SCIENTIFIC AMERICAN

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AEROTHERAPY.

Judging from the multiplicity of novel remedies brought before the public now, there must be an enormous increase in the ailments which afflict the human family, or else the more nervous organization arising from civilization and progress imagines diseases to which the more vigorous barbarians of past ages were utterly indifferent. There is an establishment on the Rhine where the grape cure is practised, where invalids are fed chiefly on grapes, and where the physician's advice merely changes the diet from one kind of grapes to another, according to the needs of the case. And Hans Breitmann sells us of "a beer cure man from Munich," who claimed that he was able to eradicate disease by selecting the quality and controlling the quantity of the national beverage of the Teutons.

We now hear of a new course of treatment practised in Milan, Italy, wherein the patient is subjected to compressed air, and our engraving represents the mode of application. The invalid is seen seated in a comfortably furnished apartment, into which air, chemically purified and maintained at a uniform temperature, is forced by steam power and kept at a pressure somewhat above that of the open atmosphere. Dr. Carlo Forlanini is the discoverer and advocate of this treatment; and his explanation of the theory may be summarized as follows: By increasing the pressure the air is forced into the minutest passages of the lungs, and a much greater oxygenation of the blood is ensured; and obstructions of the lung passages, which occur in many diseases, are removed sooner or later. And if the muscles which expand the chest are weakened, the higher tension of the air assists their action; and it remedies deficient respiration, whatever may be the cause thereof. The Doctor asserts that blood diseases, such as scrofula, can be cured by this treatment, the oxygenation being so complete as to remove all foreign matter from the blood.

The institution at Milan is stated to be elaborately arranged and furnished with every means of ascertaining the nature and extent of the disease, and for administering the air at the proper pressure for each case. If we hear shortly of any great number of cures of pulmonary complaints at this establishment, we must add another function at the list of the capabilities of the steam engine, that of converting, not only heat into pressure, but also pressure into health.

Facts about Potato Beetles.

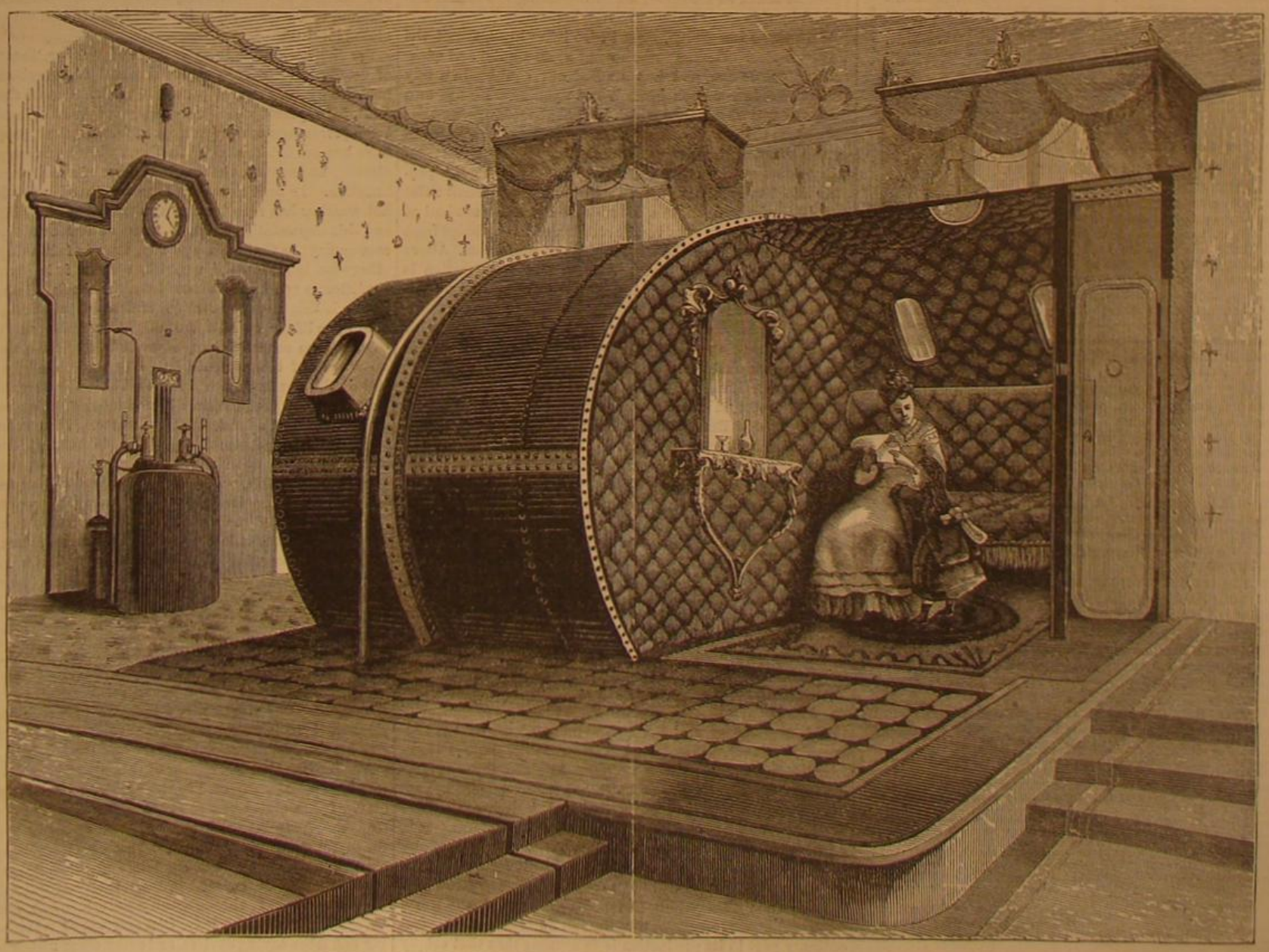
"The potato beetle remains in the ground all winter, emerges from it in the spring in a perfect state, fully grown and ready for procreation. During the day, it remains upon the potato plant and does not fly till night, when it traverses whole fields and whole sections of country, the males in search of the females, and *vice versâ*. The beetle does not eat, and so does no immediate harm. The eggs are laid on the under side of the leaves, in patches about an inch square, and are a golden yellow color. In a few days the young soft grubs are hatched, are ravenously hungry, have but slight hold of the foliage, and are easily knocked off. They have but slight ability to travel on the surface of the soil, and never descend to it voluntarily, until they have reached the perfect slug state, when their natural instinct prompts them to seek the earth, into which they burrow, form a cocoon, and in due time emerge full-grown beetles, ready to begin a new colony. This series of changes takes place from two to four times in a season, controlled by its length, warmth, etc. In the last change they remain dormant through the winter, merely because the temperature is too low to perfect the insects. It is therefore probable that, if they ever reach a tropical climate, their transmigration will be uninterrupted.

"Reasoning from these facts, we arrive at the following, which are borne out by actual experience: Any mode of destroying the beetle, practised by a farmer here and there, is only time lost, as the nightly flight of the sexes in search of each other is sure to supply local fields from the others in the neighborhood, the sense of smell being probably the insect's guide to the nearest plant, and to the general rendezvous. If extirpation of the beetle is determined upon, it must be general and simultaneous. The great difficulty of accomplishing this is insuperable. Therefore let the beetle alone. Beetles, however, produce slugs, and slugs in their turn produce beetles. Slugs do not migrate, are easily dislodged, must eat, and are therefore at our mercy in at least two ways. If they are knocked off the plants in the middle of a dry hot day, and ground into the hot soil (say by a harrow or any similar means), they perish; and if the leaves are rendered, by any external application, unfit for their food, they starve.

"An experience of six years has satisfied me that the slug state is the only vulnerable one, and either of the two modes of warfare indicated above is probably successful. They feed indiscriminately on all the *solanaceæ*. They are not poisonous, cannot bite or sting a human being, need not be a terror to any; and to conquer them, it is only necessary to attack them in a calm, cool, intelligent, business-like manner."—*S. R. M., in Scientific Farmer.*

The Dublin Lioness.

