numerous than those of railroads. Then the Stockton and Darlington Railroad was the only line in Europe upon which engines and cars could be seen moving. To-day the citizens of London can stand at one of the stations on one of the many lines of railway that center in that vast metropolis and count seven hundred trains each day bearing, with mathematical precision and safety, their animate and inanimate burdens. Thus the railroad is no longer a bugbear or chimera, but a living, indispensable reality, and projectors of railroads are not hooted at and mobbed, but rather welcomed as the real promoters of our civilization."

## MICROSCOPICAL EXAMINATION OF MILK UNDER CERTAIN CONDITIONS.

READ BEFORE THE MANCHESTER LITERARY AND PHILOSOPHICAL SOCIETY, NOV. 30, 1869, BY J. B. DANCER, F.R.A.S.

In August and September last an account appeared in one of the newspapers (and also in other periodicals), which had been copied from the *Journal des Connaissance Médicales*, of some microscopical observations made by M. V. Essling on milk, in which the author stated that "if the surface of fresh cream be examined under the lens, one perceives, amid myriads of milky and fatty globules, a number of either round or oblong corpuscles, sometimes accompanied with finely-dotted matter, being neither more nor less than germinative masses of vibrios—just what is seen in most substances in a state of putrefaction.

"In summer these corpuscles make their appearance within 15 or 24 hours after milking; in winter they will be perceptible after the lapse of two or three days. If the observation be continued until the moment of coagulation, we see these corpuscles increasing in number, bud, form ramified chains, and at length be transformed into regular mushrooms or filaments composed of cells placed end to end in simple series, and supporting at their extremities a spherical knob filled with granulous matter. M. V. Essling thinks that they may be classified among the Ascophora. But the important point is, that the first appearance of these spores occurs before the milk gets sour, and as this substance is almost the exclusive aliment of children, there is reason to suppose that many of the gastric affections to which they are subject are owing to this state of the milk. To prevent these evil consequences, M. V. Essling recommends the milk to be drunk as soon as possible after extraction, and, at all events, to keep it closely bottled during the interval, so as to keep out the smallest particle of air. Moreover, the temperature should be kept as nearly as possible the same as that which the milk had in the teats."

Having for many years been familiar with the microscopical appearance presented by milk and cream, and not having seen the changes as described by M. V. Essling, I was desirous of satisfying myself on this point, more especially as it affected a very important article of food. The composition of ordinary milk, as stated by Fownes, is as follows:

| | |
|---|---|
| Water | 873·00 |
| Butter | 30·00 |
| Casein | 48·20 |
| Milk sugar | 43·90 |
| Phosphate of lime | 2·31 |
| Phosphate of magnesia | 0·42 |
| Phosphate of iron | 0·07 |
| Chloride of potassium | 1·44 |
| Chloride of sodium | 0·24 |
| Soda in combination with casein | 0·42 |
| | 1,000·00 |

Composition of casein in 100 parts:

| | |
|---|---|
| Carbon | 53·84 |
| Hydrogen | 7·15 |
| Nitrogen | 15·64 |
| Oxygen } Sulphur } | 23·37 |
| | 100·00 |

Composition of albumen in 100 parts:

| | |
|---|---|
| Carbon | 53·5 |
| Hydrogen | 7·0 |
| Nitrogen | 15·5 |
| Oxygen | 22·0 |
| Phosphorus | 0·4 |
| Sulphur | 1·6 |
| | 100·00 |

Casein and animal albumen are remarkably similar in composition; casein differs in not being coagulated by heat, and is precipitated by acetic acid. Certain animal substances cause its coagulation, such as the dried stomach of the calf known as rennet, used in the manufacture of cheese.

When a thin film of milk is examined with the microscope, it is found to be a transparent fluid, in which are floating numerous transparent globules of fat; these are surrounded by a thin pellicle, and when this pellicle is broken mechanically, as by churning, the fat is liberated and forms butter. The fluid part consists of casein, saccharine matter, and salts in solution. The proportion of these organic principles varies in different animals, and also in the same animal when fed under different conditions. Human milk usually contains a larger proportion of sugar than cow milk, and is coagulated with greater difficulty. It is well known that the secretion and quality of milk are influenced by the mental emotions.

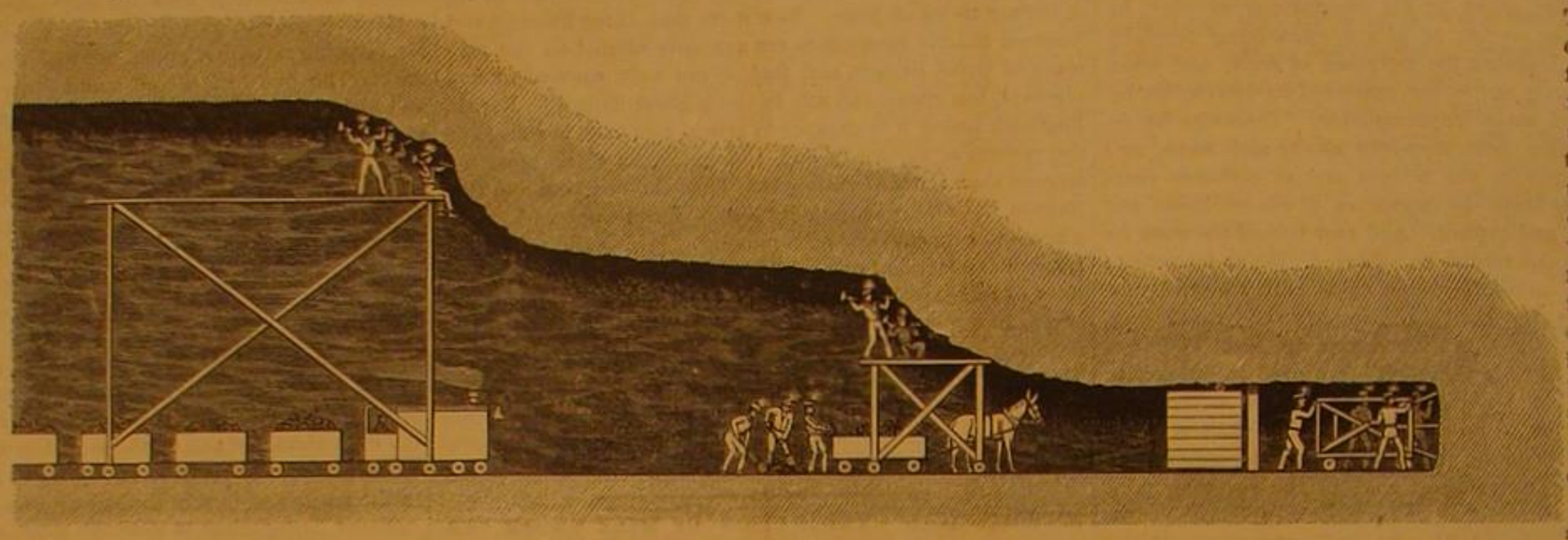
Milk as obtained in towns is frequently adulterated, and as foreign matter would alter its microscopical characteristics, it was necessary to procure pure milk. One of our members, Mr. Kipping, kindly supplied me with a bottle of fresh-drawn milk. The cow had calved about three months previously, and had been fed on grass, bran, and bean-flour. This milk was examined soon after I received it, and was found to be very rich in oleaginous globules, forming a plentiful supply of cream. There was no appearance of dotted matter or any fungoid growth when examined by powers varying from 200 to 1,500. The smallest oil globules exhibited (as usual) great molecular activity. A bottle was filled with some of this milk and securely corked; other portions of the milk were placed in open cups; one cup was kept in a cabinet which was closed during the day, the milk of the second cup was placed in a closet, the atmosphere of which I knew to be favorable to the growth of fungi, the Mucor Mucedo being the most abundant and of the same family as that mentioned as having been found in cream by M. V. Essling. The milk in the bottle and that in the cups were examined daily, precautions being taken to close the bottle speedily after a portion was removed. On the third day, the milk in the open cups was sour to the smell, but no change appeared visible under the microscope; the upper portion of the milk in the bottle had become very rich in oil globules by the formation of cream. On the fourth day the casein had coagulated in the milk in the open cups, and the flaky precipitate was visible under the microscope; the pellicle surrounding the oil globules now appeared to be very easily ruptured, and with the slightest pressure some of the globules could be joined together—sometimes a number of globules which had been ranged in line by a current would coalesce by a slight movement of the fluid, and form an elongated mass. Fifth day, no appreciable alteration. Sixth day, the milk which had been placed in the closet had patches of mold visible on its surface; a microscopical examination of this mold showed it to be the Mucor Mucedo, such as I had frequently found on fruit which had been left in this closet. The fungi appeared on the surface only, no trace of it could be found in the milk taken from various depths. The milk in the cup kept in the cabinet exhibited no appearance of the Mucor Mucedo or any other vegetable or animal organism; it had become thickened into a pasty mass, with an intense sour odor. These observations were continued for eleven days, and the only difference observable was in the oil globules—they began to lose their spherical form, as if the investing pellicle had been weakened in parts and had become expanded.

These experiments were repeated with a second supply of milk, which Mr. Kipping kindly supplied, and the results were alike in both cases. The range of temperature during the experiments was from 45° to 63° Fah. These experiments would lead me to believe that vegetable organisms do not, as a rule, make their appearance in pure unadulterated milk unless it is exposed for some time to atmospheric influences; most probably the spores are supplied by the atmosphere. Further experiments are wanted to decide the question. The microscopical examinations should be continued in hot weather. I hope to be able to resume the inquiry next summer under different conditions, which have suggested themselves during the examinations I have detailed. In any case, M. V. Essling's suggestions to bottle the milk is very good, and, in my opinion, cream pans with covers would be a very great improvement on the opens ones as at present employed, at the same time having due regard to the cleanliness of the apartment and the vessels in which the milk is kept.

In a microscopical examination, such as I have recorded, it is quite necessary to have pure materials. The milk as supplied by vendors we know to be very frequently adulterated, and the most simple and easy method is by the addition of water. We know also that in towns where the water has a high character for purity, it sometimes happens in dry, hot weather the reservoirs are charged with vegetable and animal organisms. Milk may not always have town's water added to it; in this case there may be an extra quantity of vitalized matter introduced. What a surprising account a microscopist might furnish from the examination of milk containing such an importation! In the cold weather, such as we have at present, animal organisms are not so abundant, and this may account for their absence from a sample of milk obtained in this town, in which I found *Algæ*, but not belonging to the pure milk. One curious circumstance was noticed in this milk, no Mucor Mucedo appeared in or on it, although exposed in the closet for the same length of time as Mr. Kipping's milk, which showed signs of this growth on the sixth day, and on the twelfth day the town milk had none visible. I may mention that pure milk in a bottle securely corked remained fresh twelve days; possibly the low temperature favored its preservation.

## THE HOOSAC TUNNEL.

The attention of the world is so much directed to the Alpine railroad tunnel of Mont Cenis, the connecting link between France and Italy, that we are apt to lose sight of the fact that a similar enterprise, of nearly equal magnitude, is now going rapidly on within our own borders. We allude to the great tunnel through the Hoosac mountains, in the State of Massachusetts. This gigantic work was projected and begun before the European tunnel was fully planned; and had Hoosac been half as liberally supplied with money as Mont Cenis, it would long ago have been completed. But Hoosac, instead of being supported by the treasuries of great empires, has had to depend upon the caprices of the Legislature of one little State. At some periods the Massachusetts Legislature, influenced by a feeling of poverty, would altogether refuse supplies, and then the work had to stop. But when money was again forthcoming, the ring of the drill and the roar of the blast quickly resounded. These alternating periods of idleness and activity have occupied fifteen years; but there is reason to believe that the delays are done with, as the completion of the work is now under positive contract with the celebrated mining engineers, the Messrs. Francis and William Shanly, of Canada. They have engaged to finish the work on or before March 1, 1874; they are energetic men, and the vigorous manner in which they carry things on indicates a completion of the tunnel much earlier than the date of the contract. We lately visited the Hoosac, and desire here to express our indebtedness to the above gentlemen, particularly to Mr. W. Shanly, for personal attentions and facilities in the examination of their remarkable works.



### LOCATION, LENGTH, AND CHARACTER OF THE TUNNEL.

The Hoosac tunnel forms part of the line of the railroad from Greenfield, Mass., to Troy, N. Y.; and when the mountain bore is finished, Massachusetts will enjoy two independent roads, extending from its Atlantic coast to the Hudson river, a distance of about two hundred miles. One of these roads, the Boston and Albany, having steep grades and traversing the southern section of the State, has long been in operation. The other, from Boston *via* Fitchburg and Greenfield, Mass., traverses the northern part of the State, through rich farming and manufacturing districts, with easy gradients except at the Hoosac mountains, where it was determined to avoid declivities by boring straight through. The tunnel is to extend in a direct line from the Deerfield river on the east, to or near the Hoosac river on the west, a distance of almost five miles. The bore is to be 20 feet high and 25 feet wide. The altitude of the mountains is 2,500 feet; they are composed of mica slate of variable hardness, some streaks being as hard as flint and difficult to cut. Very little water has so far been encountered in the tunnel, and for the most part it is quite dry. The tunnel rises on a grade of 26 feet to the mile from each portal to the center of the mountains, thus affording constant drainage. The rock formations thus far encountered agree closely with the geological surveys made prior to the commencement of the work. The eastern portion of the tunnel has been advanced nearly a mile and a half into the mountain, the western portion one mile. The tunnel is therefore a little more than half completed.

The contracting engineers have been compelled to make outlays for machinery to the extent of $100,000; and, in addition to this, by the terms of their contract, they were to receive no pay from the State until they had done work to the amount of $500,000. The Hon. Wm. M. Tweed, State Senator, of New York city, is the capitalist who is quietly carrying along the financial portion of this great and interesting work. It is said that the profits on the contract will exceed one million dollars.

### HOW THE WORK IS DONE.

Our diagram illustrates the general manner in which the work is conducted. At the extreme inner end of the tunnel, or heading, a large drill carrier is employed, consisting of a strong framework mounted on wheels, and carrying a number of the celebrated Burleigh drills. These drills operate independently, and each is, in effect, a separate engine with cylinder and piston, having for its motor either steam or compressed air, whichever is most convenient. At the east end of the tunnel which we are now describing, they are driven by compressed air. The drills are made with trunnions and other adjustments, so that the position of the drills may be changed as desired; and in practice they are worked in all sorts of positions—upward, downward, laterally, or obliquely, according to the judgment of the miners. The drill carrier is pushed close up to the heading and firmly secured by clamping screws which press against the roof and floor of the tunnel. The drills are then adjusted and secured so as to work on their appointed lines; the compressed air is then admitted to the drill cylinders, causing the drills to fly back and forth against the rocks like shuttlecocks. The drill rods are hollow; and through the center of each, when in operation, a small stream of water is forced, which washes the dust from the drill holes and assists to cool the tool.

The Hoosac drills have 4½-inch cylinders and 9-inch stroke. They make 250 strokes and cut a 2-inch hole at the rate of two inches deep per minute. The weight of each drill and its cylinder is 500 pounds. Cost $125 each.

The compression of the air by which the drills are driven is effected at the east end of the tunnel by water power; four 20-horse turbines being employed, which operate sixteen air pumps each of 13½-inch bore and 20-inch stroke. Not all of these pumps are used at once.

The air is compressed to 65 pounds to the square inch, or a little over four atmospheres, and conducted through an 8-inch cast iron pipe to the drills at the tunnel heading, where branch pipes connect several drill cylinders with this 8-inch pipe. With six of the drills at work and making 250 strokes per minute, the gage on the air pipe at the heading of the tunnel, shows a pressure of 63 pounds against 65 pounds at the pump rooms, one mile and a half distant, being a loss of only 2 pounds. This remarkable fact illustrates the advantage of compressed air as a motor for machinery in mines, tunnels, and other difficult places; the exhausting air also serves the purposes of ventilation.

When the drills have cut into the rock the required depth, say from four to six feet, the drill carrier is moved back out of the way and the corps of glycerin men advance, charge the holes with nitro-glycerin, insert the priming wires, and connect them all with a single pair of electrical conducting wires, which extend back to a safe distance, where the extremities connect with the electric battery. This instrument is contained in a round case about 15 inches in diameter and 4 inches thick, resembling the case of a clock, and having a small crank protruding from its upper surface by turning which a current of electricity is generated. The battery is a magneto-electro machine, the electrical current being produced by causing an armature to revolve near a permanent magnet.

After the glycerin charges are ready, the strong and heavy wooden doors near the heading, shown in the diagram, are closed, forming a protecting bulkhead with a cushion of air between it and the rocks. The signal for firing is then given, the crank of the battery is turned, a flash like lightning is seen around the doors, the mountain trembles, a tremendous roar as of thunder is heard, and a blinding cloud of smoke and dust instantly fills the tunnel. But this is soon cleared, for the ventilation is rapid and effective. In addition to the fresh air brought in and discharged through the drills, a special air pipe, 8 inches in diameter and a mile and a half long, is employed for ventilating purposes. The extremity of this pipe, consisting of a rubber hose, is carried up to the heading after the blast, and the tunnel is soon filled with fresh air which drives out the smoke. The ventilating pipe delivers over 2,000 cubic feet of air per minute.

The bulkhead is now opened and a large force of miners advance to clear away the debris, consisting of many tuns of rock dislodged and broken by the tremendous force of the blast. Small cars are brought up, the stone is loaded in, and the track laid for a new advance of the drill carrier. Mules and small locomotives are employed to haul the cars. The size of the opening drilled and blasted is 6 feet high by 25 feet wide.

Various gangs of men are employed on platforms of different hights, as shown in our sketch, to enlarge the tunnel to its proper size and finish the walls. At present the work of drilling out the enlargement is done by hand; but at the time of our visit an immense Burleigh drill carrier, composed of strong tubular iron, was in part erected, upon which a large number of the atmospheric drills are to be placed. When this gigantic machine is completed, the work of enlarging and finishing the tunnel will be greatly facilitated.

About one thousand men are at present employed on the various divisions of the Hoosac Tunnel. They work night and day, in alternating shifts of eight hours each, making one blast during each shift, and cutting through the mountain at the rate of about 250 feet per month.

### THE WESTERN PORTAL

of the tunnel is at North Adams, Mass., a very thriving place, having fine water powers and a number of large manufacturing establishments. But the village is so closely surrounded by hills and the Hoosac mountains, that building lots are scarce and are now being dug out of the hill sides. The cars from Troy, 46 miles, rest at North Adams; they cannot proceed further east until the tunnel is completed. We sojourned at the Wilson House, a large and imposing structure erected by Allen B. Wilson, inventor of the remarkable mechanism known as the Wheeler & Wilson sewing machine. Wilson married at North Adams, and worked here as a humble mechanic. It was while thus employed that he completed the model of his marvelous sewing machine, with which he started off for fame and fortune, *via* the SCIENTIFIC AMERICAN office, New York. This was in 1850. We prepared his specifications and drawings and obtained his patent.

The form and practical operation of the present sewing machines are due to the genius of Allen B. Wilson. Baster plates and other clumsy parts were required in Howe's, and other machines, until Wilson came forward, made the table and the 4-motion feed, and taught the correct principles of construction. From the little model which Mr. Wilson brought to our office in his pocket, has arisen the gigantic corporation known as the Wheeler & Wilson Manufacturing Company, whose annual revenues are estimated at between two and three millions of dollars, and whose splendid fire-proof manufactories, at Bridgeport, Conn., cover several acres.

The western mouth of the tunnel is located in a deep ravine at the base or the mountain, about two miles south of the Wilson house. The tunnel is of circular form, 20 feet high and 25 feet wide. The earth at this portion of the works proved to be a treacherous quicksand, through which a tunnel of masonry about 1,000 feet long had to be carried. The arch is composed of eight layers of brick, and its construction was most difficult and expensive.

Up the mountain, about half a mile beyond the end of the brick tunnel, a vertical shaft is sunk to the level of the tunnel, 318 feet, and two headings starting east and west have been made. The latter has been cut through into the brick tunnel, and work upon the other heading is progressing satisfactorily. The west end of the tunnel has now reached a total length of one mile.

Within the building which covers the shaft is a ponderous elevating machine, constantly employed in raising the loaded stone cars and returning the empty. Here also, arranged side by side, in active operation, are a number of 20-horse horizontal steam engines, with air pumps attached. These machines are employed to compress air, which they force down the shaft into the tunnel, supplying motive power to the drills and ventilation for the miners. The Burleigh drills, engines, and compressors are used.

Leaving this shaft we journey over the mountains. The road rises in zigzag lines upon the breast of the mountain, and we soon reach the region of the clouds; through their openings we are permitted to enjoy some of the finest views the continent affords. The Green Mountains of Vermont stretch away to the north, while close by us on the west, old Greylock, the giant of the Hoosac range, looks down benignantly upon the streams and villages, that wind and nestle in the valleys below.

### THE CENTRAL SHAFT.

Half way over the mountains is located the grand central shaft of the Hoosac tunnel, 700 feet deep and not yet complete: but the boring is progressing favorably, and it is expected that the tunnel level, a depth of 1,000 feet will be reached sometime during the coming summer, when two headings, one in each direction, will be opened, thereby doubling the rate of progress on the main tunnel. Steam power is employed to compress air, drive the drills, and supply fresh air to the miners, as before described.