In the report of the council of the Dublin Zoölogical Gardens, there is an account of the death of one of the lionesses, in which is noted a touching incident, worthy of being recorded. The large cats, when in health, have no objection to the presence of rats in their cages; on the contrary, they rather welcome them, as a relief to the monotony of existence, which constitutes the chief trial of a wild animal in confinement. Thus it is a common sight to see half a dozen rats gnawing the bones on which the lions have dined, while the satisfied carnivores look on contentedly, giving the poor rats an occasional wink with their sleepy eyes. In illness the case is different, for the ungrateful rats begin to nibble the toes of the lord of the forest before his death, and add considerably to his discomfort. "To save our lioness from this annoyance, we placed in her cage a fine little tan terrier, who was at first received with a sulky growl; but when the first rat appeared, and the lioness saw the little terrier toss him into the air, catching him with professional skill across the loins with a snap as he came down, she began to understand what the terrier was for. She coaxed him to her side, and each night the little terrier slept at the breast of the lioness, enfolded with her paws, and watching that his natural enemies did not disturb the rest of his mistress. The rats had a bad time during those six weeks."



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(Illustrated articles are marked with an asterisk.)

THE SCIENTIFIC AMERICAN SUPPLEMENT.

Vol. II., No. 31.

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THE EMPEROR'S FAREWELL.

A scientific gathering of unusual importance—not because of what was done, but on account of those who were present—recently assembled at Chickering Hall, in this city. It was a special meeting of the American Geographical Society, called to receive three distinguished foreign gentlemen, the Emperor of Brazil, Dr. Petermann, the famous German geographer, and Dr. Berendt, the Central American ethnologist. Despite the torrid weather, all the scientific celebrities resident in this locality were present, and listened to an address on the "Centers of Ancient Civilization in Central America, and their Geographical Distribution," which really was very instructive and interesting. Dr. Berendt described, briefly, some of his expeditions into Central America; told how, in 1869, he discovered the site of the ancient city of Centla, and there found a host of curious objects made of that imperishable material, terra cotta; and ended by an earnest plea for closer study of American archæology, and for the foundation of museums of relics of the ancient peoples which once occupied our own continent.

Judge Daly, the president of the society, then proceeded to that which was uppermost in everybody's mind, namely, the presence of Dom Pedro, and in a pleasant little speech contrived to say a great many complimentary but well deserved remarks regarding the distinguished guest.

Dr. Petermann's address, which followed, embodied mainly his impressions of this country, some of which, notably that which led him to eulogise our peaceful disposition, as shown by the fact of our having "only one man of war" in the navy, were rather amusing. But the eminent gentleman fairly beamed goodwill to and admiration of the United States.

The Emperor of Brazil was then elected to membership amid great applause. Dom Pedro arose, and with easy dignity advanced to the front of the platform, and spoke as follows:

"Although sincere gratitude's voice is always silent, I will not hesitate to utter my thoughts to the American Geographical Society for the honor it confers on me in the presence of men so prominent in geographical science, and such indefatigable explorers of a region where man, rivaling, as it were, with nature, feels that labor is his greatest glory and more solid base of happiness. In so solemn an occasion, however, it is my duty to express how in my country we prize geographical studies, which will bring to light its elements of wealth, and will secure for it—I speak as a Brazilian, but without partiality—a future brilliant and useful to all nations, with which Brazil has always endeavored to maintain cordial friendship. I trust the American Geographical Society will allow me to send here a feeling adieu to all the people of the United States, who welcomed me with so much kindness, and to explain to them at the same time how sorry I am that a motive, double regrettable, has not permitted my remaining longer among them, to see and examine as much as I desired, notwithstanding the means employed by this great nation to overwhelm time."

With these few words, Dom Pedro takes his leave of the United States. He has come among us as a quiet and unassuming gentleman, and has studied our country in a way that reflects honor upon himself and upon us. He has torn away the veil of romance which hedges about kings, and has showed us that the ceremony of royalty is an anachronism in the nineteenth century, and that true majesty, essentially democratic, suffers nothing by contact with the people. He has shown us how a great and independent ruler may be at the same time a humble and earnest student of science, as ready to receive information and knowledge from working men as from the most erudite of professors. Above all, he has shown us that the possession of education is deemed by him of loftier value than the undisputed ownership of a crown.

The great works accomplished by Dom Pedro during his reign were known to this country, and the welcome which has been extended him has been genuine and sincere. To their Godspeed, the American people now add their assurance of profound respect and cordial admiration—not for the Emperor of Brazil, but for Pedro of Alcantara. In their eyes, at least, the greatness of his station can add nothing to the respect now already secured by his qualities as a man.

The Emperor spent the closing days of his visit in this city inspecting the Hell Gate excavation, newspaper offices, public institutions, and other places of interest, with his usual celerity. Together with the Empress and his suite, he sailed for Liverpool on July 12.

HEATED TERMS—THEIR CAUSES AND DANGERS.

At the time we write, seventeen days of exceptionally hot weather have been experienced over the Northern States. The thermometer, despite a brief rainstorm within the past twenty-four hours, the first that has visited this region during the period above named, stands at 95° in the shade. It has stood at 90° and thereabouts for more than two weeks, and in this city has touched 102°. The most intense heat yet reported, however, has occurred at New Paltz, near Poughkeepsie, N. Y., where the mercury attained the unprecedented hight of 112° in the shade.

Of course wise people have advanced innumerable theories relative to the cause of the present heated term. It is a fact just now that the sun spots are at their minimum, and hence the supposition that we get more heat from our luminary is generally favored. It should be borne in mind that the abnormally hot weather is not omnipresent the world over, and hence to believe that the sun is taking any extraordinary part in its production is to assume that that orb, by some process of selection, has chosen a very small portion of the globe as the recipient of his scorching attentions. Besides, the fewer the sun spots, the greater the evaporative power of the sun, and hence the greater the production of rain, which depends on evaporation. Consequently, so far from the absence of sun spots tending to diminish rain, we should look to their non-existence as a reason for expecting increased rainfall. It is generally credited, also, that the Gulf Stream is moving nearer our coast, and hence the climate is gradually becoming warmer. This assertion is destitute of foundation in fact; but neither this notion, nor the one preceding, nor that involving spectroscopic observations of the sun and the discovery of immense masses of burning magnesium, etc., will ever cease to be credited as long as the daily papers find in their repetition such interesting matter to embody in their discussions of that universally interesting topic, the weather.

The truth is that hot spells like the present are due to local causes. Direction of the wind, barometric pressure of the atmosphere, hygrometric condition of the same, when acting in concert, are amply sufficient to account for increase of temperature over a few degrees; and by consulting the published weather reports and keeping a record of barometer and thermometer for his locality, the observer will soon recognize the especial conditions which underlie the extreme weather in his section of the country.

There are few parts of the world where so extreme a temperature as 112° is ever felt. According to tables given in standard meteorological works, it appears that 100° is exceeded besides in the United States and Canada, in Greece, parts of India, Afghanistan, Persia, Cape Colony, Desert of Sahara, parts of Egypt, Arabia, and the West Indies, and in Central America. In none of these localities, however, is there so wide a thermometric range as from 15° below to 112° above zero, or 127° Fah., as is the case in this and other Northern States. It is this wide variation that causes suffering, for the reason that we never become really acclimated to our own climate, or inured to all its vicissitudes In common with all the Anglo-Saxon race, we possess the energy which is characteristic of dwellers in the colder portions of the globe, and this energy, intensified by American habits and peculiarities, knows no rest. Business and labor are carried on with unabated vigor, whether in the freezing cold of January or the fierce heat of July. We have no season devoted to general relaxation, as have nations under the tropics, though our summers may be as hot as theirs, nor are we able to adapt our habits to our climate, owing to the very uncertainty of the latter. Our weather is in reality a succession of surprises. We never know when to expect such visitations of heat as we are now undergoing, nor can we certainly count upon any period when excessive cold will prevail. Our "probabilities" system gives us an approximate idea of whether to expect rain or shine within twenty-four hours; but the boldest of weather prophets cannot predict whether the coming winter will be moist and open, or severely cold. We are subject, therefore, to sudden changes of temperature; and the natural effect of these is found in the succeeding increase in the death rate in populated localities.