The general superintendent of the various mechanical departments of the Hoosac tunnel works, is Mr. Oliver Ayers, of Charlestown, Mass., long and favorably known for his executive abilities and enterprising services in connection with other prominent railway works in this country.

### THE DRILLING AND AIR-COMPRESSING MACHINERY.

The drilling machines, compressors, steam engines, etc., are simple, well made, and thoroughly effective. They are, for the most part, the invention of Charles Burleigh. Many attempts have been made to drill economically by the use of machinery; but we believe there are few devices that can compete with the Burleigh drills, especially in difficult situations. It is one thing to cut into stone where the block is under control, and where all the parts can be kept smooth and clean but it is quite another thing to produce machinery that shall work well amidst the rough and tumble of a narrow tunnel, where grit and dirt, so ruinous to exposed machinery, are flying in every direction. But the Burleigh drill stands the severest tests, and may be relied upon to operate effectively in the very worst places; and that is where its assistance is generally most needed. By its use any given amount of rock cutting may be performed three times faster and cheaper than by hand. The drill points will cut ten times further for each sharpening than hand drills.

The Burleigh drills are now at work at Hell Gate rocks, near this city, also in the vicinity of Central Park; at Jersey City, Midland Railway tunnel; Nesquehoning tunnel, Pa.; Delaware & Hudson Canal Co.; Lake Superior, Colorado, Nevada, and Nova Scotia mines; and many other places. The manufacturers are the Putnam Machine Co., Fitchburg, Mass., and the general agents, are Messrs. J. T. & W. H. Daly, 43 New street, New York city.

One of the largest of the machine shops pertaining to the tunnel is at the east end, located on the edge of Deerfield river, whence power is derived. The foreman of this shop is Mr. R. J. Parker, and it is a well-ordered, efficient establishment, full of intelligent and competent workmen, of whom, we were gratified to learn, a majority are subscribers to the SCIENTIFIC AMERICAN.

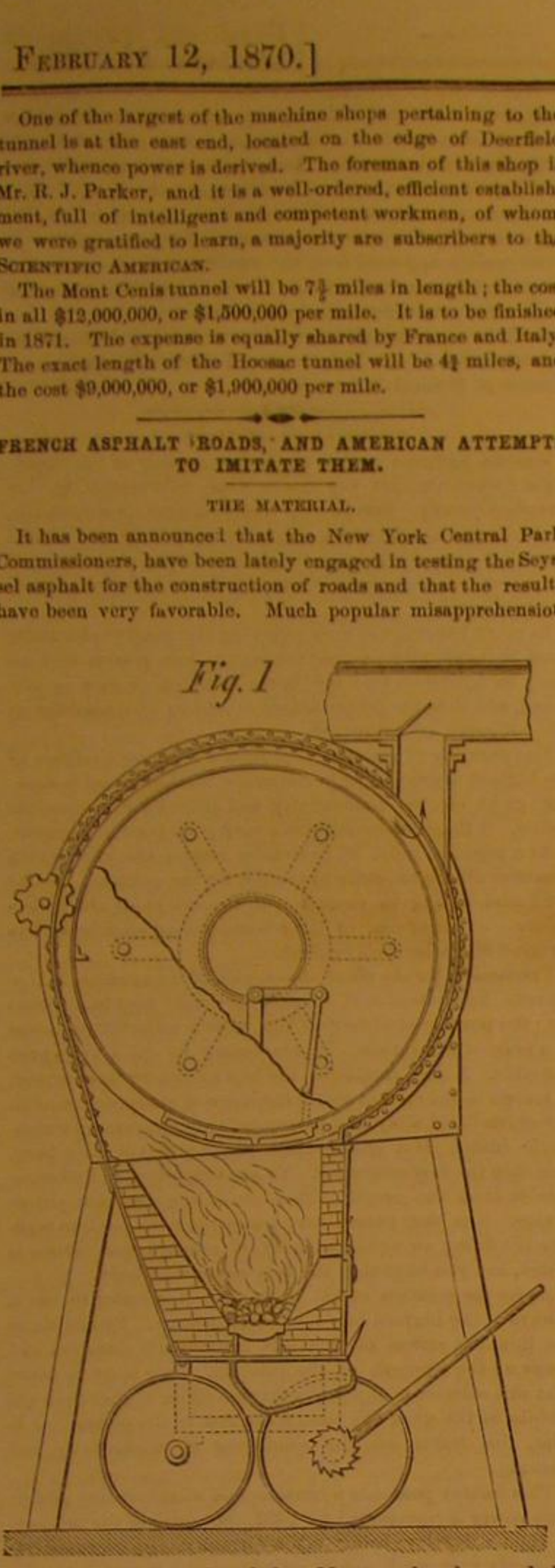
The Mont Cenis tunnel will be 7¾ miles in length; the cost in all $12,000,000, or $1,500,000 per mile. It is to be finished in 1871. The expense is equally shared by France and Italy. The exact length of the Hoosac tunnel will be 4¼ miles, and the cost $9,000,000, or $1,900,000 per mile.

## FRENCH ASPHALT ROADS, AND AMERICAN ATTEMPTS TO IMITATE THEM.

### THE MATERIAL.

It has been announced that the New York Central Park Commissioners, have been lately engaged in testing the Seyssel asphalt for the construction of roads and that the results have been very favorable. Much popular misapprehension

*Fig. 1*



exists on the subject of asphalt. Most people, when asphalt roads are mentioned, get only a confused idea of some sort of artificial concrete made of coal tar and gravel, or some inferior abomination like that which now disgraces Fifth Avenue in this city.

As the subject of road making is at this time one of current interest, and as the genuine asphalt roads in Paris are not only admirable when completed, but the material of which they are made, as well as the methods of making them, possesses points of great interest, we have been at the pains to obtain from authentic sources in Paris, full information and elaborate drawings of machinery, tools, etc., from which the substance of the present article is compiled.

The French asphalt is a carbonate of lime or chalk, naturally impregnated with bituminous matter. Extensive beds of this deposit are found at Seyssel and Pyrimont on the right bank of the Rhone, between the French fortress Bellegrade and the town of Culloz. Large amounts of this rock are quarried and sent to the French capital, where it is used in making the beautiful pavements which now adorn some of the streets of that city.

It is known that in heating asphalt rock to about 212° it disintegrates, and by the softening of the bitumen it turns into a sort of a brown dust. If in that state, while the dust is yet hot, it is compressed in a mold, the particles will stick together, and the matter will resume again, in cooling, its general appearance, hardness, and all the properties of primitive rock, while it retains the shape of the mold.

### HISTORY OF THE INVENTION OF ASPHALT ROADS.

The invention of the process now applied to a great number of Paris roads and embankments is due, in some sort, to chance. Pieces of asphalt often fell on the road from the wagons used to transport it from the mines of Seyssel to the manufactories of cement employed to make sidewalks, and were crushed by the wheels; and when the road was covered with these fragments, the heat of the sun produced decrepitation. The wagons wheels, by little and little, compressed the accumulated dust finally into a solid crust, which

*Fig. 3*

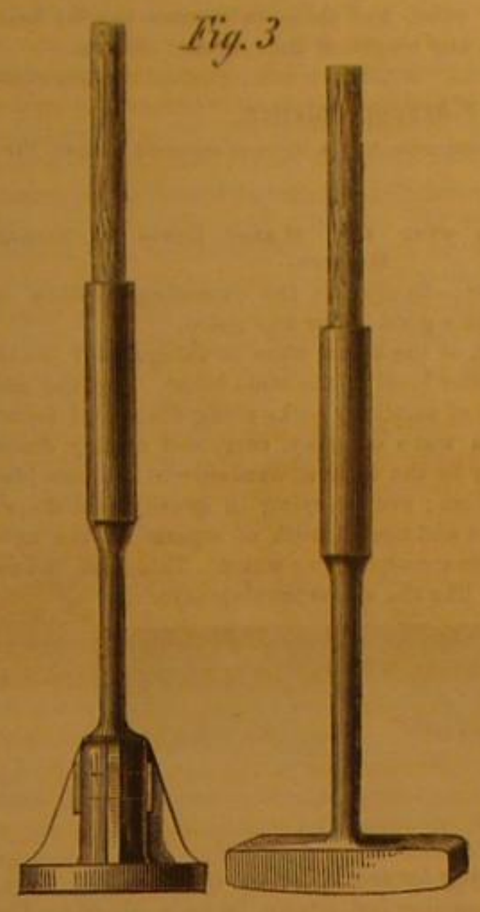
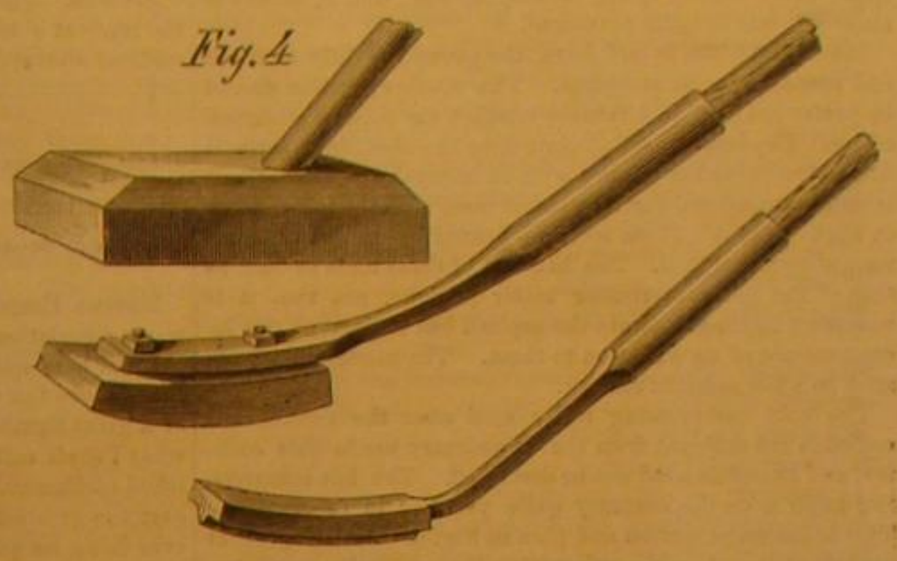


*Fig. 4*



being found an admirable road surface, led to further applications of it to the same purpose.

It was M. Merian, a Swiss engineer, who, in 1849, first improved that lesson of chance and constructed an asphalt surface on the cantonal road of Val de Cravers, which, in spite of the instability of its foundation and the irregularity in repairing, is yet in a perfect state.

In 1850, M. Darcy, Surveyor-Général of Bridges and Roads, in a report addressed to the minister of public works, proposed to apply it immediately on a portion of Paris Boulevards.

However, it was only in 1854 that, under the supervision of M. Hamberg, chief engineer, and M. Vaudry, ordinary engineer of the municipal service, the first asphalt road was constructed in Rue Bergere, Paris, on the remains of a road which had only lasted a few months and in which bitumen had been employed. Since that time the road surface of the Rue Bergere, if we except the portion in front of the Rue du Conservatoire, which is made out of cast asphalt, has never been repaired.

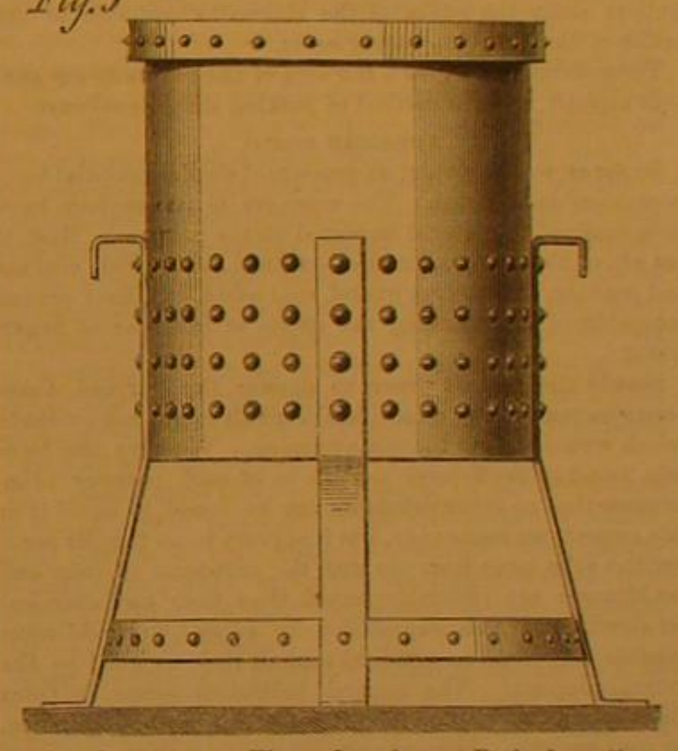
Since 1854, the system of asphalt embankments or roadways has been developed very rapidly. The first attempts in 1854 were made on a surface of about 800 square yards, and four years after asphalt was applied to 8,000 yards.

In 1859, the substitution of asphalt for stone paving was made in Rue neuve des Petis Champs. That operation resulted in some instructive observations. The season was unfavorable being damp and rainy, yet the work was performed notwithstanding. But the beton never got dry, and as travel could not on that account be long suspended in a street so very much frequented, the asphalt was put on a damp surface, and sinking in a very few days, holes and ruts made their appearance. These were produced by steam confined under the bed of asphalt, and the inconsistency of the ground a portion of which was on a loamy embankment of a drain recently built. For this reason it was necessary to make almost a new embankment, in fair weather, and on a bed of dry beton strongly beaten; and since that time the street in question has always been in a perfect state, without any repairing whatever. At the present time the whole surface of Paris asphalt streets comprises about 133,333 square yards.

### CONSTRUCTION OF THE ROADS.

The first operation in making an asphalt road is the breaking of the material. This is performed in a crushing mill of

*Fig. 5*



peculiar description. The rock arrives at Paris from Seyssel in lumps containing several cubic inches. These lumps are first broken in a machine called a rammer, and then fed to a crushing mill. This mill is of English origin and is based upon an ingenious application of centrifugal force. The details, however, are too voluminous to be dwelt upon here.

As soon as the asphalt rock is properly broken and ground into the sort of dust above described, it is put into the torrefactor or dust-heating apparatus. This is shown in section in Fig. 1. It is a stationary machine employed to heat the dust before it is carted upon the road, to avoid the unpleasant smell caused by heating in the public streets. It is made on the principle of the well known coffee roasters. An internal sheet iron cylinder is made to revolve in an external one by means of a worm gear. In the interior one is placed the asphalt dust, and the heat passes up and around it from a portable furnace. This portable furnace is placed on wheels so that when the dust is sufficiently heated it may be drawn from under the cylinder, and replaced by a cart to receive the

*Fig. 2.*

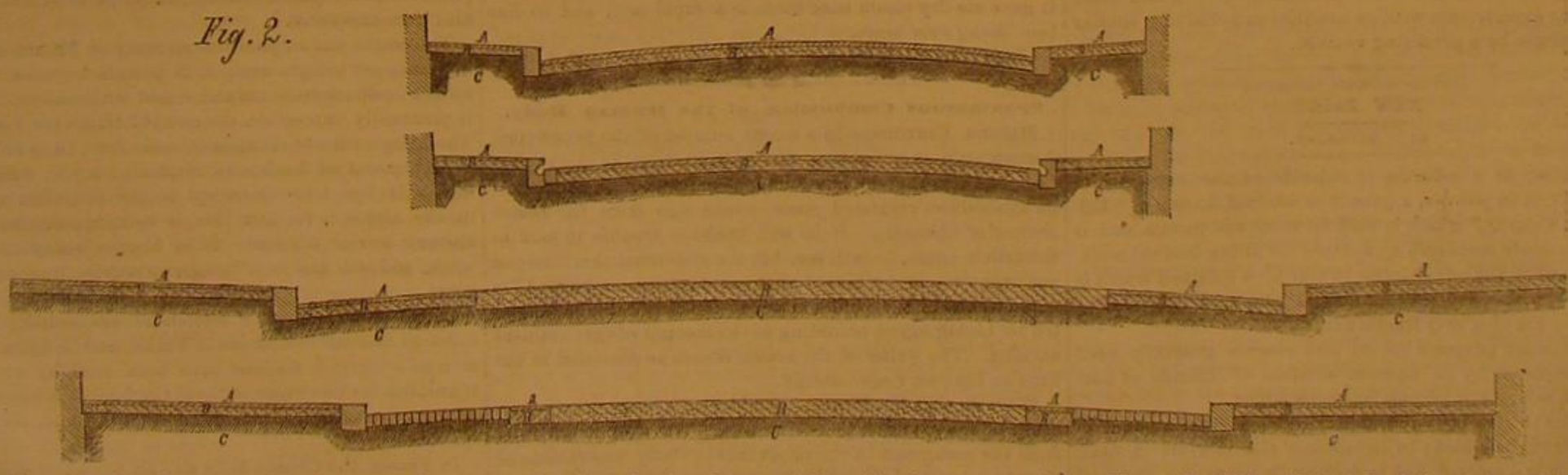
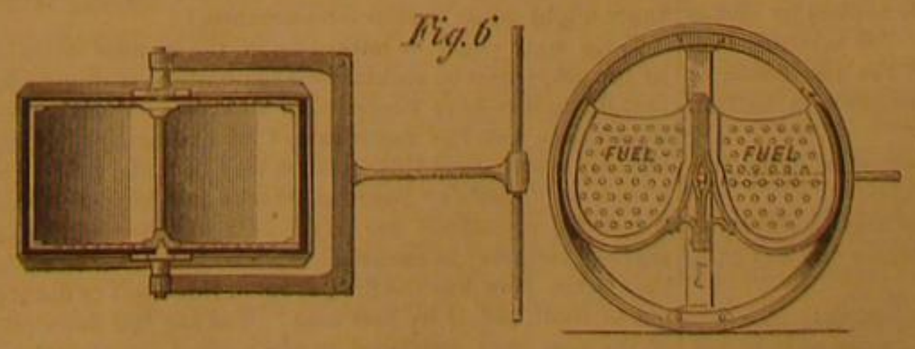


*Fig. 6*



dust from the heating cylinder. The carts are of sheet iron and the asphalt being a bad conductor of heat, cools very little during the transportation from the heater to the road surface.

Arriving at the place of deposit the dust is distributed and consolidated by hot and cold compressing rollers, and other tools hereafter to be described. The surface of the soil of the roadway is laid up to the proper convexity, and a layer of beton is put down, upon which the asphalt is concreted. Sometimes the entire roadway is covered with asphalt, and sometimes only a portion. Our engraving, Fig. 2, shows four different styles of roadway; A showing where the asphalt is used; B, the beton; C, the underlying soil; and D, blocks of stone like our Belgian pavement.

Before the beton is laid down, the ground is duly stamped and prepared for its reception. The whole operation should be performed only in favorable weather for reasons assigned above. The heated asphalt dust from the sheet iron carts is first spread over the surface with an iron rake or shovel, and is then stamped and partially compressed with the tools shown in Figs. 3 and 4. These tools are heated by means of a furnace shown in Fig. 5. The heating of these tools as well as that of the hot compressing roller is done, not that it is necessary to conglomerate the asphalt but to prevent the inconvenience of its adhesion to them. The material does not stick to a hot metallic surface.

The cold compressing roller used after the surface has cooled is not different from that in ordinary use in this country, and therefore need not be described. The hot compressing roller is on the contrary quite peculiar in construction. This is shown in section and plan in Fig. 6. An iron grate or basket is pivoted on the axle within the external compressing cylinder, and in this basket is carried a coal fire, the basket being so pivoted that it will hang below the axle in an upright position.

The various tools shown in Figs. 3 and 4 are adapted to smoothing the surface in different parts, and to shape the gutters along the edges of the sidewalks previous to the action of the hot compressing roller.

These details will give a fair idea of the nature of the genuine asphalt, and the method of making it into roadways.

AMERICAN ROADS.

So far as we are aware, no deposits of similar material have been found in America. The attempts to use asphalt have been confined to material imported for the purpose. Most, if not all, of the various forms of concrete made with coal-tar and pine-tar, mixed with gravel, coal ashes, etc., have proved incapable of withstanding the effects of frosts or of heavy travel.

Should the asphalt prove to answer the purpose, there seems no reason why an artificial asphalt might not be made which would answer the same purpose. Whether the bitumen found in the Seyssel asphalt is of such peculiar adhesiveness that no other substance can be found to equal it in this respect, we cannot say, but it appears to us that its peculiarities arise more from the way the carbonate of lime and the bitumen are naturally mixed than from any chemical peculiarity. If this supposition be correct, it would seem possible to produce an artificial asphalt rock, as good as the natural deposit. The natural indication seems to point directly to a composition of carbonate of lime and bitumen, for road surfaces Immense quantities of bitumen exist and can be obtained at a very cheap rate. An almost inexhaustible supply of it is found in the pitch lake of Trinidad and it is of very adhesive quality. Should the adaptability of asphalt to American roads be demonstrated, it would seem that some experiments with an artificial material of a similar nature might be a promising venture.

[For the Scientific American.]

## NEW PAINT.

BY C. WIDEMANN.