For the week preceding the time of writing, the number of deaths in New York city is reported at 828, showing an increase of 122 over the previous week. Out of the above total, 541 represent children under five years of age; and a large percentage of the remainder includes, first, people who have become debilitated by the heat while suffering chronic disease, and second, the direct victims of sunstroke and exhaustion. In both cases the long continued prevalence of hot weather has resulted in a weakening of vital power, and this depreciation extends more or less over the whole community; so that when a person, even in full bodily health otherwise, is stricken down, his system is in a very poor condition to repel and recover from the shock. In a greater degree is this true of invalids and small children, whose hold upon life is at best but slight. Again, as we have said, sudden climatic changes are to be expected, and hence a hot spell of the present kind may terminate by a sudden fall of the mercury from 100° to 75°. We recently saw a descent of 11° produced in a less number of minutes by the springing up of a brisk easterly breeze. Now sudden mutations of temperature, especially downward, exercise a dangerous effect upon large numbers of persons, especially the aged and sickly, while even among robust people the unlooked-for change is apt to cause colds, pneumonia, and like maladies. It will be seen, therefore, that to maintain the health, whether in winter or in summer, in a climate such as ours, constant watchfulness is imperative. Thousands yearly die, victims to lack of precaution in guarding themselves against the ailments directly due to the vacillations of our most freaky weather.

LIVING ON FIFTEEN DOLLARS A WEEK.

A correspondent expresses a high appreciation of the SCIENTIFIC AMERICAN "as a paper for bosses," but submits that it would be worth much more to him and his ninety shopmates if it would only tell them how it is possible to live decently and educate a family on fifteen dollars a week.

We confess that the efforts of this paper have not hitherto been specially directed to the problems of domestic economy. It has aimed, not so much to teach the art of regulating one's household affairs, the art of spending money, as the more productive art of making money, by laying before its readers the widest attainable range of information wherewith they may be enabled to turn their natural powers to the best advantage through the employment of newly discovered processes, the invention and use of wealth-producing and labor-saving devices, and every other means by which their intelligence, skill, and productive capacity may be in

creased. And we are not prepared to a limit that this is not the best way to make this paper valuable to our correspondent and the class he represents, would they read it aright, regarding the information it offers as for them, and useful to them, not less than for bosses.

Still, in view of the melancholy fact that thousands have no faculty for turning information to advantage, and will not rise from the lower ranks of manual workers, it may be that the value of the SCIENTIFIC AMERICAN can be increased by trying to tell such readers how small incomes may be made to cover the essential requirements of satisfactory living. We shall undertake the task at a venture, though seriously doubting the value of even the wisest advice to one who has come to think, as our correspondent appears to, that an income of fifteen dollars a week is inadequate for decent living.

We have seen too many families living wholesomely, even generously, rearing children of fine character and liberal culture, on an income no larger than that which our correspondent complains of, to doubt for a moment the possibility of the same being done by him and by his shopmates. We know, by that most convincing of evidence, personal experience, that a large family can be reared, healthily fed, comfortably clad, fairly well educated, and well provided for every way, on very much less than fifteen dollars a week. Indeed, we hazard the assertion that if ten thousand of our best and most useful citizens, living and dead, be taken at random, an inquiry into their early history would prove that the great majority of them were reared in families in which an income of fifteen dollars a week would have been accounted munificent. But times have changed, it is replied, and with them the cost of living. True enough, though we are by no means sure that the necessary cost of living well is any greater than in times gone by. Go over the price list of the essentials of healthful and honorable living; and we are inclined to think that in the aggregate the cost will be found to be less, that is, will require fewer hours of labor to buy, than ever before. The fact that our style of living is vastly more complex and costly than it used to be, that a larger portion of what we are apt to consider necessaries were inaccessible luxuries to our near ancestors, does not weaken the position we have taken in the least. One of the great social requirements of the present day is the recognition of our foolish extravagance and a readjustment of our modes of life to a more modest and more economical standard. There are even now thousands of families who have not lost the art of living wisely; and their daily experience proves that it is possible now, as never before, to reconcile humble earnings with high living, high, that is, in the truest sense of the word. Food, shelter, clothing, and all the other conditions of good living, such as our grandparents throve upon, can now be had for much less labor than they had to give for them; while the opportunities for educating a family, now within reach of the poorest laborer almost without cost, are such as former generations could not have had at any price.

To one that cannot accomplish all that our correspondent requires with the sum he mentions, barring, of course, severe misfortune, it is useless to give advice, certainly, without knowing precisely how he is situated, what his ideal of life may be, what his tastes and habits are, what sort of a wife he has, what house rent he has to pay, and some of the other conditions which go to determine the character and requirements of his home. Without the virtues of thrift, sobriety, and a hearty effort to make the most of what one has, neither twelve dollars a week nor twelve dollars a day is any guarantee of wholesome and happy living.

Of some of the simpler means by which our correspondent and others like him may help to increase the purchase power of the money they earn, and to turn to the best advantage their slender incomes, we shall speak hereafter, not theoretically but practically, dwelling chiefly on what men have done and are doing to make a laborer's income provide the necessary and often many of the higher luxuries of life. The real question is, not how it is possible to support and educate a family on fifteen dollars a week or less, but how thousands are doing it.

POISONOUS GARMENTS--A NEW HOT WEATHER PERIL.

It has been a mooted question for a considerable period whether or not the pigments derived from aniline, itself a well known poison, are poisonous to the body when brought in close and continued contact therewith. German chemists assert the negative; but on the other hand, numerous cases of obvious poisoning have been so clearly traced to the wearing of garments dyed with aniline colors as to leave no doubt that, although poisoning by such substances may be a constitutional idiosyncracy in individuals, still enough persons have suffered to render clothing thus colored to be avoided, at least in hot weather. And this for the reason that during the heated term, when perspiration is free, the pores of the skin are open, and the road for the absorption of this foreign deleterious matter is clear. Moreover, the perspiration may act as a solvent and at the same time as a vehicle for the poison; while in addition the system is necessarily enfeebled by the heat, and hence is not in a condition successfully to resist the noxious effects.

A recent case of poisoning by an aniline dye has been brought to our notice, and will serve to indicate the nature of the danger to which we allude. We may here remark that we have heard of repeated instances of poisoning due to coralline dye, a red pigment prepared from carbolic acid and allied to aniline; also to aniline red on cotton, notably colored undershirts and stockings having a red edge, and also to browns and yellows, in which dyestuffs picric acid may enter in its combinations. We have not hitherto heard of, however, nor by examining authorities at hand have we been able to discover, an authenticated case of poisoning by aniline blue, other than that to which we now refer, and which has come under our immediate observation.

The garments were of a light woolen material, and, having become somewhat worn, were sent to an extensive dyeing and scouring establishment in this city to be dyed a dark blue. The owner, after wearing the clothes for a few days in hot weather, observed that the blue color stained his undergarments, and in the localities of the stains he became sensible of a cutaneous eruption. The latter soon extended on a large area, which became excessively inflamed; and a pustular state followed, resulting in excruciating suffering and prostration. The case was carefully examined by several eminent physicians in this city, who pronounced it one of the most severe attacks of poisoning that they had ever encountered, and unhesitatingly ascribed it to the dyeing of the fabric with aniline blue. Had the sufferer been a child or an invalid, the opinion was that the disease was sufficiently malignant to prove fatal.

Perhaps the safest rule is to watch all colored goods when worn, and promptly to discard the clothes on the first appearance of the dye's discoloring the garments or person, wherever it comes in contact.

THE OBNOXIOUS POSTAL LAW PARTIALLY REPEALED.

After an obstinate disagreement which has exhausted the ingenuity and patience of several conference committees, the two branches of Congress have at length agreed upon and passed a bill, which partially repeals the obnoxious postal regulation made during the closing hours of the last session. It was confidently expected that a measure which, since its enactment, has proved itself so excessively distasteful to all classes, which brought no benefit to the government service, but actually diminished receipts, and the effect of which was injurious to the public convenience, would have been immediately repealed. But the needed reform has been delayed until the closing days of the session, and is now but partially effected. The old rate of one cent for every two ounces or fractional part thereof, for all sorts of printed matter except unsealed circulars, is restored, while the present rate of one cent for each ounce is retained on unsealed circulars, on seeds and other merchandise. This is the principal change. It reduces rates on transient newspapers; but the merchant who desires to send a package of samples, or the seedsman a bundle of slips or cuttings, must still pay high charges. The measure seems to us to be ingeniously framed to satisfy the most of the people, and at the same time not to interfere with the profits of the express companies

In addition to the above, several concessions, of not much intrinsic importance, but removing annoying and arbitrary restrictions, have been made. Postal cards, for instance, may have the address either written, printed, or affixed; any package may have the name and address of the sender, with the word "from" prefixed, on the wrapper; and the number and names of the articles in a package may be attached in a brief form to any such package.

Altogether the bill (which, as we have said, is a compromise between the Senate and House), if not what we hoped for, is an improvement over the law which it displaces. At one time an effort was made, but without success, to restore the obnoxious and expensive franking privilege, which existed so long, and was so abused by members of Congress.

OPTICAL INVERSION--AN EXTERNAL SENSE--PERCEPTION.

There are few phenomena in Science more complicated or which offer a wider latitude for differing opinions than those pertaining to vision; and it is a remarkable circumstance that the sense on which our perceptive faculties most closely depend should be the one least clearly comprehended. Helmholtz points out that our eyes are too opaque, that they lack symmetry, are wanting in achromatism, and in part are totally blind. By numerous simple devices it may be physically proved how defective are our powers of ocular estimation; and finally it is demonstrable by actual experiment that the images of objects which pass to the optic nerve are inverted, that in reality we see things upside down; and thus being led to doubt our sense, we are left in a kind of psychological fog, with all our preconceived notions of color, distance, and relative position sadly confused. In order to account for the fact that in actual life we do not see the sky below us and the earth above, or people heels upward, various hypotheses have been suggested. Of these the most commonly received, perhaps because the least definite, is that which ascribes the correspondence of our sight with the actual position of visible things to "experience." It boldly asserts that in fact we do see inverted people and things, but that our experience forbids the brain to recognize all objects as upside down, because it has made their inverted images the signs of their erect and true positions. Another theory is that the reversal of all images is due to the crossing of the filaments of the optic nerve: so that, for example, all the filaments from the upper part of the retina go to the lower part of the optic ganglia at the base of the brain, and *vice versâ*.

To the first theory stand opposed the imperative testimony of every one's consciousness, and also the extended observations of Spalding and others on newly hatched chickens and new born pigs. The chicken just out of its shell, or one, after hatching, hooded for a day or two, and then allowed to see, will instantly locate an edible seed brought near it, seizing it accurately with its bill; and will also at once run in answer to the cluck of the hen, almost always in a direct line. Similar facts have been observed with pigs immediately after their birth. Thus in these animals the non-necessity of experience, even for the visual measurement of distances at short range, is proved.

We have before us a pamphlet entitled "On Some Disputed Points in Physiological Optics," by Professor Henry Hartshorne, in which, among other problems, that above referred to is dealt with in a clear and striking manner. Referring to the Spalding experiments, the author says that, while analogy here only affords a probability as to what is true with regard to human sight, the probability is nevertheless very strong: not that correct visual impressions in all respects are congenital with man, as observation of infants does not seem to show, but that at least the simpler elements of vision attend in their development the maturity of the eye as an organ, and that, among these elements, the sight of objects as not inverted must be one of the simplest. As regarding the hypothesis that the phenomenon may be due to hereditary transmission, he points out that experimentally acquired corrections of positive sensory impressions never go so far as to annul the perception which has to be corrected to such an extent that the process of correction cannot be ascertained by consciousness.

The second hypothesis, Professor Hartshorne disposes of by showing that it is not based on anatomical fact, that it is opposed to all the analogies of nerve distribution, and that according to it the image must be reversed horizontally as well as vertically.

The explanation which, our author states, is generally growing in favor with physiologists is that we do not mentally regard the image upon the retina at all, but look from the retina at the object. "The local change excited in the retina must be conveyed to the optic nerve, communicated to the brain and again in an inverted direction projected outward; through this double inversion, the projected image corresponds to the object, and we therefore say we see the object when only the projected retinal image is before the eyes." This of course leads us to the novel assumption of an externality belonging to and inherent in all our sense perceptions. Distance of sound is apprehended, even with only one ear open to receive it. Professor Hartshorne believes that it is obtained by the exquisite sensibility of the orifice of the ear and parts near it, a sensibility intermediate between auditory and tactile sense, "a kind of gradation existing here which, there is reason to think, has many illustrations in the partially differentiated sense organs of lower animals." So also we judge in case of touch, of the direction from which anything comes, a ball, for instance, striking the hand by reversing as it were the central axis of predominance of the impressions made, which is analogous to the ocular visual axes, whose correspondence gives us single object perception in sight. In fine, Professor Hartshorne thinks that our sensorial consciousness affirms the reality and externality of the objective world, no less simply, directly, and positively than our reflective consciousness affirms our subjective being.

Waste Tobacco.

Tobacco is boiled at the Richmond Cavendish Company's bonded works in Liverpool, to make a wash for sheep. As much as 28 cwt. has been boiled down on the premises in a single day, and on one occasion the Mersey river authorities were put to much perplexity and trouble by the difficulty of sinking a mass of refuse which had been sent out to sea, and persisted in floating back with the incoming tide. There were about 50 tuns of it, and days passed before it could be induced to disappear. The decoction of tobacco is adulterated with sulphate of copper, turpentine, and salt, as soon as it is cool, and the exhausted leaf partially destroyed (denicotised) with quicklime before leaving the boiling house, under the direction of the customs. This prevents either the waste or the refuse from being used in tobacco manufacture afterwards. Each gallon of the sheep wash contains the essence of 24 ozs. of strong American leaf. The preparation, which is allowed to be sold free of duty, has found favor not only among breeders of sheep, but among agriculturalists and gardeners, as an effective vermin destroyer.—*John Dunning, in Journal of Applied Chemistry.*

A Scientific Sermon.

An English contemporary tells an amusing story of a well known scientific gentleman who, recently in a country town, gave a lecture on the coöperation of animals, taking as examples the bee, the beaver, and the buffalo. Among the deeply interested audience no one paid closer attention than an elderly clergyman, and none at the close of the discourse expressed greater gratification at the entertainment and instruction received. It was the scientist's fortune on the following Sunday to sit under the reverend gentleman's preaching. The good man, in his sermon, in turn grappled with the subject of the coöperation of animals; but judge of the horror of the previous lecturer when, in glowing fervor, the clergyman illustrated the wonderful works of Providence by representing the bee, the beaver, and the buffalo as all three working together in some foreign land in harmonious systematic combination!

Recent Meteors.