By adding to a solution of chloride of zinc some white oxide of zinc in powder, a cement is obtained, known as "Lallement's Cement," which is used for stone and metals, and is also frequently employed by dentists for filling decayed teeth, on account of the oxy-chloride of zinc thus obtained which is insoluble, white, and very hard; it is also used in modeling objects of art of a very fragile nature.

For painting purposes the oil and essence generally used can be replaced by an aqueous solution of chloride of zinc to which tartrate of potassa has been added.

In order to give body to this mixture a certain amount of potato starch is added; in submitting *this* mixture to heat, the starch is dissolved, and in cooling it gives the required consistency.

Having added to the powdered oxide of zinc, the mineral or vegetable colors (also powdered) which it is intended to use, the oxide of zinc thus colored is mixed with the aqueous solution of chloride of zinc, and the whole applied by means of a brush on the surface to be coated. The mixture soon dries after its application on account of the production of oxy-chloride of zinc, the whole will dry perfectly in half an hour.

The alkaline tartrate added has for its object to delay this drying, which without it would be too sudden.

To obtain white paint the above mixture may be employed without the addition of any coloring matter, as the oxy-chloride of zinc gives a very fine white color.

The advantages of this paint are the following:

First. They are more durable than oil paints, and do not blacken by exposure to sulphurous vapors.

Second. Devoid of any odor, and drying quickly, one coating can be applied in winter every two hours, and every hour in summer; so that a room can be completed in a day's work.

Third. Resisting dampness, and the action of water (even boiling), it can be cleansed with soap, as is ordinary oil paint.

Fourth. This paint containing the chloride of zinc is antiseptic, and preserves wood against decay.

Fifth. It diminishes the combustibility of the substance to which it is applied, as chlorine renders hydrogen incombustible in combining with the latter to form hydrochloric acid, which cannot be decomposed by heat. A certain quantity of borax may also if desired be added to the solution so as to increase its incombustibility.

Sixth. It is manufactured without danger to the health of the workmen.

Seventh. The oxide and the chloride of zinc are found in the trade at a low price, and these substances can be kept without alteration any length of time, in any climate.

## Correspondence.

*The Editors are not responsible for the Opinions expressed by their Correspondents.*

### State of Steam over the Water Level in Steam Boilers.

MESSRS. EDITORS:—In my last the exceeding rapidity of water circulation in a good boiler was noted.

I will here speak of the actual state of things as I found them above the water level of the same boiler. By the use of a great number of small try cocks along the side, I found what I shall call a wave of spray, composed of tiny drops lifted mechanically by the rapid upward current of steam just over the greatest heat; ever varying in density and shape, ever doing its quiet and useful work of separating the new made steam from its accompanying water. This wave had an outline something like the accompanying sketch.

As I am not writing for any boiler but only seeking truth, I give nothing of outline but simple interior, showing the unstable wave of spray covered by a layer of damp fog or very cloudy steam, the whole rising from 8 to 10 inches at the highest part. I noted particularly that this never moved forward near enough to the try cocks in front of the boiler to be detected by them, but kept hovering over the hottest part of the boiler.

After finding this to be the case, I very unwisely tried to get dry steam from the back end of a long boiler, which was making nearly all its steam over the fire at the front. I failed to get dry steam, although I had really more steam room than in the first experiment which had yielded such good results; but searching as before for the truth, I found my poor wave of spray on a terrible bender—demoralized to the last degree, distorted, broken and mixed, rolling, tumbling over the surface, swept before the current of steam made at the front with no exit but at the back. There was the trouble—what had I been thinking of?

My remedy was clearly pointed out, and quickly made and tested. I simply put the same number of cubic feet of steam space over the steam produced, imitating the outlines nature had given me as near as I could. All was right. My wave of spray went soberly to work under its tent-shaped steam room. It gave me dry steam once more at a rapid rate, and so has been doing ever since.

Olney, Ill. T. L. L.

### Spontaneous Combustion of the Human Body.

MESSRS. EDITORS:—In a recent number of the SCIENTIFIC AMERICAN it is stated that Mr. A. B. Flowers, of Alexander, La., considers that he has found a "mistake" in the article on this subject reprinted some weeks ago from the *Boston Journal of Chemistry*. If he will take the trouble to look at the article again, he will see that the statement that "no one has ever witnessed a case of such spontaneous combustion" is given as one of the points in which the fifty cases investigated by Liebig agree, according to the account of that eminent chemist. The writer of the article makes no assertion of the kind on his own responsibility.

We wish that Mr. Flowers would give a more detailed account of the case mentioned by him. We should not infer from the paragraph in the paper that the body was consumed or even burned at all. The breath from the mouth and nostrils appears to have contained so much alcoholic vapor that it took fire, and death was the result. Was it an open fire near which the person was sitting? And is it not possible that the vapor took fire in much the same way as naphtha vapor might under similar circumstances?

If the body could be burned up in the manner described by the old writers on spontaneous combustion, it would seem that it ought to have happened in this case. These authorities (?) state that the flame cannot be extinguished by any ordinary means—and this assertion may be found in so recent a book as "Steele's "Fourteen Weeks in Chemistry," published for *educational* use in the year of grace 1867!—and that the body may be burned to ashes without even scorching the clothes. How was the fire put out in this case? or did it go out of itself, and, if so, how soon? Has any full description of the case been published in any medical or scientific periodical? If not, it is very desirable that either Mr. Flowers, or some other of the eye witnesses should prepare such a description at once.

The last alleged case of spontaneous combustion of the body, reported in full and carefully examined by competent medical men, was that of the Countess of Goerlitz, June 12, 1847. In that instance the Hesse Medical College, after due investigation, reported that the person had not died from spontaneous combustion. The case was then referred to Liebig and Bischoff, whose report was to the same effect. It subsequently appeared from the confession of the man who committed the murder, that the Countess had been strangled and the body wilfully burned after death.

Much interesting matter on this subject may be found in Dupuytren's "*Leçons Orales*" and in Taylor's "Principles and Practice of Medical Jurisprudence."

### Leclanche's Battery.

MESSRS. EDITORS:—I see in the last number of the SCIENTIFIC AMERICAN, that you desire some information on Leclanche's battery. Starting on very judicious considerations, M. Leclanche has devised a single liquid battery, and obtains a constant current by an arrangement unknown before; all the batteries giving constant currents being hitherto employing two liquids.

In every battery, the body receiving the positive electricity must be inoxidizable, a good conductor, and possess such affinity for hydrogen that the latter is seized as soon as produced, and thus the perturbations caused by the presence of free hydrogen are prevented.

The peroxide of manganese possesses all these qualities in the highest degree, being inoxidizable, insoluble, and possessing great electric conductivity and affinity for combustible bodies. It therefore constitutes a very good positive element.

As a negative body, M. Leclanche retains the zinc, which possesses all the requisite properties for the purpose. As for the liquid coming in contact with the two poles, the hydrochlorate of ammonia, or the commercial sal ammoniac, has received M. Leclanche's preference.

Practically, for the sheet of peroxide of manganese, M. Leclanche has substituted crushed peroxide, kept in a porous jar; the positive electricity of this mass is collected by means of a plate of gas carbon. It is necessary to use a very pure peroxide. A good conductor, the best known for this purpose, is known in the market under the name of *manganese aiguilli*. It is crystallized, silky, and possesses a very pronounced graphitoide luster. If it joins to these qualities that of being hard, it is then the best conductor. To use this peroxide first separate it from the *gangue*. Then crush the mass into coarse grains. It is then passed over a metallic wire cloth to separate the dust; an equal quantity of crushed gas carbon is added, and you have thus the best conducting body.

As for the solution of sal ammoniac, it is better to use it always at the highest degree of concentration. By adding to the liquid an excess of this salt, it gradually dissolves and keeps up the strength of the solution. Care must be taken that this solution does not wet the porous jar higher than the middle, as the drier the mass contained in the porous jar is kept, the better are the conditions of conductivity and working.

This battery possesses a considerable electromotive power. This power is represented by 1·382, the power of the sulphate of copper battery being taken for unity. Its resistance is relatively very weak, a very advantageous circumstance for telegraphing.

Experience has proved that 28 elements of Leclanche's are amply equivalent to 40 of Daniell's. The Leclanche battery, put in comparison with the Marie, Davy, or the sulphate of mercury battery, much used latterly on telegraph lines, is preferred as it requires less care; the sulphate of mercury being also more expensive.

The cost of the sulphate of mercury in France is from 3 to 3¼ francs per kilogramme, or 2 pounds 4 ounces supposing all the residues collected and resold without loss; but as this is practically impossible, the cost is 7 francs per kilogramme. The kilogramme of manganese costs from 16 to 17 cents.

An element of Leclanche, remaining a year without working, will lose nothing except by the oxidation of the zinc in the atmosphere, and this is so insignificant it does not amount to one per cent. It is always ready to be set at work, and will last in a telegraph service from one to three years.

Over 20,000 elements of Leclanche are actually in use by different railroad companies in France and Belgium, and numerous telegraph stations have been working with perfect regularity for two years without the least interruption. It is principally used in France, Belgium, Holland, Austria, and Italy.

In France the *Chemin defer de l'Est* has adopted it, and the *Compagnie de d'Ouest* employs it with the apparatus of Tiers. It is also used in a great number of establishments for galvanoplasty, gilding, and silverplating, and at Brussels (Belgium), it regulates all the electric clocks.

C. WIDEMANN.

### Firing under Steam Boilers.

MESSRS. EDITORS:—The article from *The Engineer* on repaired boilers, in a late number of your journal, is so deeply interesting to me that I am strongly impressed to respond to it. I am well acquainted with the iron works referred to; and from my own knowledge I beg leave to speak in reference to their method of firing, as some of those boilers were known to me. They are fired at one end with slack of bituminous coal, fire space very large; and when the fire becomes incandescent great heat is evolved. The slack is generally thrown on while the fire is clear and in good condition, so as to more readily ignite it. But, to do this, it seems to be necessary to open the fire doors, which are generally large. Then what must be the effect of all the cold air that rushes in, while more slack is being thrown in? When once in, the

fire is cooled down very low. However, that is the practice, for the fireman thinks that one good firing is better than applying a little at a time, which would be the most judicious mode of firing. Thus we see the boiler is submitted alternately to intense heating and cooling, causing expansion and contraction to occur alternately, which operates on the patches, and on all weak parts, similar to expanding and contracting a pair of smiths' bellows.

It has been the grand object of my life to remedy the defects above mentioned, and I hope soon to present the world with a furnace that shall equalize at all times the temperature of steam boilers. ELI SLATER.

Philadelphia, Pa.

### Cheap Cotton Presses.

MESSRS. EDITORS:—I notice in your issue of Jan. 1, an inquiry for a "cheap cotton press," one that is within the means of a small planter, and which would be capable of putting forty pounds into each cubic foot. Having had twenty years' experience in manufacturing and supplying plantation machinery, my views on this subject may not be uninteresting.

But few persons unacquainted with pressing cotton, have any idea of the power that is required to press forty pounds of cotton into a cubic foot. If they will make the experiment—which can be done by taking a box one foot square, and six feet long, provided with a follower, at the top of which is a platform for loading with weights—they will find that at least twenty-five tuns will be required to force the follower to within twelve inches of the bottom of the box, or, in other words, to put forty pounds into a cubic foot. Estimating bales to average five hundred pounds each, about twelve cubic feet would make a bale, and would require the enormous pressure of over three hundred tuns. Any mechanic acquainted with the strength and cost of materials, knows that a "cheap" press to do this is an impossibility. The material alone would cost more than a small planter should pay for a press. Bales of this weight per foot are only made on the most powerful hydrostatic and steam presses to be found in all of the larger seaports of the South.

The bales, as they are received from the plantations, range from twenty to twenty-five pounds to the cubic foot, and contain from twenty-five to twenty cubic feet. To make these bales, a power of from four to five tuns to the cubic foot is needed; so that the pressure now required in making common bales is from eighty to one hundred tuns—a power which but few of the best presses will give, and work to the satisfaction of the planter.

These bales are, before shipment, where there is a steam press at the seaport, "compressed," as it is termed, and the bale reduced from one third to one half in size.

Such being the facts as they exist, the only remedy is in a reduction of the size of the bales, so that the same power which is now applied on the plantation, to a bale of twenty cubic feet, will be applied to one of, say, four cubic feet; which will put the forty pounds into each foot, and save the expense of compressing. Such bales could be easily handled, and would not be torn by hooks or rolled in the mud and water, as the present sized bales are. The press could be made smaller, would cost much less, and could be easily transported at low rates of freight. The manufacturer would receive his cotton in better order, and lose less by stealing and dirty cotton. With the present mode of packing cotton, it is estimated that after a bale leaves the planter it loses five pounds on an average, before it is consumed by the manufacturer; much of which could be saved by the substitution of small bales. J. M. ALBERTSON.

New London, Conn.

### How Small Things are Utilized.

MESSRS. EDITORS:—Reading the article in No. 3, current volume, entitled "How small things are utilized," called to mind two more facts of the same nature. I send them to you to do with as you may deem proper.

In the process of currying, leather is "stuffed" with fish oil and tallow. After stuffing, thin shavings are taken off by the workman. These shavings are purchased by parties who boil them down and extract the oil and tallow. The oil is made into "whale-oil soap," which is used by wool manufacturers for cleansing their goods. The tallow is made into common soap. The residue, after cooling, is cut into cakes and used as fuel to boil the next lot. Being more than sufficient for that purpose, the balance is sold for fuel or for manure.

The cotton waste used in some of our large machine shops and railroads is cleansed to be used again, and the oils also used for the same purpose as above. A READER.

Boston, Mass.

THEY tell a good story of a certain well-known professor of natural science. It was the custom of the doctor to encourage his geology class to collect specimens and bring them into the class for analysis and classification. So, one day a number of specimens were laid upon the table, and among them one broken bit, which, although streaked and stained to impose on the doctor, was really nothing but a piece of common brick. In due time the professor came to the specimens. Taking up one, he says at a glance, "This is a piece of baryta from the Cheshire mines;" holding up another, "This is a piece of feldspar from the Portland quarries; the next is a piece of quartz from Hadam; and this," coming to the brick, "is a piece of impudence from some member of this class."

THE well-known collection of minerals which Professor Bruce commenced at Princeton, N. J., in 1790, and which now numbers about five thousand specimens of American ores, is to be placed in the museum of the Maryland Academy of Sciences in Baltimore.

### The Washington Street Tunnel, Chicago.

From the Eighth Annual Report of the Board of Public Works of the city of Chicago, we are able to condense an interesting description of the character and final success of the above important work. The facts given are of much importance at the present time when so much attention is attracted to methods of communication between New York and the cities separated from it, by the North and East rivers.

The tunnel passes under the Chicago River, with its center line in Washington street. The eastern approach commences in the center of Franklin street and the western approach terminates in the center of Clinton street. The grade at Franklin street is 11·5 feet, and the grade at Clinton street 13·5 feet above low water or city datum line.

The bottom of the tunnel, or top of invert in the center of the river, is 32·4 feet below low water or city datum. The grades between the ends of the approaches and the center of the river are uniform, except 101 feet each way (east and west) from the center line of the river, in which there is a rise of 2·33 feet. The tunnel under the river comprises three passage ways; the south one for foot passengers, and the other two for horses and vehicles. The south passage is 10·83 feet high measured from the top of the invert to the bottom of the upper arch, and 10 feet wide. The other passages are 15·07 feet high and 11 feet wide.

These two passages for vehicles, however, extend only 111 feet each way from the center line of the river, where they merge into a single passage 23·33 feet wide, which is further narrowed in a distance of 40 feet to a width of 19·5, which is then maintained to the extremities of the tunnel. The entire length of the tunnel, including the open approaches from the centers of Franklin and Clinton streets is 1,605 feet 9 inches.

An interesting trial was made soon after completion of the tunnel, the object being to ascertain what loads could be conveniently drawn up the grades of the tunnel—and to prescribe limits to such, if it was found necessary. The trial took place January 26th, 1869, and the results are given below.

The steady throng of pedestrians and vehicles through the tunnel gives the best possible testimony to its utility. In the ease with which the passage under the river is made by pedestrians, and by all except very heavily-loaded teams, it more than answers all that was anticipated of it.

The passage through was from west to east, the teams entering at Clinton street in the west division, and coming out at Franklin street in the south division. The teams were all two-horse teams, and the vehicles four-wheeled trucks.

The descent from Clinton street to the bottom of the tunnel, is 43·75 feet, and the declivity 1 foot in 18·6265. The ascent from the bottom of the tunnel, to the eastern extremity of the approach at Franklin street, is 41·77 feet, and the declivity 1 foot in 16.

This last grade, it should be remarked, is regarded by the board as steeper than is desirable.

The distance through, from the top of the western approach to the top of the eastern, is 1,608.

FIRST TRUCK.

| | Pounds. |
|---|---|
| Weight of team, 2,600 lbs., weight of truck | 2,840 |
| " load | 3,605 |
| | 6,445 |

SECOND TRUCK.

| | |
|---|---|
| Weight of team, 2,500 lbs., weight of truck | 2,800 |
| " load | 3,700 |
| | 6,500 |

THIRD TRUCK.

| | |
|---|---|
| Weight of team, 2,500 lbs., weight of truck | 3,200 |
| " load | 4,080 |
| | 7,280 |

FOURTH TRUCK.

| | |
|---|---|
| Weight of team, 3,000 lbs., weight of truck | 3,485 |
| " load | 5,200 |
| | 8,685 |

FIFTH TRUCK.

| | |
|---|---|
| Weight of team, 2,600 lbs., weight of truck | 2,800 |
| " load | 6,365 |
| | 9,165 |

The trial, it will be observed, took place in winter, the roadway of the open approaches being somewhat snowy and slippery. All of the teams passed through without stopping. All but the last pulled up the ascent with ease; the last team with difficulty. Its gross load of over four and one-half tuns, was apparently about the measure of its strength.

### Photography on Canvas.

We were recently favored by Mr. Lothian, of Edinburgh, with a sight of some admirable examples of the mode of printing introduced some months ago by Mr. Davies, by which almost any surface, no matter how unsuitable for photographic purposes, gave fine pictures after treating with a sizing preparation consisting of a mixed solution of shellac and gelatin. It was suggested at the time that such a process appeared to be pre-eminently well suited for printing on canvas; and Mr. Davies and others promised to put the matter to the test of experiment. This has been done, and Mr. Lothian, who is well versed in canvas printing, has worked in conjunction with Mr. Davies for this especial branch, and with such satisfactory results that he has resolved to use no other.

For printing on canvas the chief modification of the formula consists in diluting the sizing solution considerably. The surface of the canvas, primed for printing, being non-absorbent, a much thinner coating of the lac and gelatin solution is desirable, as a thick film might cause some eventual tendency to exfoliation. The formula as originally given by Mr. Davies is as follows:

Take from four to six grains of gelatin, soak it in an ounce of water for an hour, then melt it gently over a fire, hot plate, or water bath, using a clean earthen pipkin. When fully dissolved, add to it, while yet warm, and stirring it gently during the mixing, from four to six drachms of a solution of white lac in methylated spirit, if for white or pale surfaces; but orange lac will do if the surface be of a darker color. This is made in the proportion of 6 ounces of spirit to 1 ounce of lac, and digesting it till fully dissolved. The mixture of the gelatin and gum lac in spirits produces a creamy-looking emulsion, to which is added four grains of chloride of sodium, or a like equivalent of chloride of ammonium or barium, and, when fully dissolved, filter through fine muslin into a clean pipkin, and it is ready for use.

This is, we believe, the formula still employed for paper with success, and we may remark, in passing, that for paper, a fifty-grain ammonia-nitrate solution gives a rich, velvety quality of picture, which is, in our estimation, much superior to that obtained with the plain silver solution. When the ammonia-nitrate is used, a fine, rich, purple brown tone is obtained by fixing in hyposulphite of soda, one part in eight of water, without toning.

In applying the process to canvas printing, the lac and gelatin solution is to be diluted with an equal bulk of water, or, we should presume, better still—in order to avoid the risk of precipitating any portion—with equal parts of alcohol and water. If the preparation be made for use with canvas, of course it will be made of the proper strength at once; but if the mixed solution have been prepared for paper, it must be warmed, and the proper proportion of alcohol and water added, a little at a time, stirring briskly. The preparation thus diluted remains fluid, and requires but slightly warming for use.

Previous to applying it to the painter's canvas, the prepared surface of the latter is sponged with a little methylated spirit, to remove dirt or grease, and prevent any tendency to repel the sizing solution. When the surface is dry, the lac and gelatin solution is applied smoothly with a sponge. The surface dries in a few minutes. The silver solution is applied with a tuft of cotton wool. We may observe here that ammonia-nitrate of silver is on no account to be used in exciting the canvas, as the alkali, rapidly acting on the priming of the canvas, would penetrate and dissolve it. The silvered surface being dry, the canvas is placed under a negative and exposed, the printing being more rapidly effected than with albumenized paper. When sufficiently deeply printed, the canvas is turned up at the edges, and secured at the corners by spring clips, so as to form a dish. Into the dish so formed the hyposulphite fixing solution is poured, and suffered to remain about ten minutes.