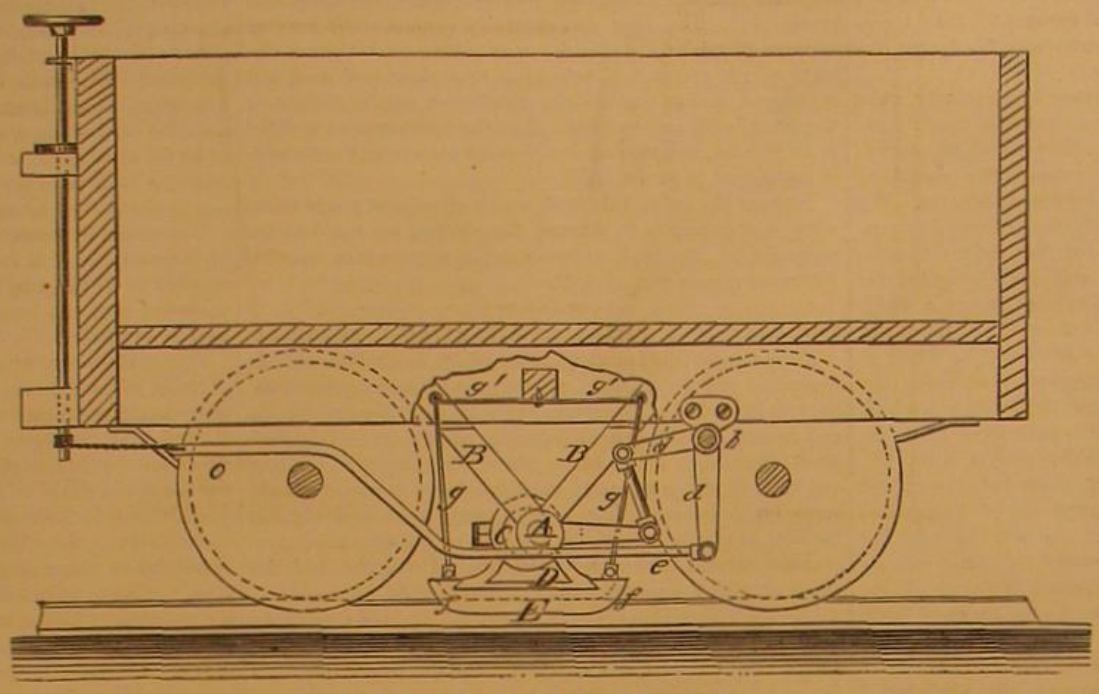
On the evening of July 8, a large meteor passed across the southern heavens, visible in Chicago and vicinity.

On the evening of July 9, a large meteor was seen in the north, at New York and vicinity. It presented a beautiful appearance, being about four times the size of the planet Venus, with all the colors of the rainbow. It left a long and brilliant trail. A moment before it disappeared it broke into several pieces of a bright crimson and blue color. Several correspondents have informed us of this phenomenon, and are tendered our thanks for their letters.

IMPROVED CAR BRAKE.

Mr. William L. Hofecker, of White Haven, Pa., has invented the car brake shown in the annexed engraving. A represents a short lateral shaft that is supported on hangers, B, applied rigidly to the truck frame, between the wheels. A lever arm, *a*, is keyed to the shaft, and connected either directly or by an intermediate shaft, *b*, crank, *d*, and connecting rods, *e*, with the hand wheel and ratchet and pawl mechanism at the front and rear platforms of the car, or to steam or vacuum appliances, by which the brakes are operated in the customary manner. Shaft, A, carries vertically above the rail of the track an eccentric, C, keyed thereto, to which is applied, by an encircling band, the loosely sliding frame, D, that supports at its lower end the brake shoe, E. The encircling band and shoe-carrying frame are secured by fastening bolts, or in other suitable manner, around the eccentric, the brake shoe being connected by a dovetail groove and bolts to the frame, and suspended at the ends by rods, *g*, attached to a spring of the truck frame, by which the brake shoe is steadied and carried in upward direction. The shoe is made of suitable length with a side flange, *f*, extending downward along the rail head for the purpose of bearing jointly on the top and side of the same. The shoe is carried by the turning of the eccentric either toward or from the rail, being retained by its weight and the sliding band parallel to the top of the rail.

The brakes are applied by turning the operating wheel in one direction, and raised from the wheel by means of the spring, *g*, on releasing the hand wheel mechanism.



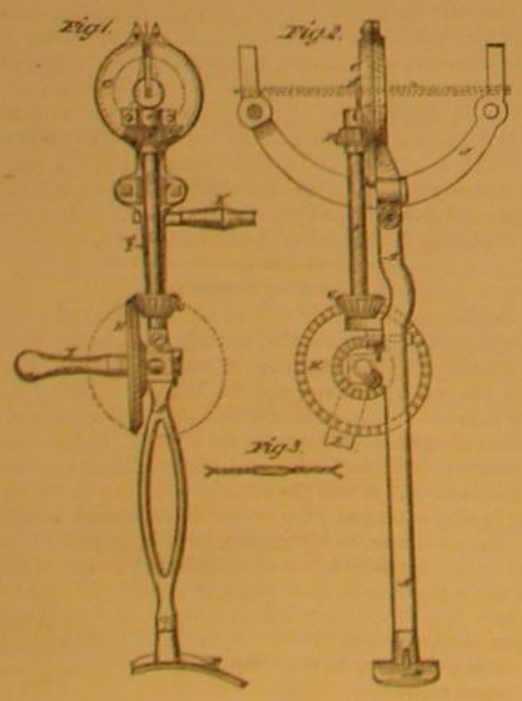
HOFECKER'S CAR BRAKE.

Patented March 7, 1876, through the Scientific American Patent Agency.

A NEW MACHINE FOR SECURING BALE WIRES.

A correspondent recently suggested that some new and simple method was necessary for securing the ends of the wires used for bands on bales of merchandize, etc., so that said ends would not slip or allow the bale to expand. Mr. Moses C. Smith, of Starkville, N. Y., has patented through the Scientific American Patent Agency, June 6, 1876, a novel device for twisting the ends of a wire band together, to form a tie after the band has been passed around a bale or other bundle.

A, in the engraving, is the shank of the machine, to the upper end of which is swiveled a breast plate, B. The lower end of the shank, A, is widened into circular form, and is concaved upon one side to form half of the case, C, the other half of which is secured to said first half and the shank. In the case, C, is inclosed a large bevel gear wheel, D, the ends of the hub of which project through holes in the center of the case, C. The case, C, from its lower side, and the gear wheel, D, from its rim, are slotted, said slots leading into the center of the gear wheel. E is a small gear

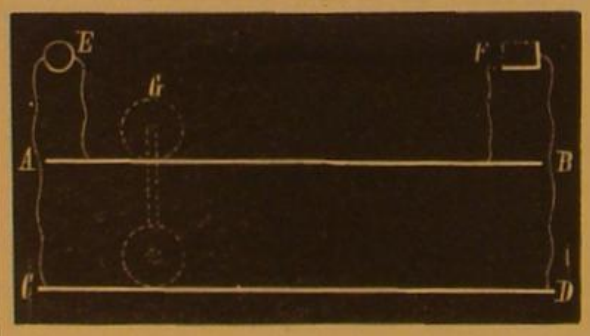


wheel, the side of which passes in through the side of the case, C, and its teeth mesh into the teeth of the gear wheel, D. The gear wheel, E, is attached to the shaft, F, which revolves in bearings attached to the shank, A, and case, C. To the upper part of the shaft, F, is attached a small bevel gear wheel, G, the teeth of which mesh into the teeth of the large bevel gear wheel, H, pivoted to the shank, A, and to which is attached a crank, I, which serves as a handle for applying power to operate the machine. To the opposite sides of the lower part of the shank, A, are attached curved arms, J the lower ends of which are slotted in line with the slot in the case, C, and gear wheel, D. To the shank, A, upon the opposite side from the gear wheel, H, is attached a handle, K, for convenience in holding the machine. In using the machine the wire band is passed around the bale, and its lapped ends are passed into the slots in the arms, J, case, C, and wheel, D, and the crank, I, is turned four or five revolutions, which will twist the wires together, as shown in Fig. 3.

The device is shown in the engraving, Figs. 1 and 2, arranged for twisting wires that pass around the bale the short way. When the wires are passed around the bale the long way, the gear wheel, H, and handle, K, are detached and moved one quarter around the shank, A, and are again attached to it.

A NEW ELECTRIC RAILWAY SIGNAL.

A new railroad signal has been in use on the Boston, Lowell, and Nashua Railroad, for a short time past, which appears to solve the long sought problem of making the rails serve as conducting wires in an electrical circuit gov-



erning the signal mechanism. We append an engraving of the arrangement, which certainly is exceedingly simple, and, from the testimonials of railroad engineers and others who have had direct experience in its working, a very effective invention.

A B and C D are the rails; E is a single cell Callaud battery; F is the signal, the mechanical arrangement of which need not be described. The conducting wires of the battery are secured, as shown, one to each rail, and the two rails, as here represented, may indicate a section of track, say two miles in length, each section being, however, insulated from adjoining sections. The signal at F has an electro-magnet connected to each rail by the wires, as shown. When the circuit is closed, as is normally the case, the magnet is excited, and the signal controlled thereby so as to show "line clear." Should, however, a car or a train run upon the section, then the circuit is completed by the wheels and axles, and the current, taking the shortest course, will traverse through G and then return to the battery rather than go through the longer distance necessary to pass through the signal. Consequently the circuit will at once be ruptured, the magnet will cease to attract, and the signal, by mechanical means, is at once turned to "danger."

It is obvious that this must occur as long as a single car remains on the track, or when the circuit is broken by a displaced or ruptured rail, or any other cause. Hence the device may be applied over an entire line, and will indicate the condition of every section thereof to the train about entering on the same.

The inventor, Professor Wm. Robinson, of 268 Washington street, Boston, Mass., informs us that there is no drawing-off of the current of the earth under the rails; nor, during his experience with the device under all conditions of rain, snow, etc., has he found any time when it became inoperative. In actual employment he has also determined that the single Callaud cell will last for 158 days; and by using two cells in connection with an ingenious device whereby every train which passes over the section throws the cell in use out of action and the other into action, the lasting qualities, curious as it may appear, are greatly enhanced. The invention, by suitable mechanical arrangement, is made applicable to switches, drawbridges, etc.

The Simplest Tide Motor.

For the benefit of several correspondents who have inquired relative to means for utilizing tide power, we would state that the simplest and probably the most effective device for the purpose is that in use in several flouring mills on Long Island Sound. The mill is commonly located at or near the mouth of any little arm or inlet of the main body of water, and across the inlet a short dam is erected. The only access left for the water to run in or out of the arm is under the mill, and there the two undershot wheels are located. As the tide rises outside, the aperture is too small to admit its entering the inlet with sufficient rapidity to keep the water level uniform. Hence there is at flood tide a powerful current running under the wheel inward, and at ebb tide a similar current running outward. The wheels are of course turned, as it may be flood or ebb tide, in reverse direction; but by simple mechanical gearing they are caused to drive the machinery always in the same direction. There is no time when the machinery need not be going, as even when slack water arrives the dam is holding back a sufficient head to keep the wheels going until the tide definitely sets in or out; and even then it is obvious that a very slight difference of level on one or the other side of the dam is sufficient to generate current enough to operate the wheels.

This is an old invention and a very simple one, but it appears not to be known to a great many people, who are vexing their brains over intricate systems of movable floats and gearing for accomplishing the same purpose. The mill is the nearest thing to *a* perpetual motion (not *the* perpetual motion—for that includes the idea of self-generated power) on earth.

A NEW SCISSORS GAGE.

Mrs. Elizabeth Wiggins, of Brooklyn, N. Y., has patented through the Scientific American Patent Agency (May 20, 1876), a novel device for attachment to shears for cutting bias and straight trimmings. It enables the trimmings to be cut much more rapidly and accurately than in the old way.

In the engraving, A, Fig. 1, represents a pair of shears, to the upper blade of which, near its pivot, is attached the end of an arm, B, which is made in two parts sliding upon each other, and clamped to each other, when adjusted, by a set screw, *b'*. The inner end of the arm, B, is bent at right angles, to form a base to rest against the blade of the shears, and has a hole formed through it to receive the screw, by which it is secured to the blade of the shears. Upon the parts of the arm, B, is formed a scale of inches and fractions of an inch, for convenience in adjusting the gage plate, C. The gage, C, slides upon the extension arm, B, and is secured in place, when adjusted, by a clamping screw, C'. The gage plate, C, is made in two parts, pivoted to each other near their inner ends, and connected to each other near their outer ends by a pin attached to one of the said parts, and passing through a slot in the other, as shown in Fig. 2. By this construction, when the blades are closed, the two parts of the gage plate, C, are closed; and as the blades are opened, the lower part remains upon the table, so as to serve as a stop to the goods. In using the device, the cloth is fold-

Fig. 1

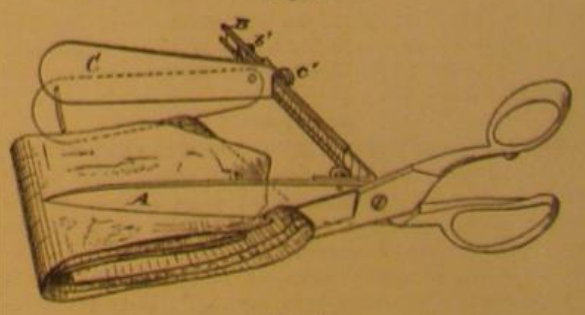
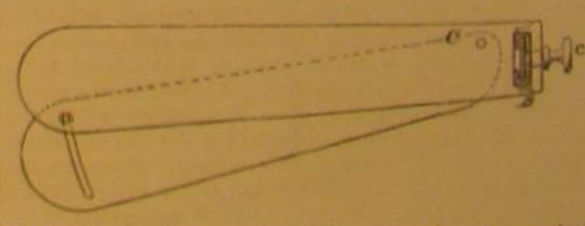


Fig. 2.



ed evenly, and the gage plate, C, is adjusted to the required distance. The lower blade of the shears is then passed beneath the folded fabric, in such a position that the edge of the same may rest against the gage plate, C. The strip is then cut off by a single clip of the shears.

An ordinary boiler furnace requires 300 cubic feet of air for the consumption of each lb. of coal. From 13 to 20 lbs. of coal may be consumed per superficial foot of fire grate. Three quarters of a foot of fire grate are required to evaporate a cubic foot of water.

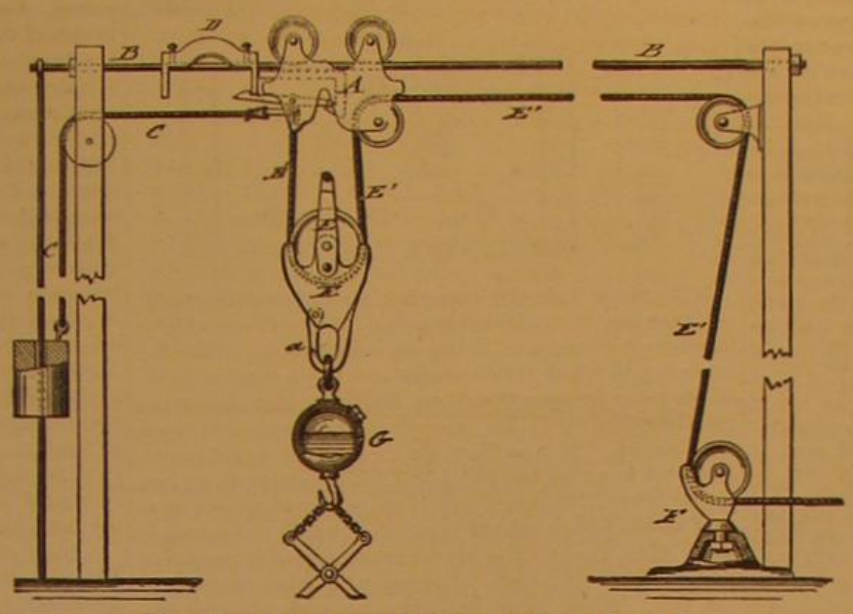
IMPROVED HAY ELEVATOR AND CARRIER.