Mr. Lothian states that by observation he had arrived at a criterion of perfect fixation. When the surface is so thoroughly permeated by the fixing solution that it felt slightly soft and yielding when pressed by the finger, instead of being perfectly hard and rigid, experience has proved that the image is perfectly fixed.

When the image is fixed, one corner of the canvas is released from the clips; and, after pouring away the hypo., the surface is washed for a quarter of an hour by means of a flexible tube attached to the water pipe, care being taken at no stage of the proceedings to wet the back of the canvas. No toning is necessary, as the image, when fixed only, is of a rich, warm, purple brown tint, well suited to the purposes of the oil painter.

It will be seen that in this form of canvas photography printing direct from the negative is contemplated; where enlarging is necessary an enlarged negative is used, and a direct print produced therefrom. There is little doubt, however, that by the use of iodides and bromides the surface prepared with the same sizing solution might be made sufficiently sensitive for solar camera printing by development. —*Photographic News.*

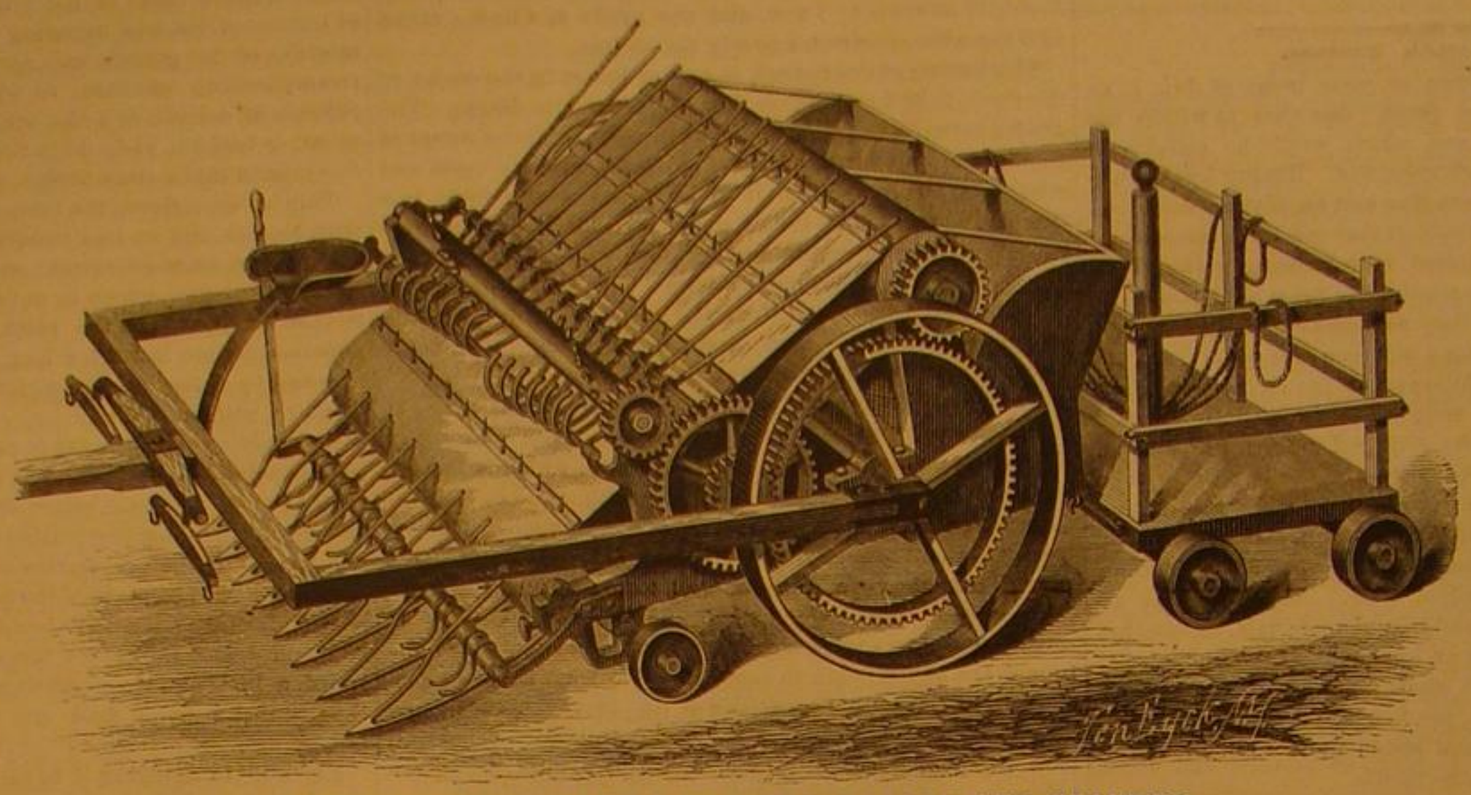
### Breech Loaders.

The breech-loading systems which have been adopted by the armies of the European States appears in the "Eastern Budget:" England—for the conversion of old rifles, the Snider; for new rifles, the Martini-Henry. France—for the conversion of some old percussion muskets, the Snider; for the new rifles, the Chassepot; a metal cartridge is now being made for the latter weapon, the old paper cartridge not being considered satisfactory. Russia—the Kruka for conversions, the 50,000 rifles already converted according to the Karte system having proved failures; Russia has also ordered 30,000 Berdan rifles from America, some of which have already arrived. Sweden and Denmark—the Remington, with Austrian barrels. Norway—not settled. Italy—Pettiti, similar to the Chassepot (for conversions only). Switzerland—for conversions, the Millbank-Amsler; for new rifles, the Vetterli; Switzerland also possesses 10,000 Peabody rifles. Turkey—the Snider, for conversions. Belgium—the Albini. Spain—the Remington. North-German Bund—the needle gun. Bavaria—for conversions, the Lindner-Podelwils; for new rifles, the Werder. Holland—the Snider, for conversions. Montenegro has obtained 2,000 Kruka rifles from Russia. Austria—for conversions, the Wanzl; for new rifles the Wernal. Papal States—the Chassepot. Roumania—the Peabody.

A PATENT for warming piano-forte keys, so as to make practicing a pleasure in the coldest weather, is announced in London. The improvement is made by means of little cylinders of hot water concealed under the keys.

### Combined Hay Rake, Thrasher, Loader, and Stacker.

We have spoken in previous articles of some peculiar combinations in agricultural machinery, designed to perform simultaneously several kinds of work. The machine herewith illustrated is a combination of this kind. Its general appearance is well shown in the engraving, but as all the parts cannot well be referred to in detail in an engraving made on so small a scale, we must content ourselves with such a general description as shall give the reader a conception of the character of the machine, and the work it is designed to perform.



HAMMOND'S HAY RAKE, THRASHER, LOADER, AND STACKER.

The machine is drawn like the ordinary mowing machine, and the movable parts are also impelled by driving wheels, in a similar manner to that by which the working parts of mowing machines are actuated. The hay is gathered by curved teeth at the front of the machine. From the gathering teeth it is caught by rows of short straight teeth, attached to an endless apron or carrier, and is drawn back toward a truck-rack at the rear of the machine. The endless apron or carrier is made of canvas, or other suitable material, and its upper half passes, in its progress toward the truck-rack, under a series of rods, or whippers. These rods, or whippers are driven by a cam-roller, which causes them to beat the hay violently. The seed thus beaten out is caught in the endless apron, and deposited in a box placed between the endless apron and the truck-rack. A forcible motion is imparted to the beaters by means of springs.

A set of gleaner teeth supplement the work of the first teeth, and when they become charged, a lever is employed to bring them so near the teeth on the endless apron, that their contents are seized and carried back with the rest of the hay to the truck-rack. The gleaning teeth are then dropped into the position shown in the engraving.

The truck-racks, of which there should be a sufficient number to keep the machine in full operation, are detachable; and as soon as one of them is loaded with hay it is replaced by another, and the loaded one is drawn to the stack or mow, where it is elevated by a derrick, and its entire contents are discharged at once.

The inventor has also devised a convenient derrick, calculated to facilitate the operation of stacking. If the hay is to be pressed, it is lifted only from the truck to the press, the charge of the truck-rack being just enough for a bale. When the loads are deposited in the stack or mow, they are readily separated, and the mass divided without the use of a hayknife.

The seed, in passing from the endless apron to the seed-box, is screened by the action of two wires of different fineness.

Although it is employed in a modified form, we have in this device a recognition of the principle enunciated in our description of another hay-loading machine in this issue, namely, the endless apron to convey hay from the rake to the load. We repeat that in our opinion this principle will, in various forms, be ultimately employed in most machines of this class, and the time cannot be far distant when machines for loading hay will be as common as horse hay forks.

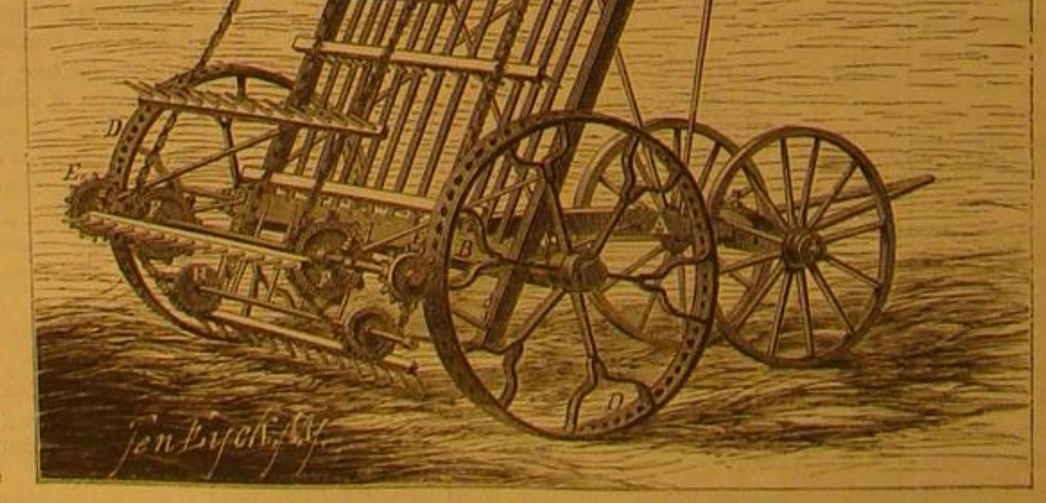
This invention was patented through the Scientific American Patent Agency, November 30, 1869, by James R. Hammond, of Sedalia, Mo., whom address for further information.

### Hay Raker and Loader.

We have already said so much on the importance and necessity of hay loading machines that we need not on this occasion repeat what must be familiar to every reader of the SCIENTIFIC AMERICAN. In the machine under consideration we recognize the embodiment of a principle, which we long ago predicted would ultimately be adopted in machines of this class; namely, the continuous gathering up and transfer of the hay to the load by means of endless belts and an apron extending upward somewhat higher than the top of the load.

In the machine before us we perceive a development of this crude idea, which has always seemed to us the most promising of all mechanical appliances for this purpose. The arrangement of parts is simple and free from complications, and the mechanical expert will readily understand the action of the machine without verbal description. We shall, however, in behalf of those not accustomed to the analysis of machinery give an explanation of the details and the operation of the machine.

To the back axletree of any common farm wagon is connected the pole, A, of the hay raker and loader. This pole is attached to the axletree, B, of the machine. The pole is firmly braced back to the axletree, and upward to support the inclined frame, C, of the machine. Upon the axletree, B, are placed driving wheels, D, which actuate the pinions, E. These pinions are attached to a shaft running in bearings supported from the framework, C, and through ratchets and pawls, they actuate the rag-wheels, F, whenever the machine moves forward, but allow them to cease their revolution in backing the machine. Endless chains, G, passing over the pulleys, H, are impelled by the rag-wheels, F. To these endless chain bands are attached, at proper and equal intervals, rakes which collect the hay and draw it up along the inclined wood framework until it reaches the top cross-bar, when it falls off the rakes upon the load, where it is received and arranged by a workman in the usual manner.



WILLARD'S HAY RAKER AND LOADER.

It will be noticed that instead of being toothed, the driving wheels have their rims perforated, which prevents clogging by dirt, as the teeth of the pinions, E, punch them out at each revolution.

In operation the horses attached to the wagon are driven so that the winrow or swath lies between them and passes under the wagon between the wheels, so that the rakes continuously gather the hay and pass it up the inclined frame as described above. When the load is obtained, the machine may be disconnected and the load conveyed to the barn or stack, leaving the machine in the right place to commence loading upon the return of the wagon.

We are informed that this machine has been thoroughly tested during two haying seasons, and has been found to work excellently, and that it has shown itself capable of loading fifty tuns of hay from the winrow in five hours.

With such rapidity we should think it would be necessary to have more than one man to distribute the hay upon the wagon so as to form a proper load, but the inventor informs us that one active man can do this part of the work. A machine of this kind capable of such rapid work must greatly facilitate the securing, in good order, of a hay crop.

Patents bearing date August 21, 1866, and October 15, 1869, have been secured through the Scientific American Patent Agency, by Hosea Willard, of Vergennes, Vt., who will dispose of territory to manufacturers, and who may be addressed for further particulars.

### A Final Zoic Catastrophe.

There are chemical changes now active on the earth's surface, whose continuance must inevitably bring about the final extinction of man, and ultimately that of all other life upon our planet.

What furnishes the actual fundamental chemical nutriment or pabulum of vital existence? No chemist will contradict, when I say that it is the carbonic acid of the atmosphere. How long is this going to last? There is one mode of consumption, active and continous, which will ultimately exhaust the air of its carbonic acid, and thus put an end to organic life This agency is itself due to vital influences. It is that by which marine animals with calcareous shells or skeletons secrete carbonates from the ocean water, the carbonic acid of these carbonates having been originally derived from the atmosphere. Such carbonic acid thus passes into solid forms, permanent and forever unavailable thereafter. This is where the great machine runs down, and Affinity obtains its final victory over its mysterious antagonist, Vitality.

Whenever the last molecule of carbonic acid produced from the combustion of all the carbon on the earth shall have been locked up in this shape, no form of life now known to us can any longer be possible, and the present Zoic Cycle must end. Comparatively and geologically speaking, the end is near; though millions of years may yet intervene. But long before this end of *all* life, the atmosphere must gradually diminish in its capacity to produce food suitable for man. Man, by burning up the carbon stored in eras past in the earth's *viscera*, is doing his utmost to preserve the status of the machine, possibly even partially and temporarily *rewinding* it; but it must still continuously run down. In the oceanic depths, this precious constituent of the air is continually undergoing

A sea-change
Into something rich and strange,"

Never to reappear in form available to life, until indeed that time shall arrive when "the elements shall melt with fervent heat;" and, when, under the influence of this heat, the calcic and magnesic carbonates shall be converted into igneous silicates, rendering up again the treasure of carbonic acid in their marble grasp, the atmospheric oxygen, representative of Affinity, enemy of Vitality, shall also then be at least partially withdrawn by oxidation of sulphides and of ferrous oxide; and the earth be thus far advanced in preparation for a new Zoic Cycle. —*Pof. H. Wurtz.*

EDITORIAL COURTESY.—D.D.T. Moore, the enterprising publisher of the *Rural New Yorker*, gave an elegant entertainment to members of the press, at his residence on Fifth avenue, on Wednesday evening, the 2d inst. The floral display was extensive, the music fine the table bountiful with fat "wine on the lees." A large variety of delicious fruits was served, all of home production —oranges from Florida, apples from Kansas, grapes from New York, and so on. Thus nearly every State contributed to the entertainment, which seemed to be enjoyed by all present

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## THE ATTAINMENT OF BEAUTY IN COMMONPLACE HANDIWORK.

Is there any real advantage in having all that surrounds us beautiful, so far as may be, consistently with other requirements? Is man any the better or happier for cultivating the sense of the beautiful and gratifying that sense within reasonable limits? There have not been wanting those who have answered these inquiries with an emphatic "no," and who have even gone so far as to assert that all mere gratifications of sense are snares of the devil, to be shunned by all such as would keep their hearts pure and aspire to a better life hereafter.

On the contrary, there have been a large class of philosophers who have no less sincerely believed that the love of beauty in nature and art has a refining and elevating influence upon the mind and soul of man; and that its indulgence tends to draw him nearer to the great Author of all good, which term includes beauty. Whatever is beautiful, say these philosophers is so far good. To love and admire beauty is therefore to love and admire goodness; and therefore the man whose heart delights in the beautiful is so much the better for it. This belief we hold, and we therefore maintain that a proper attention to the attainment of the beautiful in every work of his hands is a duty which every man owes not only to himself but to others.

Most men feel themselves impelled to do something towards the adornment of any kind of handiwork, no matter how humble or simple it may be; but as the sense of the beautiful is, in the vast majority of minds, very imperfectly developed, their attempts too frequently rather result in forms and colors repulsive to a refined and cultivated taste.

The really beautiful is only attainable through patient cultivation of taste. How then can ordinary mechanics whose time is mostly occupied in toil, and whose daily walk is among rude rather than graceful forms, ever attain such cultivation? This is a question which we find it quite difficult to answer satisfactorily. In France where—going or coming—every workman can scarcely fail to see and be impressed with some form of beauty, the art sense has become so highly developed in all classes of people, that the designs of French workmen and work-women, find ready acceptance in any market of the civilized world; and that country unquestionably now stands at the head of all nations in the arts of design.

There is always a singular appropriateness in French designs. You feel even while you are looking upon the box from which you eat your Paris *bon-bons* that the ornament on it is just the right thing in the right place.

While the art sense is so highly developed in the French mind, it manifests itself very faintly indeed in the American mind. The large majority of all designers, decorative artists, and makers of fancy and ornamental wares in this country are of foreign extraction. These facts will not be disputed, and therefore need no argument; but that we, with so few objects of taste to which our workmen can have daily access, are ever to elevate the taste of our working classes, seems, to say the least, problematical. New York, the Paris of America, has it is true done something which will tend to produce this desirable result. Her magnificent Central Park, to which working-men and working-women have free access, contains much that cannot fail to appeal to the artistic sense of the rudest workman. A small art collection exists in the Cooper Union building, which may be visited in hours of leisure by mechanics. The last twenty years have added much to the architectural beauty of the city. But beyond this all that is likely to cultivate the taste of working people is what may be seen in the shop windows. We have no magnificent art collections, to which artizans may have free access, and the metropolis is yet poor in the public art wealth which enriches all parts of the French capital.

Still, in the absence of such collections of art as may be found in the old world cities, it seems we might do something to stimulate the growth of a feeling for art. It does not seem essential that costly statues or paintings should be accessible, in order that such ideas of art as would be useful in handicraft may be obtained. Copies of rich and elegant designs in the various departments of the mechanic arts might be collected at a comparatively small expense, which would not only be very interesting and attractive, but very instructive to inspect and study. Such a collection would be a valuable, useful, and honorable addition to the facilities which private benevolence has bestowed upon the city for the instruction and improvement of the working classes.

It is to be hoped that some steps will ere long be taken to secure such collections, in all the principal cities of the United States, and to make them accessible at such hours as workmen are at leisure. They could be made made without very great cost, and certainly would greatly tend to improve all classes of mechanics, especially such as are engaged in those arts that require superior taste and appreciation of beautful forms and combinations of color.

## TECHNICAL EDUCATION IN THE UNITED STATES—THE SHEFFIELD SCIENTIFC SCHOOL OF YALE COLLEGE.

The importance of scientific and technical education is generally acknowledged both in this country and in Europe. Old systems have been forced to yield in some measure to the current of popular opinion, and at the present time there are quite a number of scientific and technical schools established in various parts of the country.

It is no fault of these schools that the common school instruction has not as yet been modified to fully accord with modern views on this subject. It is doubtless the proper purpose of common school instruction to supply a knowledge of reading, writing, and arithmetic, with an outline of grammar and geography. These simple and homely tools, especially the three first, are all important to subsequent success in business or study. But they are by no means the only benefits which the common school should afford.

A mind trained to habits of minute and accurate observation, and to the analysis of things and events, is of more importance than a knowledge of either or all of the elementary branches now taught. With a mind so trained, a knowledge of whatever is necessary to future progress, not only can be, but *will be* obtained. We hazard the opinion that no youth possessing this quality of mind in a high degree, combined with physical health, ever failed to rise above the common level in the respect of his acquirements.

But while the pupil is mastering the elements of reading, writing, arithmetic, etc., his faculties of observation and analysis may not only be cultivated, but in so far as they are cultivated, in so far will his progress in any and all branches of study be facilitated. It is foreign to our purpose to elaborate arguments to substantiate this proposition. It will, undoubtedly, be confirmed by the opinions of all those who have attained eminence as instructors, or who have made the human mind the subject of careful study.

If this be a fact—and if, as we believe, the presentation of natural objects to the eyes and minds of pupils for inspection and minute examination, be the best and most natural means of cultivating the power and habit of observation—it follows that this sort of training cannot be begun too early or persevered in too long. The place then for the commencement of natural science teaching is the common school; the place for its continuance and more extended employment is the high, or grammar school, and the college and university should only complete it so far as aid of special appliances and instructors are concerned. A graduate thus trained will not only be competent but disposed to continue his progress without special aids other than those which he can himself supply.