Messrs. M. C. & A. H. Smith, of Starkville, N. Y., have recently (March 7, 1876) invented a hay elevator, which is operated by attaching one end of a lifting rope to the carriage, passing it then under the load-carrying pulley, thence over a guide pulley on the carriage, as well as one on the frame, and finally under a grooved pulley journaled in a swiveled frame A variable balance weight is used with the load carrying pulley; and the latter is hung to the carriage, raised and lowered by a swivel pulley, and moved forward to the contact stop by a cord and weight applied to the carriage. An adjustably weighted ball hung to the fork-carrying pulley balances the length of rope by which the load is raised and lowered.

In the engraving, A is a movable carriage, running by top wheels on a strong track rod, B. The carriage, A, is moved along the supporting rod by a rope, C, that passes over a pulley, and is supported sufficiently to produce the ready motion of the carriage in one direction, until the same comes in contact with a stop frame, D, that may be adjusted by clamp screws to any point along the rod, B, so as to admit the taking up of the load at any suitable point on the rod, B.

The carriage is so constructed that the arrow or bail of a load-carrying pulley, E, is locked thereto after being elevated, and released by the contact with the stop frame. The load-carrying pulley, E, is hung to the carriage by a rope, E′, which is applied to a fixed point of the carriage, A, and passes over a pulley of the same to the end of the supporting rod, then over a second pulley to the ground, and over a swivel pulley, F, to the draft bar of the horse or other power. The swivel pulley has the advantage of adjusting itself readily to the direction of strain without clamping or wedging the hoisting and lowering rope, E′. A bottom hook of weight, G, carries the hay fork or load.

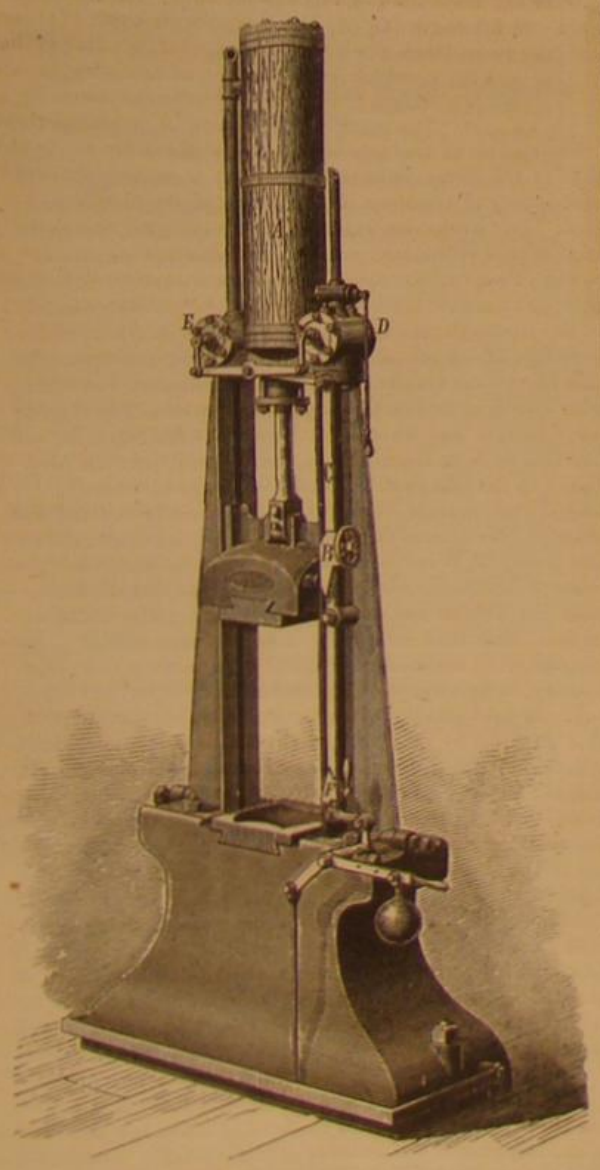
The weight, G, is capable of being adjusted to the varying length of draft rope by being made in the shape of a hollow ball, that is filled with the required quantity of shot. It accelerates the carrying back of the fork pulley on the supporting rod, and of preventing any twisting or entangling of the draft rope, so as to interfere with the regular and exact working of the locking and releasing mechanism of the carriage.



SMITH'S HAY ELEVATOR AND CARRIER

HILL'S DIRECT-ACTING DROP HAMMER.

We illustrate herewith a new direct-acting steam drop



hammer for forging, forming, and welding metals, stamping sheet metals, and other similar purposes. It is self-moving and therefore requires no shafting, belting, or pulleys. The only exterior attachments needed are the pipes by which its cylinder is connected to the boiler. The mode of operation is as follows:

The hammer is secured on the piston rod of the steam cylinder, A. In the illustration the hammer is represented as ascending, and it continues this motion until it strikes an adjustable stud, B, on the pivoted bar, C. The latter, by a system of pivoted and counterweighted levers, connects with the treadle at the base of the machine. While steam is entering beneath the piston, and so lifting the hammer, it is obvious that the inlet valve, D, must be open, and the exhaust, E, closed. Both of these valves, by suitable levers, are connected with the bar, C. When the hammer strikes the stud, B, the latter moves the bar, C, in such a manner as to close the inlet valve, the exhaust still remaining shut. The steam under the piston now sustains the hammer. To drop the latter the operator presses the treadle with his foot, and in so doing he opens the exhaust valve through the medium of bar, C. The steam escapes, and the hammer falls until it strikes a second stud, F, also on bar, C, and thus pushes over that bar to cause it to open the inlet port. The steam, therefore, at once catches the hammer, obviates any possible rebound, and carries it up for a new stroke.

It will be seen that by moving the treadle the operator can cause the hammer to fall at any time during its ascent, arrest it at any time during its descent, or cause it to give light or heavy blows in rapid succession, at will. By adjusting the upper stud up or down on the bar, C, any length of blow desired may be obtained. By removing the counterweight shown on the left, and suitably adjusting the studs, the hammer can be made to continue indefinitely moving, setting its own valves, and delivering blows with any degree of rapidity or force. This is a useful advantage and one which will recommend the machine for purposes of forging and welding.

Patented May 2, 1876, to Thomas Hill. For further particulars address the owners of the patent, Messrs. Hill & Williams, corner 5th and Ohio street Quincy, Ill.

IMPROVED TUBE WELL.

We illustrate in the annexed engraving an ingenious device for driving tube wells. It consists in a detachable point, A, against a shoulder, B, on which the end of the tube rests. Above the shoulder is a shank, C, which extends up into the tube and terminates in a tapered point. It frequently occurs, in making tube wells, that difficulty is met with by the filling of the perforations made above the point for the admission of water. The object of the device we have described is to obviate this, and to allow of securing an unobstructed entrance for the water, by raising the tube up to the conical part of the shank, after the plug has been driven to the required depth. Further, in case water is not found in sufficient quantity after the tube has been raised, it can readily be let down again on the plug to drive it still deeper.

The invention was patented through the Scientific American Patent Agency, April 25, 1876, by Mr. Stephen Henry, of Marshfield, Mass.

A Beauty Society.

Mr. George Dawson, in a recent lecture at Birmingham, England, said that the office of a man's house was not only to give shelter, food, and meat, but also to surround his children with those fair sights and sounds by which the sense of beauty might be developed. There were houses in that town in which not a poem was read nor a song sung throughout the year, and yet people wondered why their children were vulgar. Attention to the beauty of towns was one of the most neglected duties and one of the most deserving. If a town was beautiful, the people took pride in it, like to live in it, and were sorry to leave it In Birmingham they wanted a new society, to be called "the Beauty Society."