The subject of technical education in all its bearings is one that cannot be discussed in brief. Our present purpose is to show that while we have a number of institutions specially set apart for scientific instruction of the most thorough kind, and fitted out with the most improved apparatus, and with ample collections of specimens to facilitate study, they are some of them even thus early languishing, because, through the inattention to early scientific training, the tastes of a majority of our young men and women are turned to other pursuits.

The scientific schools which seem to prosper most are those which devote themselves to special departments, as engineering or mining, or both. Some of those intended to furnish facilities for the pursuit of all departments of scientific study, can hardly yet stand alone. The reason for this is that the large corps of professors necessary to conduct the several departments require for their support more than can be realized from the tuition of the students and the income from their endowments. Institutions so situated are troubled to retain the proper talent in the different professorships, and the grade of ability would be speedily lowered, were it not that in some notable cases, there have been found able men willing to forego positions of honor and emolument rather than to see the cause of sound scientific education suffer.

Such a case is presented in the present condition of the Sheffield Scientific School, at Yale College. This school is intended to provide a special professional training for the engineer, chemist, naturalist, etc. Through the gifts of various liberal donors it is possessed of an endowment of $420,000. The corps of professors is large, and the apparatus, building, etc., have been much enlarged since the erection of the first structure—Sheffield Hall, so called from the founder of the school, Mr. Joseph E. Sheffield, of New Haven.

An effort is now making to increase the endowment of the school by $250,000, in order, as the committee state in their circular letter, "to perfect their plans for giving a college training based on modern studies for modern avocations." They further state that "they do not propose to employ any paid agency, or to use any personal pressure in securing this amount, but they ask the influence and aid of all who think that the country will be benefited by the maintenance of this undertaking. The sums now collected will not go into 'bricks and mortar' but will be permanently held as an Instruction Fund to carry on and improve the education now given."

The committee are Professors Daniel C. Gilman, Geo. J. Brush, and Chester S. Lyman. We sincerely hope that their appeal to the generous friends of "Good old Yale" and the friends of education everywhere in America, may result in securing the full amount required to carry out the plans of the institution they represent.

## REPORT OF THE COMMISSIONER OF PATENTS FOR THE YEAR 1869.

UNITED STATES PATENT OFFICE,
January 27, 1870.

SIR:—In accordance with the act of March 3, 1837, which requires the Commissioner "to lay before Congress in the month of January, annually, such information of the state and condition of the Patent Office as may be useful to Congress or to the public," I have the honor to submit the following report of the business of this office during the year 1869.

The receipts and expenditures for the year, and the condition of the balance in the treasury, standing to the credit of the patent fund at its close, are shown in the following statements:

NO. 1.

| | | |
|---|---|---|
| No. of applications for patents during the year 1869 | | 13,271 |
| No. of patents issued, including reissues and designs | | 13,986 |
| No. of applications for extensions of patents | | 153 |
| No. of patents extended | | 108 |
| No. of caveats filed during the year | | 3,624 |
| No. of patents expired during the year | | 2,083 |
| No. of patents allowed, but not issued for want of final fee | | 997 |
| Of the patents granted, there were to citizens of the United States | 13,443 | |
| Subjects of Great Britain | 294 | |
| Subjects of the French Empire | 91 | |
| Subjects of other foreign governments | 159 | |
| | | 13,986 |

NO. 2.—STATEMENT OF MONEY RECEIVED DURING THE YEAR 1869.

| | |
|---|---|
| Amount received for applications, caveats, etc. | $632,700 65 |
| Amount recived for copies and for recording assignments | 60,445 16 |
| Total | $693,145 81 |

NO. 3.—STATEMENT OF EXPENDITURES FROM THE PATENT OFFICE FUND FOR 1869.

| | |
|---|---|
| Cash paid for salaries and for miscellaneous contingent expenses | $486,430 74 |

NO. 4.

| | |
|---|---|
| Amount to the credit of the patent fund January 1, 1869 | $324,330 57 |
| Excess of receipts over expenditures during the year 1869 | 206,715 07 |
| Leaving a balance on the 1st of January, 1870, of | $531,045 64 |

NO. 5.—STATEMENT SHOWING THE BUSINESS OF THE OFFICE FOR THIRTY-THREE YEARS, FROM 1837 TO 1869, INCLUSIVE.

| YEARS. | Applications filed. | Caveats filed. | Patents issued. | Cash received. | Cash expended. |
|---|---|---|---|---|---|
| 1837 | — | — | 435 | $29,289 08 | $33,506 98 |
| 1838 | — | — | 520 | 42,123 54 | 37,402 10 |
| 1839 | — | — | 425 | 37,269 69 | 34,543 51 |
| 1840 | 765 | 228 | 473 | 38,056 51 | 39,030 67 |
| 1841 | 847 | 312 | 465 | 40,413 01 | 52,669 87 |
| 1842 | 761 | 291 | 517 | 36,505 08 | 51,241 48 |
| 1843 | 819 | 315 | 531 | 33,313 81 | 30,776 95 |
| 1844 | 1,045 | 380 | 502 | 42,509 26 | 36,244 73 |
| 1845 | 1,246 | 432 | 502 | 51,976 14 | 39,395 65 |
| 1846 | 1,272 | 448 | 619 | 50,264 16 | 46,158 71 |
| 1847 | 1,531 | 553 | 572 | 63,111 19 | 41,978 35 |
| 1848 | 1,628 | 607 | 660 | 67,576 69 | 58,905 84 |
| 1849 | 1,955 | 595 | 1,070 | 80,252 78 | 77,716 44 |
| 1850 | 2,193 | 602 | 995 | 89,927 05 | 80,100 95 |
| 1851 | 2,258 | 760 | 869 | 95,738 61 | 86,916 93 |
| 1852 | 2,639 | 596 | 1,020 | 112,696 34 | 95,916 91 |
| 1853 | 2,973 | 701 | 938 | 121,577 45 | 122,869 83 |
| 1854 | 3,324 | 868 | 1,902 | 163,789 84 | 167,146 32 |
| 1855 | 4,435 | 901 | 2,034 | 216,459 35 | 179,549 33 |
| 1856 | 4,960 | 1,024 | 2,302 | 192,388 02 | 199,301 02 |
| 1857 | 4,771 | 1,010 | 2,910 | 196,132 01 | 211,582 09 |
| 1858 | 5,364 | 943 | 3,710 | 203,716 16 | 193,198 74 |
| 1859 | 6,225 | 1,097 | 4,808 | 245,942 15 | 210,228 41 |
| 1860 | 7,053 | 1,094 | 4,819 | 256,284 59 | 252,820 89 |
| 1861 | 4,613 | 700 | 3,340 | 137,354 44 | 221,491 91 |
| 1862 | 5,038 | 824 | 3,521 | 215,754 29 | 182,810 39 |
| 1863 | 6,014 | 787 | 4,179 | 195,508 29 | 189,414 14 |
| 1864 | 6,932 | 1,003 | 5,020 | 240,918 88 | 229,988 00 |
| 1865 | 10,664 | 1,937 | 6,616 | 348,701 84 | 274,199 34 |
| 1866 | 15,309 | 2,723 | 9,450 | 495,995 38 | 301,724 28 |
| 1867 | 21,276 | 3,597 | 13,015 | 646,361 92 | 630,283 32 |
| 1868 | 24,439 | 3,705 | 13,328 | 681,503 96 | 628,678 77 |
| 1869 | 19,271 | 3,624 | 13,986 | 693,145 81 | 486,430 78 |

It will thus be seen that, with average receipts and expenditures not greatly varying from those of the past year, the net income of the office will be about $200,000 per annum; and that there is now standing to the credit of the patent fund a balance of over $530,000.

This fact should be borne in mind in connection with any suggestions relating to increase of salaries, or facilities for performing the work of the office.

The Patent Office earns all the money which it expends, or proposes to expend; and as the inventors give, in the form of useful invention, quite as much as they receive by way of protection; as they are, moreover, taxed as citizens, as manufacturers, and as vendors of their patents and inventions, it would seem to be unjust to tax them again, in the form of additional fees, for the support of the Government or the payment of the national debt.

The patentee does not pay these fees as a compensation for the exclusive privilege which he receives. For that, he makes a full disclosure of his invention, for the future benefit of the nation. The fees are intended solely to pay the necessary expenses incurred in the examination of the invention and in the issue of the patent. In all other countries, the fund derived from the patent fees is applied to the advancement of science The fees which are paid in this coun-

try are less than in any other, but if they are more than is needed for the expenses of the Patent Office, as at present organized, it is but fair, either that the fee should be reduced, or that the balance should be employed in such increase of the force of the office, or in providing such publications and appliances, as may increase the ease, thoroughness, and efficiency of the work of examination.

INVENTIONS IN SOUTHERN STATES.

One of the most gratifying results of the restoration of peace and of the introduction of a new system of labor in the South, is found in the increase of applications for patents from that part of the country. During the past year forty-six patents were granted to citizens of Alabama, eleven to those of Arkansas, five to Florida, sixty-eight to Georgia, eighty-six to Louisiana, fifty-three to Mississippi, forty-four to North Caroline, twenty-four to South Carolina, sixty-nine to Tennessee, forty-four to Texas, eighty-six to Virginia, and thirty-seven to West Virginia.

In the class of agriculture, the examiner reports that "in 1859 the number of applications from the South, as compared with those from the North, was less than two and a half per cent of the whole number. In 1869 the number of applications from the South was increased to over twenty-three per cent of all the cases in my class."

What the Pacific Slope and the Great Basin are doing in the way of invention may be inferred from the fact that in 1869 there were granted two hundred and sixty-six patents to California, thirty-nine to Oregon, four to Nevada, two to Washington, ten to Colorado, three to Dakota, one to Idaho, one to Montana, and two to Utah.

GROWTH OF THE PATENT OFFICE.

Few persons realize the rapid growth of the office, and the annual accretion of material. The models increase at the rate of one hundred square feet per week, or five thousand square feet per annum. The drawings increase at the rate of seventy-two cubic feet per annum; the files at the rate of four hundred cubic feet; the printed specifications at the rate of four hundred and twenty-five cubic feet; the printed drawings at the rate of four hundred cubic feet; the books in the library at the rate of one hundred and sixty lineal feet of shelving; and the copyright books at the rate of one hundred lineal feet. There will be twenty thousand more cases to be examined this year; and, if the applications made in the present year should not exceed those of 1869, they will still add, with models and drawings, twenty thousand new cases to be inspected by the examiners of future years.

It must soon become a serious question to determine what disposition is to be made of the models. In a vast number of cases no such illustration is required, the inventions are so simple that they can be readily understood by good drawings. Models soon become broken and inoperative, and in some cases have been altered surreptitiously, so as to become false witnesses.

We may take just pride in our national museum of the mechanic arts, but it is questionable whether this museum can be allowed to grow at the rate of five thousand square feet per annum.

A remedy for the difficulty will probably eventually be found in dispensing with all models, except when, in the discretion of the Commissioner, such mode of illustration is absolutely necessary. This would relieve inventors of a very considerable tax, as the preparation of the model is usually the most costly part of the application.

It is also a question for serious consideration, whether the rejected applications should be used as references to defeat new applications. Many cases have been rejected because the devices were impracticable and useless, or because they in turn were anticipated by others. Since their rejection these cases have been kept in pigeon-holes not open to public inspection. The public has taken nothing by the description of the alleged invention, and probably in the great majority of cases the manufacture of the article has never been commenced. Such mere descriptions or sketches of an invention not reduced to practice or made accessible to the public, but kept in the library of a private person, would not destroy a patent. It is not perceived that they should have this effect because the pigeon-hole in which they are entombed is in the Patent Office, rather than elsewhere.

To reject applications upon patented or published cases and pending applications only, would probably protect the public from real injury as well as by the present system, while it would diminish the labor of the office in the work of examination fully one third.

Otherwise, although the number of applications to be examined be the same from year to year, the work of the examiner is constantly increasing, since each year's accumulations are added to his portfolios. A gradual increase of the examining corps from year to year becomes, therefore, absolutely necessary.

QUALIFICATION OF EXAMINERS.

Although ample means are provided for the correction of an erroneous decision of an examiner, when adverse to the grant of letters patent, there is no check to his action, when favorable to the applicant, except the general authority lodged in the Commissioner. But it is impossible to revise the cases that are passed for issue except in special instances. It becomes very important, therefore, to secure competent men for positions of such responsibility. An examiner should be a man of great patience, industry, and honesty, of varied and yet thorough mechanical and scientific attainments, with a good knowledge of patent law, and a mind capable of the nicest discrimination. Though many men offer themselves for the position, but few are fit to fill it. As a rule, it is entirely safe to say, that no man should be appointed a principal examiner who has not served as assistant, thus becoming thoroughly conversant with the practice of the office, and demonstrating his capacity. But the demand for qualification does not apply to examiners only. So numerous are the applications for patents that assistant examiners, and even examiners' clerks, are charged with a portion of the duty of examination, as soon as it is possible thus to employ them.

Other clerical positions in the office require in the incumbents a knowledge of the different classes and machines, that many men do not possess, although they may be otherwise competent as clerks.

It is obvious, therefore, that the ordinary rules regulating the appointment of clerks in other bureaus, cannot safely be followed in this.

COMPETITIVE EXAMINATIONS.

These considerations have led to the adoption of competitive examinations as the basis of nominations for office. It may be conceded that, by this method, in exceptional cases, a competent man may be kept out of office, but an incompetent one can very rarely come in. To lessen the chances of error, great care has been taken in adapting the examination to the work to be done, so that theory and practice must both be combined to achieve the highest measure of success. Two of these competitive examinations have been held for the position of second assistant examiner. At the first, seventeen candidates were present; at the second, twenty-four. As an illustration of the working of the system, the following table will show the antecedents of the four candidates who stood at the head of the list at each examination. From this it will be seen that the young and old, the practical and theoretical, those in and those out of the office, are very fairly represented:

FIRST EXAMINATION.

| No. | Age. | Education. | Practical experience. | Army or Navy service. | Previous office service. |
|---|---|---|---|---|---|
| 1 | 22 | High school. | 3½ years machinist. | None. | 1 month. |
| 2 | 50 | Collegiate. | 32 years engineer. | 8 years. | 21 months. |
| 3 | 20 | Collegiate. | 2 years cabinet mak'r. | None. | 2 months. |
| 4 | 28 | Academical. | 8 years printer. | 2¼ years. | 2 years. |

SECOND EXAMINATION.

| No. | Age. | Education. | Practical experience. | Army or Navy service. | Previous office service. |
|---|---|---|---|---|---|
| 1 | 40 | Collegiate. | 5 years. | None. | None. |
| 2 | 31 | Common school. | None. | 2½ years. | 2½ years. |
| 3 | 37 | Collegiate. | None. | 1 year. | 2 months. |
| 4 | 33 | Collegiate. | Leather manufactory 6 months. | None. | None. |

To secure impartiality the examination was conducted by persons who had but slight acquaintance with the candidates, the latter being known only by private marks.

One hundred questions were put, copies of which were furnished to each candidate. The answers were in writing, and they were examined and marked, and the relative averages made up before the names of the candidates and their work were identified.

The list furnished by these examinations has been used in supplying such vacancies as have occurred, and the result upon the office at large, and especially as shown in the character and capacity of new employés, has been most gratifying.

THE AMERICAN SYSTEM.

Letters patent for invention in this country are in the nature of a contract between the public and the original and first inventor, whereby he receives the exclusive privilege of exercising his invention for a limited time, as a compensation for his time, ingenuity, and expense in perfecting the invention and reducing it to practice; for the communication of it to the public, and for their right to use it freely when the exclusive right of the patentee expires.

An invention is property of the highest order. Whatever may be said of the right which man may acquire in the soil, by his occupancy of it, or in the materials with which he works, or in the profits of his barter, it would seem to be a self-evident proposition that he is the owner of that which he creates; and that when his ideas, no longer vague or dreamy speculations, have taken useful form and been reduced to practice, not the abstract ideas, but the concrete and embodied principles are his own, to dispose of as he will.

As it is impossible to pay for useful inventions in money, we pay in time, which the inventor must turn into money if he can.

To insure the fairness of this transaction, under the patent laws of the United States, an examination is made into the novelty of the invention prior to the granting of the patent. This investigation includes an examination of the patents already granted, of the applications rejected, of the foreign patents, printed copies of which are furnished to us, and of the text books and cyclopedias. In making the examination reliance is placed for the most part upon the drawings; the text and models being resorted to only where the drawings are obscure and need further explanation.

As nearly one hundred thousand patents have been granted, and fifty thousand applications have been rejected, in this country alone, it is manifest that this examination is not an easy task. It would be impossible to make it without a careful classification of the subjects of invention, and without the assistance of trained and skillful examiners. With these appliances it is for the most part accurately made at a cost of only fifteen dollars for each application.

I do not hesitate to say that such an examination made by skilled, sworn, and impartial experts is more thorough and satisfactory than it would be, if made at much greater cost, by solicitors, who made it in the interest of their clients.

Accordingly, the history of patent litigation will prove that but few patents have been held to be void by reason of the existence of prior inventions, the knowledge of which was beyond the reach of the Patent Office. The great source of litigation is the conflict upon the issue of infringement, or the effort on the part of the inventor to carry the patent beyond the limits assigned to it by the office at the time of its issue.

However good the patents may be, as representing an invention of undoubted novelty and technical utility, doubtless many of the inventions covered by them prove worthless upon practical test. The number of useless inventions is, however, much less than is commonly supposed.

Our patent laws have proved such a stimulus to invention, and have fostered so many valuable improvements, that we can well afford to patent some trash. A patent for a useless contrivance does but little harm, if it carefully defines the invention, since men will neither use nor steal that which is good for nothing. It must, however, be borne in mind that many good inventions are not developed for want of means, and many are laid aside because, although good and useful, and in advance in the art to which they belong, others, their cotemporaries, are so much better and cheaper that they catch the public eye and secure the market.

Whenever the need of a new invention is suggested, the Patent Office is inundated with the applications of those who attempt to supply the demand. Some of these are crude, but suggestive of improvements, and very many are useful. Some few, however, in each class will prove to be the best and cheapest, and these alone will come into notice to the exclusion of others. The protection afforded by the patent and the hope of reward have proved the incentives to invention, and the public, enabled to choose from many devices, obtains the best thing.

Of course the larger number of patents now granted are for improvements, and for new combinations. Some of these are doubtless trivial, while many are of real benefit. The issue of patents for mere technical combinations is mainly due to the present system of patent soliciting.

Where establishments are organized for the purpose of procuring patents, they are apt to become more solicitous about the number than the quality of those which they obtain. This tendency is aggravated by those who solicit patents upon contingent fees, or who, without special training or qualifications, adopt this business as an incident to a claim agency, and press for patents as they press for back pay and pensions. Such men are often more desirous of obtaining a patent of any kind and by any means than they are of obtaining one which shall be of any value to their clients. Inventors are often poor, uneducated, and lacking in legal knowledge. They desire a cheap solicitor, and do not know how to choose a good one. They are pleased with the parchment and the seal, and are not themselves able to judge of the scope or value of the grant. Honest and skillful solicitors, with a thorough knowledge of the practice of the office and of patent law, and who are able and willing to advise their clients as to the exact value of the patents which they can obtain for them, may be of much service to inventors. There are many such, but those who care for nothing but to give them something called a patent, that they may secure their own fee, have in too many instances proved a curse. To get rid of their client and of trouble, they have sometimes been content to take less than he was entitled to, while in many cases they have, with much self-laudation, presented him with the shadow, when the substance was beyond his reach. Between such men and the office the strife is constant. They have the ear of their client, and, to some extent, of the public, and much of the misrepresentation of the spirit and character of the work of the office is directly traceable to this source. It must be said, however, in justice to attorneys, that many inventors are so foolish as to wish to obtain patents for trading purposes, or as a salve to wounded expectations, even when they know that the grant covers nothing of value unless it be combinations which, if never made before, are never likely to be made again, even by themselves.

REGISTRATION SYSTEM.

The patent system in vogue in Europe is substantially one of registration. Patents are granted upon the application of the inventor, without examination into the novelty or utility of the invention. The responsibility is thrown upon him of so framing his specification and claims that they will bear the test of subsequent investigation. This he does at his peril; and if he attempts to make any preliminary examination into the state of the art, he can do it only by the aid of solicitors, whose charges are far greater than the fees for a similar service would be if the work were done by sworn officers. But, although no examination is made, the patent fees abroad exceed those which the inventor pays in this country. This will appear from the following table:

| COUNTRIES. | Duration of patent. | Fees. |
|---|---|---|
| United States | 17 years. | $ 35 |
| Great Britain | 14 years. | 875 |
| France | 15 years. | 800 |
| Russia | 10 years. | 450 |
| Italy | 15 years. | 200 |
| Bavaria | 15 years. | 115 |
| Austria | 15 years. | 350 |
| Belgium | 20 years. | 420 |
| Prussia | 15 years. | 100 |

That the foreign plan is inferior to what I have called the "American system" of examination, will appear from the following considerations: During the year 1869, 19,271 applications were filed in the United States Patent Office. Of these, 5,285 were rejected finally, and no patents were granted upon them. These constitute about twenty-eight per cent of the whole number. By the English or foreign system, all of these rejected applications would have become patents, and 5,285 worthless patents would have been foisted upon the country. But this is not all. Of the 13,986 patents which were actually issued, about 12,500 were rejected in the first instance, and were only finally allowed after material modifications of the specifications or claims. By far the greater part of these modifications were in the nature of limitations

of claims, which would otherwise have been too broad. In other words, the applicants for 12,500 of the patents issued during the past year originally claimed too much, and were required to abate their pretensions before the grant was made. If the patents had been issued as they asked for them, they would have deceived the public as to the scope of the inventions and the state of the art.

It may be safely asserted that the large majority of the patents issued from the Patent Office are good and valid; and, if rightly read and properly construed, fairly represent the status of the inventions in the arts to which they relate, so that no one who adopts ordinary precautions need be deceived by them as to the character of the inventions patented. It is a testimony to the thoroughness of the examinations, and to the public appreciation of them that while no man would buy a lot of land at any price without an examination of the title by competent counsel, thousands of dollars are freely invested in patents upon mere verbal representations, and with scarcely a reading of the document. That much loss has been the result of this easy-going confidence may be asserted, but very few such losses occur which ordinary prudence and business sagacity might not have prevented.

Under the foreign system, however, neither patentee nor public can have any confidence in the patent, however carefully it may be construed or scanned. It represents nothing more than the "guess" of the inventor as to what his invention may be, unsupported by any investigation or adjudication whatsoever. It is sometimes said that no patent can be known to be valid until tested by litigation, and that, therefore, a registered patent is as good before litigation as one granted upon examination. To this it might well be answered that frequently neither a first nor a second suit fully develops the state of the art or confers a fixed validity upon a patent. It may also be asserted that the machinery of the courts is not as good for the examination of mechanical questions as that of the Patent Office. A more conclusive answer is, that, by the system of examination, one third of the applications are not patented at all, and the remainder are so winnowed from the chaff of false claims that they are necessarily better than if issued as originally presented. Every process of examination compels the supposed invention to assume, to some extent, its proper place in the art, and, to that extent, adds validity to the patent that has passed its ordeal.

Indeed the lack of this examination and the practice of granting patents to the first introducer, as well as to the first inventor of a new improvement, has led to a movement abroad against the whole patent system. Its enemies clamor for its abolition. Its friends demand that it be improved, and the improvement which they suggest is the adoption of the American system. One or two smaller powers have declared against protection by patents; not so much, it would seem, to destroy the monopoly of their own inventions as to obtain the free use of those made by their neighbors. In the abolition of patents this nation, which during the last year patented more inventions than all of the rest of the world put together, would of necessity be the greatest loser. It would not give much more than it could receive in exchange.

I doubt if any one can seriously advocate or desire a change of our system, unless it be disappointed applicants, who would rather have bad patents than none, their counsel, who share in their disappointment, and such patent solicitors as hope to increase their fees by making for the inventor, at much cost of fees, that examination which the office now makes for the moderate charge of fifteen dollars.

A system of registration is, however, at present, practically impossible. It would be a simple outrage upon inventors and the public if either were prevented from making any examination whatever into the state of the art prior or subsequent to the grant of the patent. Until the drawings are printed or copied so as to be made accessible to the public, this can never be done. This subject is, however, considered elsewhere.

### APPEALS.

In the infancy of the office and of the patent law, when the force consisted of the Commissioner and one "examining clerk," and when all examinations were supposed to be made by the Commissioner or under his eye, an appeal was provided in certain cases to a board of examiners or experts, to be appointed by the Secretary of State, as occasion required. Subsequently, the Chief Justice of the District Court, and, at a later period, the associate justices, were vested with the powers and duties of the board of examiners. It is supposed that the justices of the Supreme Court of the District of Columbia have succeeded to the functions of the former judges. It was further provided that upon each appeal a fee of twenty-five dollars should be paid from the patent fund to the judge to whom the appeal was taken. As this was the only appeal allowed to an applicant from an adverse decision, either within or without the office, there may have been, originally, some propriety in its institution.

By the act of March 2, 1861, however, it is provided that each case shall be twice examined by the primary examiner; that from him an appeal may be taken to a board of examiners-in-chief, and from them to the Commissioner in person. A fee is provided upon each of these appeals. No mention is made in this act of an appeal to the judges of the local court; and although in the schedule of fees it is said "that all laws now in force fixing the rates of the Patent Office fees to be paid are hereby repealed, and in their place the following rates are established," yet no fee is provided for the appeal from the Commissioner to the judge. It is believed that Congress intended at this time and in this way to abolish this appeal. The judges have, however, asserted their jurisdiction, and the Attorney-General has held that the appeal fee is still payable from the patent fund. This appeal is now useless and mischievous.

1. Three appeals are already provided for in every case, viz.: A second hearing before the examiner, an appeal to the examiner-in-chief, and another to the Commissioner.

2. There seems to be no propriety in a summary appeal from an executive to a judicial department; at all events, no such appeal is allowed from decisions of the Commissioners of Pensions, Internal Revenue, Land Office, Indian Affairs, or of the Comptrollers of the Treasury, notwithstanding the great pecuniary interests involved in their decisions, and the fact that in no one of those bureaus is such liberal provision made for appeals within the office as in the Patent Office.

3. As there are four judges, and the appeal may be taken to either of them, at the option of the applicant, and as there is no appeal from the individual judge to the court in banc, it has naturally resulted that the judges have made conflicting decisions, and have thus practically overruled each other, so that if this appeal was designed to secure uniformity in the administration of the patent laws, it has signally failed to do so. The nature of the provision was fatal to harmony, and this has been fully proven in its practical operation.

4. The allowance of a fee of twenty-five dollars for each appeal has a tendency to encourage appeals. When there are frequent reversals of the office, attorneys are induced to appeal from every decision; and the more frequent the appeals the larger the aggregate of fees paid to the judge. In this connection, as a simple matter of fact, it may be mentioned that during the administration of my immediate predecessor forty-two cases were appealed from him to one of the judges, and of these thirty eight were reversed and only four affirmed.

5. The tendency of such a jurisdiction is to extend itself. Accordingly the judges have every year encroached more and more upon the executive duties of the Commissioner. The law gave an appeal in a few cases. Appeals are now taken and sustained in many; until it is asserted that the judge, and not the Commissioner, is the head of the Patent Office, and that he is authorized to interfere and to overrule the Commissioner, in any order or rule which the latter may make or attempt to execute.

6. The practical working of this appeal has been so far from protecting the interests of the public, that the fact is, that those innovations in the practice of granting letters patent, of which the public have justly complained, have been forced upon the Commissioner against his protest by the decision of a judge upon appeal; thus, it has been held in one case that upon an application for a reissue of a patent, new matter might be introduced into the specification and drawings; in another case, that, upon the decision of an application for a reissue, the patent must be dated back to the date of filing (in one case four years), thus making infringers of manufacturers who were using the invention ignorantly during all the time that it was locked up in the secret archives of the office, and while it was impossible for them to know of the existence or character of the claims. In another, that an applicant who had filed an application and withdrawn it eight years before, might refile it and obtain a patent for seventeen years from the present date, although the same thing had long since gone into public use and was incorporated in the mechanism of many subsequent inventions. In another, that a patent might be reissued by the patentee after it had been assigned to others; and in another, that he might reissue it after it had expired. Many like instances might be cited, but these specimens will serve to illustrate the mischief of the present system.

7. If it be said that these matters ought not to rest in the judgment of the Commissioner, the answer is:

*a.* He is selected because of his supposed familiarity with the business transacted in the Patent Office, and is, therefore, more likely to be right than the judge, who is appointed without reference to mechanical knowledge, or learing in patent law.

*b.* The fear that the Commissioner might err, would demand a further provision for an appeal from the judge, and so on *ad infinitum*, since both are human.

*c.* The Commissioner of Patents ought to be as competent to decide questions arising in the conduct of his office as are the heads of other like departments; and,

*d.* An appeal from the Commissioner is in fact provided, and would exist, even if the present appeal were abolished; indeed, even the decision of the judge is not final. It is provided in section 0, act of March 3, 1839, that the applicant may file a bill in equity in any circuit court, having cognizance thereof, "where patents are refused for any reason whatever, either by the Commissioners of Patents or by the Chief Justice," and the complainant may obtain a decree authorizing the Commissioner to issue the patent.

8. Nine-tenths of the cases appealed, involve mere questions of fact upon which the judgment of the primary examiner is as likely to be correct as that of the Commissioner or judge.

9. This appeal causes great delay in the determination of the rights of the parties. The office has no power to enforce a prompt decision, and causes are thus sometimes greatly protracted.

10. The office files, models, and papers are taken from the Patent Office to the Court House, and are retained there at the pleasure of the judge. They are thus out of the reach of the office when wanted, and in some instances have never been returned.

I therefore, earnestly request that this appeal be abolished. In this, I do but repeat the recommendation of the former and present Secretaries of the Interior Department, of my predecessors in office, of the most respectable solicitors, especially those having the largest business before the office, and, as I believe, of some of the judges themselves.

### DRAWINGS.

No part of the machinery of the Patent Office is of more value than the drawings. It is to these, as has been stated, that reference is made by the examiner, in order to determine the novelty of every new application. Models may be altered or broken, but the drawings remain unchanged. Under the law, the applicant furnishes one drawing for the use of the office. These are carefully preserved in portfolios where they can be readily examined. Some of these drawings have been in the office over thirty years. They are handled every day, and have become much soiled and worn; some are nearly destroyed, and all soon will be. Some provision for their reproduction *must* be made, or the present system of examination must be abandoned. Indeed, under any system, there must be something in the office by which new applicants and the public may know what drawings have been attached to the patents that have been already issued; and whether it be examined by attorneys, or by sworn officials, a single copy of a drawing will soon become worn and useless.

Besides this, as there is but one copy of the drawing in the office, it must be used upon all occasions. It is frequently taken to the examiner's room; it is taken to the room of the examiners-in-chief; it is used before the Commissioner, and must go to the appellate judge. It must be withdrawn from the portfolio whenever a copy is ordered or an applicant wishes to examine a reference.

This multiplies the chances of loss and of destruction, and, what is of more importance, it increases the risk of examination; since the very drawing which anticipates a new application and shows the alleged invention to be old, may not be in the portfolio when the examination is made.

To remedy these evils and provide against the gradual but inevitable destruction of the drawings, at least ten copies should be prepared: one for the use of the examiners; one for the record room where the specifications are kept, and where it would be accessible to the public; one for the library; two for the English Patent Office, in return for the duplicate set of printed specifications and drawings furnished to us; and five for sale, when copies are ordered.

The English, French, Italian and Belgian Governments engrave the drawings of all patents at a considerable expense, and are, in this particular, in advance of this country.

At the beginning of this present fiscal year, as no special appropriation was made for this purpose, and the necessity was so urgent, I availed myself of the general authority of the Commissioner to provide copies of the drawings, and of such sum as it was believed might be saved from the amount appropriated for contingent expenses, and entered at once upon the work of reproduction.

For ten copies of the drawings to be furnished weekly, photography appeared to offer the cheapest and surest method. A contract was made in June last, with Messrs. Peters & Rehn, upon terms advantageous to the office, and the weekly issues have been regularly photographed ever since. The quality of the copies thus produced has steadily improved as difficulties have been overcome, and the work has become more familiar; until it is now performed in the most satisfactory manner, both to the office and the public.

During the year experiments have been made in other methods of engraving and printing the drawings.

The American Photo-lithographic Company offered, if tracings were furnished, to supply, free of further cost to the Office, ten lithographed copies of each of the fourteen hundred drawings of patents granted during the month of June, 1869. This proposition was so favorable, that it was at once accepted and the work has been done in a very creditable manner.

The firm of French, Langran & Ogilive, of this city, made an offer for the drawings of May, 1869, at a nominal price, which was also accepted, and the work which has thus far been well done, is now nearly completed:

The experiments have led to the conclusion that, for a few copies for office use, photography is the cheapest process, while for a large edition either of the back drawings or of the current issues, lithography or photo-lithography must be employed. An appropriation has been asked for, to make this business of reproduction a permanent feature of the office work.

### ANNUAL REPORT.

Since the year 1843, a report has been published annually, containing an alphabetical index of inventors, an index of the subjects of invention, a list of expired patents, and the claims of the patents granted during the year. In the year 1853, and since, small engraved copies of a portion of the drawings have been added to explain the claims; and of late years, it has been customary to add a very brief abstract of the specification, comprised usually in not more than four or five lines. The report was a pamphlet of a few pages in 1843; in 1867 it had swelled to four large volumes. The expense of producing it is now over two hundred thousand dollars per annum. It is true that this amount has not been paid out of the patent fund; the report has been published as a document by Congress. Nevertheless, as a portion of the expense of preparing it is borne by the office, it is proper to refer to it here.

I doubt if a sufficient advantage accrues to the country, from the publication of this report to justify the expense. Its bulk is such that it cannot be published until from eighteen months to two years after the expiration of the year in which the patents are issued. The claims are in most instances unintelligible, without the specifications, even with the aid of the abstracts and engravings; while the engravings themselves are not and cannot be copies of all the drawings, or figures accompanying the patent. A large number of patents have more than one figure, sometimes twenty. In the printed reports, one, or at most two, are given, for want of space to

do better. Such mere sketches of the patent and drawings, in many cases, do more harm than good. They mislead the public, instead of instructing it. It is true that it is desirable for some persons to know, from time to time, what patents are granted, but the number of such persons is limited, and the knowledge, to be valuable to them, must be simultaneously with the issue of the patents. This information has, until a year ago, been supplied by certain mechanical journals. They published weekly lists of claims, until the issue increased to such an extent as to make it impossible for them to continue the practice. The office then attempted to supply this want. A weekly list of claims has been published, and furnished to subscribers, since January, 1869, at the rate of five dollars per annum. To this has since been added a pamphlet, containing the Commissioner's decisions, which is issued at intervals of from one to two months. This year these claims are being stereotyped, so that, at the close of the year, they may, with proper indexes, constitute the annual report, without the abstracts or drawings. If Congress should desire to strike off copies of these for gratuitous distribution, it could be done at small expense, scarcely exceeding one dollar per volume, whereas the present reports cost twelve dollars and a half per set. It is submitted, however, that if these lists of claims are of value to any one, they are worth the small price which the office now asks for them.

In addition to these weekly lists, I propose, as a substitute for the annual report as now published, that a sufficient number of copies of each entire specification and drawings be printed in full, and that one full set be deposited in the capital of each State, and in each large city. This would furnish nearly all the information to be obtained by a visit to the Patent Office, and would save inventers many journeys to Washington. It would enable counsel at a distance to examine references, and to obtain information, now practically inaccessible, without a personal visit, or the employment of resident counsel. To the Pacific coast, the West, South, and far Northeast, such collections would be invaluable. Each annual set would be comprised in about fifty-two volumes. A sufficient number of them for the purpose stated, and for office uses could be furnished at an annual cost not exceeding one hundred thousand dollars, or about one half the cost of the present annual report. To make such a collection complete, the back drawings and specifications of patents already issued should be published also. For this purpose, the balance already standing to the credit of the patent fund is probably sufficient.

### STATUTES OF LIMITATIONS.

The courts have decided that no statute exists, limiting the time within which actions may be brought for the infringement of letters patent. The action on the case in the several States is variously limited to one, three, five, and six years. I submit that a limitation of five years, after the expiration of the patent, would be a proper provision.

Some provision is also needed limiting the time during which applications shall be permited to lie in the Patent Office, after adverse action, before the next step by way of appeal or amendment is taken. Much injury to the business of the country is likely to result from the construction lately given to the law by the judge of the supreme court of this District, by inflicting patents upon the nation for inventions which have long been in public use. This is, in effect, to create a monopoly, instead of affording encouragement to inventors.

There are hundreds of these cases in the office, many of which are being bought up upon speculation, and vigorously pressed for issue. One of these, lately filed, was withdrawn in 1851, and has now been refiled, after a lapse of nineteen years, when the substance of the invention which it seeks to monopolize has gone into use in nearly every form in which a well known agricultural implement is now manufactured.

### FEMALE COPYISTS.

Prior to July 1, 1869, much of the copying of the office was done by females. About sixty-five were employed, who worked at their own homes, and who were paid at the rate of ten cents per hundred words for the amount actually copied. By an act approved March 3, 1869, provision was made for fifty-three female copyists at an annual salary of $700. As it was obvious that this force must labor within the office, in order to secure proper discipline and efficient work, six rooms were provided in the Patent Office building for the entire number. These rooms and clerks were placed under the charge of an efficient female superintendent. It soon became evident that although the number of copyists was reduced, there were still more than sufficient to do the work originally performed by the larger number. Additional work was therefore assigned to them from other divisions, and the force of male clerks was correspondingly reduced. Accurate time tables have been kept since July 1, 1869, of the attendance of these ladies, and a careful record has been made of their work.

The result of the experience of six months is that the attendance is nearly as good and the work is fully equal in quantity and quality to that of male clerks performing corresponding duties. The salaries of these ladies were originally fixed at $700 only, instead of $900. This, it is presumed, was an oversight, as they have labored as faithfully, and until November 15, 1869, one hour per day longer than the female clerks of any other department. I know of no reason why their pay should not be equal to that of male clerks of like grades, except that there are, as nearly as can be ascertained, twenty-five applications for positions by women to one from men. This division is the largest in the bureau and is under excellent discipline, yet the superintendent of it, because a female, has with difficulty been enabled to secure the pay of a first-class clerk. I recommend that the pay of the female clerks be raised to at least $900 per annum; that they be paid at that rate from the beginning of the present fiscal year; and that permanent provision be made for a female superintendent, at a salary of at least 1,400 per annum.

### SALARIES.

Principal examiners are now paid $2,500 per annum, while first assistant examiners receive $1,800, and second assistants $1,600. The difference between the assistants is but $200, while between the first assistants and principals it is $700. There is not a corresponding difference in duties, qualifications, or ability. I submit that if the salaries of first assistants were fixed at $2,000 the scale would be more equitable.

The character and necessary qualifications for the examiners and chiefs of divisions require adequate compensation to secure the best men. These positions ought to be filled by permanent incumbents, and a sufficient price should be paid to retain them in office. That this is not yet done, appears from the fact, that they voluntarily resign to accept other positions or to go into business as solicitors. Every second assistant examiner now in the office, twelve of the twenty first assistants, and seven of the twenty-two principal examiners were appointed during the year 1869; of these twenty-five were appointed to fill places made vacant by voluntary resignations. In the other departments of the office, while it is doubtless true that many young unmarried men are amply paid, it is also true that experienced clerks of mature years are poorly compensated. Under the last appropriation bill not a single fourth-class clerk was assigned to the Patent Office.

If there should be any increase of salaries, I commend the employés of this office to the attention of Congress, especially as the revenue which enables the office to support itself is largely due to their faithfulness and industry.

It has been the practice, in former years, as the work of the office increased, to detail clerks to perform the work of assistant examiners, and assistants to perform the work of examiners. From time to time acts of Congress have been passed authorizing the Commissioner to pay these persons at the rate annexed to the higher positions filled by them. A bill for this purpose was before the last Congress, and was favorably reported, but failed for want of time. I am constrained to say that I doubt the expediency, as a rule, of encouraging clerks to expect increase of pay with every change in their duties. It ought to be in the power of the Commissioner to assign his force to the best advantage without incurring the obligation of increasing salaries.

The additional honor and experience ought to be some compensation for a temporary occupancy of a more advanced position. But the practice has hitherto been otherwise; my predecessors who made the assignments, accompanied them with a distinct pledge to endeavor to secure the extra compensation, and the labor was performed upon the faith of that pledge.

I, therefore, recommend that the appropriation be made, with the distinct understanding that hereafter no such advances are promised or will be given.

### DISBURSING CLERK.

The large amounts of money paid into the office daily, in small sums, and the necessary pay rolls and accounts, have rendered the services of a financial clerk absolutely necessary. This officer was also formerly the disbursing clerk of the bureau, and in this capacity performed the full labor of a disbursing clerk in any other department. Nevertheless he has never received the $200 additional pay allowed by law to disbursing clerks. On the 14th of January last the Secretary of the Interior sent a communication to both houses of Congress, inclosing a claim for the payment of this sum, being the preceding year of service, and recommending the same to their favorable consideration. The letter was referred in the Senate to the Committee on Appropriations, and in the House of Representatives to the Committee on Claims, where the matter now rests.

As no officer has been more faithful in the discharge of his duties, and as those duties and the experience of the incumbent fully warrant the expenditure, I recommend that the arrears of additional compensation be paid.

Since the expenditures of this office are now provided for by special appropriation, and a financial clerk of some kind cannot be dispensed with, I can see no reason why the disbursements of the office should not also be made by him. The present system involves double labor, and affords no additional guarantee against abuse, since the accounts of any disbursing officer, either of the department or bureau, must still be audited by the Treasury Department.

### ASSISTANT COMMISSIONER.

The duties devolving upon the Commissioner of Patents cannot be performed by one person. He is not only the executive head of a large bureau, but he is vested with the sole right to extend patents, and he is charged with the duty of hearing appeals from the board of examiners-in-chief. The extension cases amounted to 153 during the last year, and as more patents were granted in 1856 than in 1855, the number of applications must constantly increase. The appeal cases of all classes amount to about 200 per annum, some of them involving the consideration of vast amounts of testimony and voluminous arguments. When to this is added so much of the correspondence as he must attend to in person, applications for office, and the necessary time for interviews, it is obvious that the labors must be arduous and unremitting.

I therefore respectfully recommend that an assistant commissioner be provided for by law, to be appointed by the President, by and with the advice and consent of the Senate; such officer to perform the duties of Commissioner in the case of death, sickness, or absence; and such other duties as may be assigned to him by the Commissioner.

### ROOM OVER SOUTH PORTICO.

My attention was lately called to the existence of a room over the south portico of the Patent Office building, which, when explored, proved to be a hall 90 feet long by 30 feet in width and 20 in hight. This has been hitherto practically inaccessible, as it was unfinished and useless. It has now been fitted up and rendered easy of access, at a moderate expenditure, thus affording very eligible quarters for the library of copyrights and for the copyists of drawings.

Smaller rooms exist over the other porticoes of the building, which may be profitably arranged for the reception of rejected models.

### COPYRIGHTS.

Congress omitted at its last session to make any appropriation for the care of the copyrighted books and records.

I am persuaded that the time has come when a radical change should be made in the system of registering copyrights. This is now done in the clerks' offices of the various district courts. It is so imperfectly done that copyrights are proverbially worthless. They are usually invalid from a failure to comply with essential formalities; because no officer is interested to see that these formalities are complied with. The clerks omit in many cases to send their records to this office, and to transmit the books. Many of the latter are never received at all. Meanwhile Congress has been called upon from year to year to make appropriations from the funds in the treasury for the care of these books and papers. It is submitted, since mail facilities are now so cheap and abundant, that the work of registration could be done much more thoroughly in the Patent Office, and that the fees for that service (about $3,500 per annum) would pay all the expenses of the necessary clerical force, and for the custody of the books. If it were the business of a division in this office to do this work, correspondence could be maintained with authors and publishers, and copyrights could be perfected. I also ask that the Patent Office be permitted to display and use as books of reference, under proper restrictions, the books, especially those of a legal, mechanical, and scientific character, which are deposited by the authors and publishers under the law. These have been hitherto of no value whatever, except as vouchers.

### TRADE-MARKS.

By conventions between the United States and France and Russia (U. S. Statutes at Large, vol. XV, p. —), provision is made for the deposit of trade-marks by citizens of either country, in the United States Patent Office, the Tribunal of Commerce of the Seine, at Paris, and the Department of Manufactures and Inland Commerce, at St. Petersburg. No fee is provided for the reception and filing of these papers. As the office labor to be performed in relation to them is analogous to that attending the filing of caveats or disclaimers, the same fee ($10) would be a proper charge.

It would also, doubtless, be a proper provision if a law were enacted giving validity to trade-marks so filed, either for an indefinite or for a limited period of time.

### CONCLUSION.

In conclusion, it is right that I should say that no class of our citizens has done more for the glory and substantial prosperity of the nation than the mechanics and inventors of the United States, and yet they have never been favored children.

They do not deem it too much to ask that the Patent Office, which is the only institution which they can specially call their own, and which they have built up with their money and established by their genius, shall be supplied upon a liberal scale with every needed appliance for the performance, in the best manner, of all its legitimate duties.

I transmit herewith an alphabetical list of the patentees to whom patents have been granted during the year 1869, together with their places of residence and the subjects of their inventions, and also a list of all patents which expired during the same period.

Respectfully submitted.

SAMUEL S. FISHER, Commissioner.

## Recent American and Foreign Patents.

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

SEWING MACHINE SHIELD.—Mary W. Welty, New York city.—The object of this invention is to provide a shield attachment to sewing machines, by which the fabric to be sewed will be protected from the oil of the journals and from injury by contact with the machinery, and which will, at the same time, form an extension and continuation of the feed plate of the machine to let the fabric move smoothly over it. Heretofore several forms of shield attachments have been proposed, but the same were either secured upon or under the feed plate by projecting screws or other devices. They became thereby more of a hindrance to than support of the fabric, and fulfilled merely the object of protecting the fabric from the oil mechanism of the machinery. The present invention consists chiefly in providing ears or lugs on the front end of the shield, such ears catching under the feed plate so that they hold the shield in line with the feed plate and cause it therefore to form a smooth continuation of the latter.

PUNCH AND DIE FOR MAKING SLOTS IN METALLIC TUBES.—John Gibbs, Brooklyn, E. D., N. Y.—This invention relates to a new and useful improvement in the method of cutting slots in metal tubes, having more particular reference to the tubes or safes employed in the use of the "endless match," and consists in the use of a die and punch in combination with a partition bed and mandrel for making longitudinal slots or recesses in one or both sides of the tube for giving access to the match used. This method of cutting slots is applicable to tubes used for other purposes.

JOIST PROTECTOR.—H. Galmann and Charles Ruhe, Buchanan, Pa.—This invention relates to a new and useful improvement in a device for supporting and protecting joists in buildings, and consists in a cast-iron box support placed in the wall, which the end of the joist enters, and by which it is protected.

SPARK ARRESTER.—Edward Waud, Eugene City, Oregon.—This invention relates to a new attachment to the smoke stacks of locomotive engines, steamboats, etc., and has for its object to prevent the escape of sparks from the smoke stack. The invention consists in the arrangement of channels and conductors, whereby the ashes and sparks carried up by the draft are conducted away from the engine to one side of the same.

THATCHED ROOF.—Lionel Foster, Burlington, Iowa.—This invention relates to a new manner of fastening the straw upon the tie bars, or slats which cross and connect the rafters, and to a new mode of treating a thatched roof in order to make it entirely water-proof, and, to a great degree, fire-proof, and also to increase its durability.

STIRRUP MACHINE.—Dempsey Forest, Mottomosa, Texas.—This invention comprises a clamping vise with pins of peculiar construction and adaptation for bending the thin wood plates or sheets around a lever former which is used by the operator to bend the blanks down into the forming recesses of the jaws and hold them until the said jaws are clamped together, and the blanks reduced to the finished form and secured to the blocks by which the suspending straps are connected.

GROOVING MACHINE.—W. G. Raoul, Independence, La.—This invention consists in an improved adjustable rotary cutter, and the arrangement of the same with a vertically and horizontally adjustable feeding table and clamping devices for holding the work to be operated on.

CAMERA SCREEN.—F. Peabody, Louisville, Ky.—This invention relates to a new and improved arrangement of screens for cameras, and consists of a circular screen made of black cloth or other suitable substance stretched on a wire, and placed on the inside of the camera box just above the inner end of the tube, and on hinges to swing up and expose the plate to the object to be taken, or down to cover the inner end of the tube.

STEP SUPPORTS FOR MILL SPINDLES.—John Russell, Prairie, Mo.—This invention relates to improvements in the adjusting devices for the steps of mill spindles, and consists in the arrangement of the steps in the top of a vertically adjustable tube or other sliding support, provided with vertical guides and working through guide plates to insure the vertical position and to prevent rattling, the said support being mounted on a rod rising up from the bridge tree and jointed to it, so that the joint may compensate for the curve described by it due to the one end of the bridge tree being fixed and the other swinging around the said fixed point and tree step may be raised in a right line.

ELECTRIC CLOCK.—Kennedy Electric Clock Co., New York city.—These improvements have for their object the simplification of the clock, the reduction of the cost of manufacture, and the improvement of the time-keeping qualities. The clock train consists of a single wheel, and a single magnet only is employed to operate the pendulum. The friction of the parts is reduced to a minimum.

ELECTRIC CLOCK.—Elisha Wilson, New York city.—In this invention the pendulum is acted upon by an electro-magnet, which is so arranged that it cannot retard the pendulum. The pendulum is provided with a permanent magnet, which swings within an open electric coil, arranged on one side; and the circuit breaker is so placed that the electric current does not operate upon the magnet of the pendulum, until just as the latter has begun to fall on its return sweep. It is believed that this improvement will contribute essentially to the accuracy of the clock, and also prove to be economical.

CAR FARE-BOX.—W. G. Raoul, Independence, La.—This invention relates to a new and useful improvement in boxes for receiving passengers' fares on cars of street railroads, omnibuses, and other vehicles for transporting passengers.

PENCIL SHARPENER.—Jacob McClure, Nashua, N. H.—This invention relates to new and useful improvements in sharpeners for lead pencils, and consists in making the sharpener in the skeleton form, or as an open hollow cone, either square, diamond-shaped, or triangular, as may be desired, and also in the arrangement of projections or shoulders to guide the knife, and in an aperture or relief opening for the lead point of the pencil at or near the point of the sharpener.

HORSE HAY FORK.—Simeon Clark, Howard, N. Y.—This invention relates to new mechanism for operating the oscillating toes of horse hay forks.

BOOTS AND SHOES.—Samuel Babbitt, Brazil, Ind.—The object of this invention is to so construct boots and shoes that the same will be at once water-tight and warm, and that the soles will be strengthened and not apt to wear at or near the soles. The invention consists chiefly in interposing a piece of flannel or other fabric between two layers of leather which constitute the upper of the boot or shoe, and also in attaching to the main sole convex sole on which the foot may rock.

MORTISE PIECE FOR LOCKS.—Wm. Weisner, Elizabethtown, New Mexico.—This invention relates to improvements in mortise pieces for mortise locks or sliding bolts, and consists in the combination with the said mortise pieces as commonly used, of plates arranged in the mortises to close the same when the bolt is withdrawn, to present a more ornamental appearance, and to prevent the mortises from filling up with collections of dust and other matters.

STRAW CUTTER.—G. S. Garth, Mill Hall, Pa.—This invention relates to improvements in straw cutters, having for its object to provide an arrangement of the support of the fulcrum of the cutter lever, better adapted for holding the cutter firmly up to the steel or metal plate against which it cuts, and also for withstanding the wear; and the combination with the same of a friction or regulating plate, and thumb screw, for holding the cutter firmly up to its position, but in such a manner as not to cause too much pressure of the knife against the fixed bed or cutter.

WATER ELEVATING APPARATUS.—J. L. Garlington, Snapping Shoals, Ga.—This invention relates to improvements in apparatus for raising water from wells in buckets, by cords working over pulleys, and consists in the application to the cord between one end made fast to any support, and the pulley over which it works for raising the said bucket, of a weight or a friction pulley, arranged to run on the bight of the said cord down in the well or a chamber therein to elevate the bucket; and in the application to the weight of a cord, winding drum, and crank shaft for raising it, whereby the weight will raise the bucket in moving half the distance the bucket moves; consequently requiring only half the turning of the crank that would be required, if applied directly to the bucket.

RAMMER FOR PACKING TOBACCO.—John R. Sutton, Brooklyn, N. Y.—This invention relates to improvements in the small rammers used by tobacco packers for packing the fine tobacco into the small papers in which it is packed for retail purposes, and it consists in the application to the end of the rammer which acts on the tobacco, of a projection resembling in form, to some extent, the bowl of a pipe; also, in the application to the rammer, and for action in conjunction therewith, of a sliding pin or punch, for forcing down into the tobacco to make a hole for the stem of a pipe in such relation to the recess formed by the said projection, that when the rammer is withdrawn and before the paper is withdrawn, a smoking pipe can be conveniently packed in the paper with the tobacco

DRAWING FRAME.—Charles Wall, New York city, and John Stewart, Brooklyn, N. Y.—This invention relates to improvements in drawing frames, for dressing manila, hemp, and other similar substances, and consists in the combination with the endless chain combs and condensing apparatus such as commonly used for dressing the laps, and reducing the same to slivers, of a series of revolving combs working on an endless carrying apron, and dressing the hemp and delivering it in laps or bats to the said endless chain, in a way to serve as a substitute for the lap machines now used for dressing the hemp previously to being fed to the same endless chain, the said chain being arranged to move at a greater surface speed than the revolving combs, whereby it draws the hemp through the teeth of the revolving combs, and its own teeth are caused to move faster than the hemp, and a thorough and efficient combing action is produced on the same, producing better results than can be effected in the present way; and the same is accomplished in one machine and more economically, requiring only one feeding operation, and less attendance.

PRINTERS' CHAIR.—Amasa J. Finch, New York city.—This invention has for its object to furnish an improved chair for printers' use, which shall be so constructed as to allow the sitter to have as free a movement in every direction as when standing.

ORNAMENTING AND COLORING PLASTER OF PARIS AND OTHER CEMENTS. Gustave Schlueter, Brooklyn, N. Y.—The object of this improvement is to harden plaster of Paris, and also impart ornamental colors to it. The colors are mixed with the plaster in the form of dry powders; gum arabic, or other adhesive substance, also in the form of powder, is likewise added When water is mixed with the plaster thus prepared, it sets in the usual manner, takes on the desired color, and becomes hard and smooth, capable of receiving a fine polish.

ELASTIC LANYARD.—J. E. Jones, Waretown, N. J.—This invention has for its object to furnish an improvement in lanyards, by means of which the lanyards may be prevented from breaking when exposed to a sudden strain, which, coming suddenly upon taut ropes is liable to break them at a time when they are most needed to support the rigging of the vessel.

FEED CUTTER.—Wm. H. Rosser and James Stiver, Mill Hall, Pa.—This invention relates to a new and useful improvement in machines for cutting hay and straw, and other articles designed for feed.

DEVICE FOR CONNECTING HORSES TO VEHICLES.—Alexander Shaler, New York city.—This invention has for its object to furnish an improved device for connecting horses quickly and securely to the thills of vehicles in such a way as not to require tugs or traces, and in such a way that the horse may be instantly detached from the vehicle should he become frightened or fall.

LUBRICATOR.—Royall S. Hildreth, South Adams, Mass.—The object of this invention is to furnish a simple and cheap means for oiling or lubricating journals in all situations, and consists in the use of a spring within the oil cup in connection with an oiling wire, so arranged that the wire shall be at all times pressed against the journal in whatever position the oil cup may be placed.

LAMP EXTINGUISHER, ETC.—S. C. Catlin, Cleveland, Ohio, and A. Corbin, Ellenville, N. Y.—This invention relates to a new and useful improvement in a device for extinguishing lamps and trimming the wick, and consists in a sliding sleeve, the top end of which is a circle to serve as a guide in trimming the wick with scissors, and in a hinged extinguisher which serves as a self trimmer.

BUTTON FOR GLOVES, ETC.—John A. Spooner and John Ellerby, Brooklyn, N. Y.—This invention relates to a new self-fastening button, which is to be applied to gloves and other articles of wearing apparel, without the use of thread, and without injury to the fabric to which it is secured.

WASHING MACHINE.—Linton Wharton, Richland, Iowa.—This invention relates to improvements in washing machines, and consists in an improved arrangement of means for working a reciprocating rubbing board over a stationary board placed in a suitable box or tub.

CHURN POWER.—Theodore C. VanWyck and Wm. Kent, Poughkeepsie, N. Y.—This invention relates to improvements in powers for driving churns, sewing machines, lathes, and other light machines, and consists in the combination with a weighted drum, or it may be a clock spring device and suitable multiplying gear, of a regulating apparatus of peculiar construction.

WATER ELEVATOR.—W. G. Hamilton, Milton, Wis.—This invention relates to improvements in water elevating apparatus, whereby it is designed to simplify and improve the apparatus, patented March 2, 1869, No. 87,438, and it consists in an arrangement of the lifting spout, which receives the water from the buckets, so that it will be restored after the buckets pass by it by gravitation, thereby dispensing with all restoring apparatus.

MOLD FOR MAKING COMBINED IRON AND STEEL INGOTS.—Patrick Doyle, Newark, N. J.—This invention relates to improvements in molds for making ingots of iron and steel, in a manner to dispose the one metal on one or more sides of the other and secure a perfect union of the two, and it consists in a vertical mold of four, or other number, of plane sides, one or more of which may be detachable, and clamped to the other by strong bands, in which a strong thick plate of metal is arranged to fit near one side, from top to bottom, snugly, to occupy a part of the space when the metal of which the greater part of the ingot is to be composed is poured in, and to remain until the same has solidified sufficiently to retain its position, when it is withdrawn, having a space for the other metal, which, being poured in unites perfectly with the first and forms the required composition ingot.

BRICK MACHINE.—H. D. Thorp and J. G. Lehr, Harlan, Ind.—This invention relates to improvements in brick machines, and consists in an improved arrangement of devices for discharging the molds after being filled from under the machine; also an improved arrangement of movable and stationary kilns in the mud mill above the paddles for facilitating the grinding and mixing; and also, an improved adjusting arrangement for raising or lowering the mold supporting table.

# Official List of Patents.

## Issued by the United States Patent Office.

FOR THE WEEK ENDING FEB. 1, 1870.

*Reported Officially for the Scientific American.*

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99,277.—ROOFING COMPOSITION.—Thos. R. Abbott, Lowell, Mass.

99,278.—MODE OF ATTACHING HORSES TO VEHICLES.—J. K. Andrews, East Lampeter township, Pa.

99,279.—RAILWAY RAIL CHAIR.—Richard Anthony, Pittston, assignor to himself and Thomas Williams, Luzerne county, Pa. Antedated Jan. 19, 1870.

99,280.—POWDER KEG.—L. Austin and J. E. Hall, Cleveland, Ohio.

99,281.—BOOT AND SHOE.—S. Babbitt (assignor to himself and G. W. Orr), Brazil, Ind.

99,282.—SUN SHADE FOR HORSES.—E. T. Balch, Philadelphia, Pa. Antedated Jan. 20, 1870.

99,283.—SEWING MACHINE.—William Black, Hagerstown, Ind.

99,284.—TRUNK.—Thomas Bond, East Brookfield, Mass., assignor to Daniel J. Clark, W. F. Doggett, and S. M. Burr, Columbus, Ohio.

99,285.—GAS METER.—Thomas Brattan, Birkenhead, Eng., assignor to A. H. Dixson.

99,286.—SEED PLANTER.—George W. Brown, Galesburg, Ill.

99,287.—ROLLER JAW TEMPLE FOR LOOM.—W. H. Burns, Grafton, assignor to J. Luther, Worcester, Mass.

99,288.—FENCE POST.—M. K. Butterfield, Eddyville, N. Y.

99,289.—LAMP EXTINGUISHER.—S. C. Catlin, Cleveland, Ohio, and A. Corbin, Ellenville, N. Y.

99,290.—ENVELOPE MACHINE.—Henry W. Chamberlin, New York city.

99,291.—APPARATUS FOR EXTINGUISHING FIRES.—Isaac H. Clark, Boston, Mass. Antedated Jan. 20, 1870.

99,292.—HORSE HAY FORK.—Simeon Clark, Howard, N. Y.

99,293.—ANIMAL TRAP.—W. J. Clarkson, Gourdin's Depot, North-Eastern Railroad, S. C.

99,294.—FERTILIZER.—John Commins, Charleston, S. C.

99,295.—BALING PRESS.—P. K. Dederick, Greenbush, N. Y. Antedated Aug. 1, 1869.

99,296.—BALING PRESS.—P. K. Dederick, Albany, N. Y.

99,297.—BALING PRESS.—P. K. Dederick, Albany, N. Y.

99,298.—CHAIN OR BAND.—John H. Doerr, Philadelphia, Pa.

99,299.—MOLD FOR MAKING COMBINED INGOTS OF STEEL AND IRON.—Patrick Doyle, Newark, N. J.

99,300.—ELECTRO-MAGNETIC MACHINE.—A. E. Dupas, New Orleans, La.

99,301.—MEAT AND VEGETABLE CHOPPER.—S. F. Emerson, Seville, Ohio.

99,302.—PRINTERS' CHAIR.—M. J. Finch, New York city, assignor to Margaret A. C. Finch, Shellsburg, Wis.

99,303.—MACHINE FOR BENDING STIRRUPS.—Dempsey Forest, Mottomosa, Texas.

99,304.—THATCH ROOF.—Lionel Foster, Burlington, Iowa.

99,305.—JOIST PROTECTOR.—H. Galmann and Charles Ruhe, Buchanan, Pa.

99,306.—COLORING MARBLE.—Smith Gardner, New York city, assignor to the International Marble Coloring Company, New York city.

99,307.—APPARATUS FOR RAISING WATER.—J. L. Garlington, Snapping Shoals, Ga.

99,308.—STRAW CUTTER.—G. S. Garth, Mill Hall, Pa. Antedated Dec. 1, 1869.

99,309.—PUNCH AND DIE FOR PUNCHING TUBES.—John Gibbs, Brooklyn, E.D., N. Y., assignor to himself and Calvin H. Carter Waterbury, Conn.

99,310.—THRASHING MACHINE.—E. W. Griffin, Pepperell, assignor to himself and F. S. Brown, Cambridge, Mass.

99,311.—STUMP EXTRACTOR.—Albert Gummer, Omro, Wis. Antedated Jan. 29, 1870.

99,312.—CHURN.—Floyd Hamblin, Madrid Springs, N. Y.

99,313.—WATER ELEVATOR.—W. G. Hamilton, Milton, Wis.

99,314.—STREET LAMP.—J. F. Harly, Kipton Station, Ohio.

99,315.—LOCK NUT.—G. G. Heermance, Claverack, N. Y.

99,316.—CULINARY STEAMER.—J. H. Heritage, Wilmington, Del.

99,317.—BIT STOCK.—Royall S. Hildreth, South Adams, Mass.

99,318.—RAILWAY CAR REPLACER.—Horace H. Holmes, Elmira, N. Y., assignor to himself, J. D. Dale, Ira S. Beers, and J. H. Dale.

99,319.—HORSE HAY RAKE.—Charles Howard, West Hurley, N. Y.

99,320.—ELASTIC LANYARD.—J. E. Jones, Waretown, N. J.

99,321.—ELECTRIC CLOCK.—Samuel A. Kennedy, Attleborough, Pa., assignor to the Kennedy Electric Clock Co., New York city.

99,322.—BLOWING APPARATUS FOR ORGANS, ETC.—M. James Kerigan, Boston, Mass. Antedated Oct. 21, 1869.

99,323.—MACHINE FOR MOVING BOATS ON CANALS.—Wm. R King, Washington, D. C.

99,324.—COMPOSITION FOR THE MANUFACTURE OF WATER, GAS, AND DRAIN PIPES.—W. P. Kirkland, San Francisco, Cal.

99,325.—SASH HOLDER.—D. R. Kline, Allentown, Pa.

99,326.—COMPUTING ARRANGEMENT FOR WEIGHING SCALES.—H. D. Lathrop and Albert Gay, Bedford, Ohio.

99,327.—BLIND SLAT MACHINE.—F. Leclere (assignor to M Eames), Watertown, N. Y.

99,328.—STALK CUTTER.—Joel Lee, Galesburg, Ill.

99,329.—ROLLING MILL FOR ROLLING GROOVED METAL ARCHES.—W. S. Levake, Cleveland, Ohio.

99,330.—BOLT FOR DOORS.—Jacob Levy, New York city.

99,331.—HORSE HAY RAKE.—William H. Long, Eddyville, Iowa.

99,332.—COMPOSITION FOR PAINT.—Robert Love, New York city.

99,333.—VALVE AND PISTON PACKING.—Joseph Marks, Boston, Mass.

99,334.—TAG ATTACHMENT.—T. P. Marston (assignor to himself and N. M. Phillips,) New York city.

99,335.—PENCIL SHARPENER.—Jacob McClure (assignor to C. D. Copp and E. J. Copp), Nashua, N. H.

99,336.—PAPER-FOLDING MACHINE.—William Mendham, Philadelphia, Pa. Antedated Jan. 15, 1870.

99,337.—EGG BEATER.—Nathaniel C. Miller, Stroudsburg, Pa.

99,338.—PAINT BRUSH.—G. G. Morris (assignor to himself and W. W. Eastham), Boston, Mass.

99,339.—ILLUMINATOR FOR STOVES, ETC.—Benjamin Nott, Albany, N. Y.

99,340.—HARVESTER RAKE.—Aaron Palmer and Charles W Palmer, Brockport, N. Y.

99,341.—TABLE FORK.—James Patterson, San Francisco, Cal. Antedated Jan. 29, 1870.

99,342.—SELF-ACTING MULE FOR SPINNING.—Seth D. Paul, Woonsocket, R. I.

99,343.—CAMERA SCREEN.—F. Peabody, Louisville, Ky.

99,344.—LOCK.—N. Petre, New York city.

99,345.—RAILWAY CHAIR AND FISH-JOINT.—D. C. Pierce, Chicago, Ill. Antedated Jan. 24, 1870.

99,346.—RAILWAY FROG.—D. C. Pierce, Clayton, N. Y. Antedated Jan. 31, 1870.

99,347.—LADIES' SAFETY BELT.—Mary G. Porter, Charlestown, Mass.

99,348.—MACHINE FOR POLISHING MARBLE.—Edwin Price and E. B. Price, Norwalk, Conn.

99,349.—FRUIT-PRESERVING HOUSE.—Jesse Prior, Adrian, Mich.

99,350.—GROOVING MACHINE.—W. G. Raoul, Independence, La.

99,351.—FARE-BOX FOR RAILROAD CARS.—W. G. Raoul, Independence, La.

99,352.—FEED CUTTER.—Wm. H. Rosser and James Stiver, Mill Hall, Pa.

99,353.—STEP-SUPPORT FOR MILL-SPINDLES.—John Russell, Prairie, Mo.

99,354.—RAILWAY CAR JOURNAL LUBRICATOR.—Thos. Sayles, Chicago, Ill.

99,355.—COMPOSITION FOR MOLDING FROM PLASTER OF PARIS.—Gustave Schlueter, Brooklyn, N. Y.

99,356.—GEAR CUTTING MACHINE.—Wm. Sellers, Philadelphia, Pa.

99,357.—DEVICE FOR CONNECTING HORSES TO VEHICLES.—Alexander Shaler, New York city.

99,358.—FIRE-ALARM SIGNAL-BOX.—G. W. Shawk, Cleveland, Ohio, assignor to the Cleveland Fire-Alarm Company.

99,359.—APPARATUS FOR SINKING PNEUMATIC PILES.—T. E. Sickels, Kennett's Square, Pa.

99,360.—APPARATUS FOR SINKING PNEUMATIC PILES.—F. E. Sickels, Chicago, Ill.

99,361.—COTTON SEED PLANTER.—Bryan Smith, Falkland, N. C.

99,362.—GAFF-BLOCK FOR VESSELS.—C. D. Smith, Bridgeport, Conn. Antedated Jan. 20, 1870.

99,363.—WIND-WHEEL.—E. S. Smith, Macomb, Ill.

99,364.—CLOTHES WRINGER.—A. H. Spencer, Providence, R. I.

99,365.—BUTTON.—J. A. Spooner and John Ellerby, Brooklyn, N. Y.

99,366.—THRASHING MACHINE AND SEPARATOR.—Abraham Staffer and Peter Staffer, Salt Creek, Ind. Antedated Jan 29, 1870.

99,367.—MANUFACTURE OF IRON.—David Stewart, Kittanning (assignor to himself and S. M. Kier), Pittsburgh, Pa.

99,368.—MANUFACTURE OF IRON.—David Stewart, Kittanning (assignor to himself and S. M. Kier), Pittsburgh, Pa.

99,369.—RAILWAY WATER ELEVATOR.—Arthur A. Stivender, Ocala, Fla.

99,370.—RAMMER FOR PACKING TOBACCO.—John R. Sutton, Brooklyn, N. Y.

99,371.—BRICK MACHINE.—H. D. Thorp and J. G. Lehr, Harlan, Ind.

99,372.—MACHINE FOR PACKING TOBACCO.—J. H. Trowbridge, New Haven, Conn.

99,373.—DRIVEN WELL.—Isaac Trump, San Francisco, Cal.

99,374.—WATER-WHEEL.—B. W. Tuttle, Galena, Ill.

99,375.—BASE BURNING STOVE.—H. B. Van Benthuysen, Lock Haven, Pa.

99,376.—REGULATOR FOR MACHINERY.—T. C. Van Wyck and Wm. Kent, Poughkeepsie, N. Y.

99,377.—SUBSOIL PLOW.—Wm. Watkins, Joliet, Ill.

99,378.—SPARK ARRESTER.—Edward Waud, Eugene City, Oregon.

99,379.—GANG PLOW.—Samuel Welch, Belpassi, Oregon.

99,380.—SHIELD FOR SEWING MACHINES.—Mary W. Welty, New York city.

99,381.—LIGHTNING ROD.—J. D. West, New York city.

99,382.—RAILROAD SIGNAL-BOX.—E. B. Westfall (assignor to himself and Frank Thomas), Williamsport, Pa.

99,383.—WASHING MACHINE.—Linton Wharton, Richland, Iowa.

99,384.—FIRE-PLACE GRATE.—Wm. E. Whitehurst, Norfolk, Va. Antedated Jan. 20, 1870.
99,385.—CLOTHES-LINE CLAMP.—Geo. W. Wilbar, Taunton, Mass.
99,386.—ELECTRIC CLOCK.—Elisha Wilson, New York city.
99,387.—COMPOUND FOR BATING AND RAISING HIDES.—G. W. Agler (assignor to himself and George Bochins), Philadelphia, Pa.
99,388.—WAGON-TONGUE SUPPORT.—Isaac Albright, Jr., and J. Y. Bloomingdale, New Salem, N. Y.
99,389.—TOY PROPELLER.—A. M. Allen, New York city.
99,390.—PRUNING KNIFE.—Henry Alter, Lakeport, Cal.
99,391.—WOOD PAVEMENT.—W. W. Ballard, Elmira, N. Y.
99,392.—TOOL FOR TONGUEING AND GROOVING.—Edward F. Bengler (assignor to himself and G. S. Post), Williamsport, Pa.
99,393.—BILLIARD CUSHION.—John Berlien, Chicago, Ill.
99,394.—APPARATUS FOR CENTERING SHANKS OR EYES IN BUTTONS.—W. H. Blake (assignor to himself and C. M. Mitchell), Waterbury, Conn.
99,395.—PRINTING PRESS.—T. W. Bracher, New York city.
99,396.—HYDRANT.—T. C. Bride, Quincy, Ill.
99,397.—HARVESTER RAKE.—Cyrus Buckwalter, Davenport, Iowa.
99,398.—MITER-BOX.—John Bullard, Hyde Park, Vt.
99,399.—FIRE ESCAPE.—Wm. Burditt and G. H. Burditt, Boston, Mass.
99,400.—LOCK SPINDLE FOR SAFES.—A. G. Burton, Rochester, N. Y.
99,401.—PRINTING TELEGRAPH.—E. A. Callahan, Brooklyn, N. Y.
99,402.—MACHINE FOR FORMING SHEET METAL TUBING.—Mortimer M. Camp (assignor to himself, D. Goffe Phipps, and E. I. Foote), New Haven, Conn.
99,403.—SUBMERGED PUMP.—Perrin H. Cardwell, Knoxville, Tenn. Antedated January 27, 1870.
99,404.—APPARATUS FOR BINDING GRAIN.—George W. Chandler, Mason, N. H., assignor to himself, Henry I. Whitney, same place, and Albert A. Whitney, Battle Creek, Mich.
99,405.—CARRIAGE HUB.—John P. Chandler, Wilton, Me. Antedated January 28, 1870.
99,406.—METHOD OF AERIAL TRANSIT.—Robert A. Chesebrough, New York city. Antedated January 24, 1870.
99,407.—OIL CAN.—P. C. Clark, Philadelphia, Pa.
99,408.—APPARATUS FOR ADMINISTERING MEDICATED VAPORS.—J. C. Cook, New Haven, Conn.
99,409.—MACHINE FOR PLANING IRON.—Alfred B. Couch, Worcester, Mass.
99,410.—SOLDERING MACHINE.—E. T. Covell, Brooklyn, N. Y.
99,411.—MACHINE FOR JOINTING BARREL STAVES.—Harry A. Crossley, Cleveland, Ohio, assignor to himself and Ada D. Crossley.
99,412.—WATERPROOF STOCKING.—Frederick Curtis, Boston, Mass.
99,413.—SPRING BOLT AND CLIP.—John Deeble, Plantsville, Conn.
99,414.—ELECTRO-MAGNETIC MACHINE FOR MEDICAL PURPOSES.—Luis Drescher, New York city.
99,415.—FURNACE FOR MELTING AND REFINING IRON AND OTHER METALS.—Adolph Faber Du Faur, New York city.
99,416.—CLASP FOR TRUNKS, ETC.—Theodore R. Dunham, Newark, N. J.
99,417.—MILK BOX.—C. W. Eastwood, New York city.
99,418.—ADJUSTMENT OF WHEELS ON THE AXLES OF RAILWAY CARS.—Richard Eaton, Eaton Lodge, England.
99,419.—COOKING STOVE.—George M. Eckert, St. Louis, Mo.
99,420.—HANDLE FOR CHILDREN'S CARRIAGES.—R. G. Elder, New York city.
99,421.—FOUR-WHEEL PROPELLER.—R. G. Elder, New York city.
99,422.—JOURNAL BOX.—Seth C. Ellis, Jersey City, N. J.
99,423.—VALVE OF ROTARY ENGINE.—Walter Fitzgerald, Boston, Mass.
99,424.—RAILWAY CAR BRAKE.—Wm. G. Foster, Apalachin, N. Y.
99,425.—CIRCULAR KNITTING MACHINE.—William Franz and William Pope, Crestline, Ohio.
99,426.—CIRCULAR KNITTING MACHINE.—William Franz and William Pope, Crestline, Ohio.
99,427.—MANUFACTURE OF FLOUR.—William Freudenau, St. Louis, Mo.
99,428.—ATTACHING THE MAIN SPRING OF WATCHES.—Charles D. P. Gibson, Boston, Mass.
99,429.—VENTILATOR.—Robert A. Goodyear, Binghamton, N. Y.
99,430.—SPRING MOTOR.—Richard Grimm, New York city.
99,431.—LEATHER SAMMIER.—D. C. Guttridge (assignor to himself and R. A. Dunn), Pittsburgh, Pa.
99,432.—SHEATHING BOARD FOR BUILDINGS.—W. E. Hale, Chicago, Ill. Antedated August 1, 1869.
99,433.—ELEVATOR.—Melancthon Hanford, Boston, Mass.
99,434.—FLY NET FOR HORSES.—Jacob M. Harman, Orangeville, Pa.
99,435.—SUPPORTING COLUMN FOR ELEVATED RAILWAYS.—Charles T. Harvey, Tarrytown, N. Y.
99,436.—COOKING STOVE.—Levi Hermance, Lansingburg, N. Y.
99,437.—CHAMBER PAIL.—George A. Higgins, New York city.
99,438.—COFFEEPOT.—George Hotte, New York city.
99,439.—HARVESTER GEARING FOR CHANGING SPEED.—Moses G. Hubbard, Syracuse, N. Y.
99,440.—SCHOOL DESK.—A. J. Hull (assignor to Novelty Iron Works Manufacturing Company), Sterling, Ill.
99,441.—CHAIR BOTTOM.—Platt C. Ingersoll, Green Point, N. Y.
99,442.—LANTERN.—John H. Irwin, Philadelphia, Pa.
99,443.—LAMP BURNER.—John H. Irwin, Philadelphia, Pa.
99,444.—HARVESTER DROPPER.—Cyreneus D. Jeffries, Wooster, Ohio.
99,445.—ROCKING CHAIR.—Olaus Jensen, Christiain, Norway, Antedated January 24, 1870.
99,446.—DOVETAILING MACHINE.—Dedrick Jordan, Charlestown, Mass., assignor to A. S. & J. Gear & Co., New Haven, Conn.
99,447.—SADDLE TREE.—Israel Landis, St. Joseph, Mo.
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99,456.—METALLURGIC FURNACE.—James Montgomery, Sing Sing, N. Y.
99,457.—HORSE HAY RAKE.—John Morgan and Wm. Cline, Jun., Clayton, Ind. Antedated January 24, 1870.
99,458.—HAT-SHAPING MACHINE.—Jean Prosper Marlot, Paris, France.
99,459.—STOVEPIPE JOINT.—H. B. Morrison, Le Roy, N. Y.
99,460.—DEVICE FOR HOLDING TOGETHER THE DIFFERENT PARTS OF BUREAUS AND OTHER ARTICLES OF FURNITURE.—D. A. Mullane and J. O. L. Murray, New Orleans, La.
99,461.—LIGHTNING ROD.—David Munson, Indianapolis, Ind. Antedated Jan. 26, 1870.
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99,467.—TOOTH FOR GRAIN DRILLS.—Chas. E. Patric, Macedon, N. Y.
99,468.—MANUFACTURE OF SOAP.—H. A. Pease, Hartford, Conn. Antedated Jan. 21, 1870.
99,469.—GRAIN FAN.—Isaac Pennington, Tiffin, Ohio.
99,470.—COMPOUND TOOL.—A. S. Perham (assignor to himself, Alonzo Bell, and Amos Hadley), Washington, D. C.
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99,510.—PADDLE WHEEL.—Adam Wingard, San Francisco, Cal.
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99,516.—MOLDBOARD FOR PLOWS.—F. E. Sessions and S. A. Knox, Worcester, Mass.
99,517.—BOOTJACK.—Chas. Brown, Charlottesville, Va.
98,163.—ROLLER FOR FLUTING MACHINES.—H. G. Pearson, New York city. Patented Dec. 21, 1869.

## REISSUES.

3,813.—VARNISH.—D. R. Averill, New Centreville, N. Y. Division A.
3,814.—MANUFACTURE OF VARNISH.—D. R. Averill, New Centreville, N. Y. Division B.
3,815.—COOKING STOVE.—Esek Bussey and C. A. McLeod, Troy, N. Y., assignees of Esek Bussey.
3,816.—TREATMENT OF LEATHER.—N. C. Russell, Gloversville, N. Y.
3,817.—REFLECTOR FOR LAMPS.—W. G. Schmidlin and J. W. Driscoll, New York city.
3,818.—NEEDLE FOR SEWING MACHINES.—H. G. Suplee, San Francisco, Cal. Division A.
3,819.—NEEDLE FOR SEWING MACHINES.—H. G. Suplee, San Francisco, Cal. Division B.
3,820.—PRINTING TELEGRAPH.—The Gold and Stock Telegraph Company, New York city, assignees by mesne assignments, of T. A. Edison.

## DESIGNS.

3,827.—STOOL PAN AND ITS COVER.—John Clarke, Boston, Mass.
3,828.—ORNAMENTING GLASSWARE.—J. H. Hobbs, Wheeling, W. Va.
3,829.—ORNAMENTING GLASSWARE.—William Leighton, Jr., Wheeling, W. Va.
3,830 to 3,832.—CARPET PATTERN.—Charles T. Meyer, Newark, N. J., assignor to Edward C. Sampson, New York city. Three Patents.
3,833.—SASH OR SHUTTER LIFT.—Emery Parker (assignor to The Russell & Erwin Manufacturing Company), New Britain, Conn.
3,834.—STEM FOR GLASSWARE.—Daniel C. Ripley, Birmingham, Pa.
3,835.—MEDAL OF ELIAS HOWE, JR.—Allen B. Stockwell, New York city, sole surviving administrator of the estate of Elias Howe, Jr., deceased.
3,836.—BOTTLE.—L. J. Wicks, Bridgeton, N. J., assignor to himself, Wm. Selser, C. N. Selser, J. A. Selser, G. W. Turner, and J. H. Poole.

## Inventions Patented in England by Americans.

[Compiled from the "Journal of the Commissioners of Patents."]

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3,776.—MANUFACTURE OF IRON AND STEEL.—H. Spencer and L. K. Taylor, Philadelphia, Pa. December 30, 1869.

3,780.—ELECTRIC-MAGNETIC ENGINE.—L. Bastet, New York city. Dec. 31, 1869.

8.—HARNESS.—J. B. Crosby, Boston, Mass. Jan 1, 1870.

16.—BALE TIES.—E. S. Lenox, New Brighton, N. Y. January 3, 1870.

17.—ELECTRO-MAGNETS, AND THE APPLICATION THEREOF FOR OBTAINING MOTIVE POWER.—H. M. Paine, Newark, N. J., and M. S. Frost, New York city. January 3, 1870.

43.—SEWING MACHINE.—Hiram Plummer, Brooklyn, N. Y. January 5, 1870.

59.—LAWN-MOWING MACHINE.—Samuel Colt, Hartford, Conn. January 7, 1870.

## Business and Personal.

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## APPLICATIONS FOR EXTENSION OF PATENTS.

EXCAVATING SCOOPS.—John Taggart, of Boston, Mass., has petitioned for an extension of the above patent. Day of hearing May 4, 1870.

SAW MILL DOGS.—George W. Hill, of Olean, N. Y., has applied for an extension of the above patent. Day of hearing April 30, 1870.

BOOT TREES.—Charles T. Eames, of Milford, Mass., has petitioned for the extension of the above patent. Day of hearing May 11, 1870.

ELECTRO-MAGNETIC PRINTING TELEGRAPH.—Henry N. Baker, Binghamton, N. Y., has applied for an extension of the above patent. Day of hearing April 13, 1870.

MODE OF ATTCHING SLEIGH BELLS TO STRAPS.—Abner G. Bevin, of East Hampton, Conn., has petitioned for an extension of the above patent. Day of hearing July 6, 1870.

ODOMETERS AND COUNTING MACHINES.—J. Lloyd Martin, of Baltimore, Md., has applied for an extension of the above patent. Day of hearing June 1, 1870.

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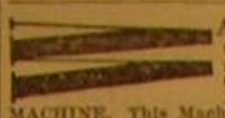

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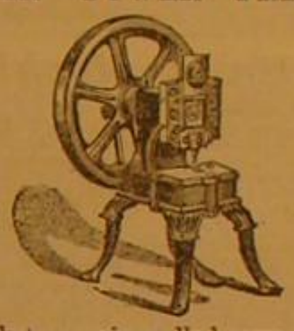

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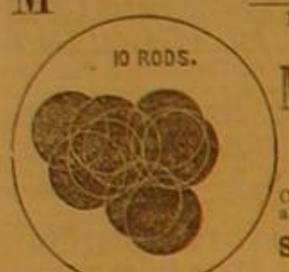


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