Remarkable Japanese Compass.

Mr. Frank Buckland, in *Land and Water*, gives the following account of a remarkable compass taken from the wreck of a junk at the entrance of Yokohama Bay, in 1874. The pilot by whom this instrument was discovered could give no information about the compass, except that it was found on board the wreck. It is of a circular form, measuring 13¼ inches across, cast in bronze, and weighs 21 lbs. It has a thick rim, in which two ordinary compasses are set, one on each side.

The center of this remarkable plate-like looking object is considerably raised from the surface, and is covered with a number of raised spots or stars of various sizes, each more or less connected by lines with its neighbors. The shapes of these star-like objects are remarkable; in the center there are five which are larger than the rest.

Then there is another group very like a net; another group represents almost a complete circle of these stars; another represents a Y with the arms closed together; another a Y with the arms extended. Altogether, there are no less than two or three hundred of these elevated spots of different sizes. Running throughout the whole series are several lines radiating from a circle drawn round the center. The brass rim on which the compasses are set is divided into 360 degrees, the same as an English compass. At every thirty degrees there is a Japanese character.

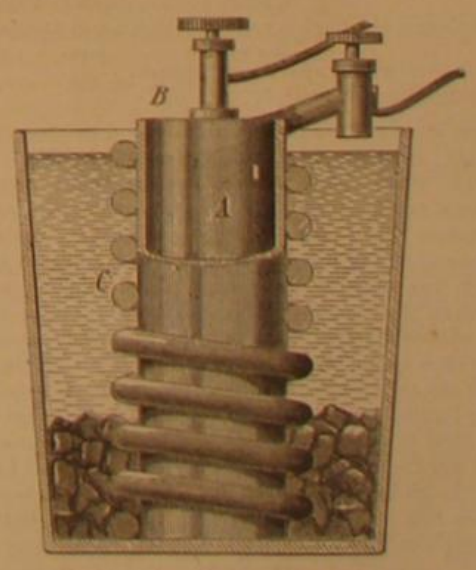
Neither Captain Murray, to whom Mr. Buckland is indebted for the loan of the compass, nor any one to whom he has shown this curiosity at home or abroad, has any idea whatever of the meaning of the star-like bodies in the center, or for what purpose the Japanese used them, but it is quite certain that they must have been of some use to them. It is most interesting that these rude characters should be united in the same instrument with the 360 degrees of modern civilization. The casting of this remarkable instrument is very marvelous. An optician, who cleaned it up for Captain Murray in Glasgow, said he had never seen a finer bit of work.

The Electric Light on a Transatlantic Steamer.

The French transatlantic steamer Amérique is now provided with an electric light, in order to prevent her collision with other vessels. The lantern is placed on the bow at a hight of 22 feet above the forecastle, or 42 feet above the water. The current is produced by a Gramme electric machine, revolving at the rate of from 950 to 1,000 turns per minute, and affording a light equal to 150 carcel burners. An ingenious device places the control of the light in the hands of the officer of the watch, and by this he can extinguish the illumination or renew it at will without stopping the machine. Experiment has recently proved that the most effective use of the light, as a means of warning, is to allow it to shine for ten seconds and then extinguish it for the succeeding two minutes.

A NEW ELECTRIC BATTERY.

M. Onimus recently exhibited to the French Academy of Sciences a new and simple battery, an engraving of which is given herewith. Instead of the usual porous vase he substitutes a diaphragm of parchment paper. The zinc cylinder, A, being enveloped in the paper, B, copper wire, C, is wound over all. The latter holds the paper against the zinc and answers for a fastening. The whole is plunged in the sulphate of copper solution, and the battery soon works regularly. For some carbon batteries, the carbon is enveloped



in parchment paper, and around this is placed either a zinc wire or a zinc cylinder. The battery thus constructed will, when moistened, work for some hours after being removed from the exciting liquid.

The following are useful memoranda for hydraulic calculations: 1 cubic feet of water = 62·425 lbs.; 1 cubic inch of water = 0·03612 lbs.; 1 gallon = 10 lbs., or 0·16 cubic foot. The pressure of water per square inch in lbs. = the head in feet multiplied by 0·4335. Sea water = 1·027 weight of fresh water, or 64·11 lbs. per cubic foot.

Correspondence.

The Mississippi Jetties.—Letter from Captain Eads.

To the Editor of the Scientific American:

The following extract is from a private letter just received from Colonel W. Milnor Roberts. Believing it to be a well merited compliment, I cannot resist the desire to ask you make it public. As Mr. Corthell lately contributed to your valuable journal one of the most complete and intelligible descriptions of the construction of the jetties, and the principles upon which their application to the South Pass bar is based, that has yet been written*, I am sure you will cheerfully publish this handsome recognition of his ability, coming, as it does, spontaneously from one of the oldest and most eminent civil engineers in America, in praise of one who, though still young in the profession, has by his industry and talents largely aided in achieving the success thus far secured by the jetties.

MR. JAMES B. EADS, C. E.—*Dear Sir:* I have just returned from Philadelphia, from the annual convention of our society; and although pressed with an accumulation of various matters here, I must take time to congratulate you upon the grand success which your assistant, Mr. Corthell, achieved before the convention in his presentation of the operations and present status of the South Pass. It was clear, succinct, easily intelligible to those not familiar with the place, and delivered in a manner to impress every man with its truthfulness. It had, I think, a better and more potent influence, in clearing away doubts which existed in the minds of many who were present, than anything ever before presented.

Facts are stubborn things. I had prepared some remarks, chiefly based on the information I had received, some of which I gladly waived in the presence of the thing itself, so to speak, as shown to the convention by Mr. Corthell. If I say you could not have done it better yourself, I only say what I believe is true, and I know that you will understand my meaning. Yours, as ever, W. MILNOR ROBERTS.

I was unable to be present at the convention, but have heard from many others who were there that Mr. Corthell's presentation of the subject was most admirable.

JAMES B. EADS.

The Long Gas Pipe in Pennsylvania.

To the Editor of the Scientific American:

In your issue of June 24, we notice an article, taken from the *American Manufacturer*, which, if left unexplained, would do us both injustice; and as neither of us wishes to be an iconoclast of "tables and books on pneumatics and hydraulics," we will endeavor to give a correct statement of the experiment of passing gas through a three inch pipe, 32 miles long, from Millerstown, Butler county, to Harmersville, Allegheny county, Pa. The time was computed by watches adjusted before the experiment and compared after it. The pressure at the well before the cock was opened stood at 55 lbs.; after opening the cock, it stood at 50 lbs. throughout the day. At 32 minutes after the cock at the well was opened, we could smell the gas plainly at Harmerville, but it would not ignite for some time after. We had fixed at the discharge end of the pipe a 300 light meter; and by reducing the size of the opening so as to deliver 50,000 cubic feet in 24 hours, as registered by the meter, the pressure in the pipe increased to 34 lbs., and stood at that, being a loss of 16 lbs., delivering 50,000 cubic feet through 32 miles of three inch pipe; and by extending the same sized pipe to Pittsburgh (8 miles) the loss in pressure would equal 20 lbs.; and by increasing the opening so as to reduce the pressure to equal a column of water three inches high (the pressure required to lift the gas holders in our works), the delivery would equal 161,000 cubic feet in 24 hours.

This you will (we think) find is "in conformity with the theories and demonstrations of scientists," and it does not "look as though some facts would have to be changed or tables and books on pneumatics and hydraulics revised."

ROBERT YOUNG, JOHN MCELROY.

Engineers of Allegheny and Pittsburgh Gas Companies.

The Voracity of Fishes.

To the Editor of the Scientific American:

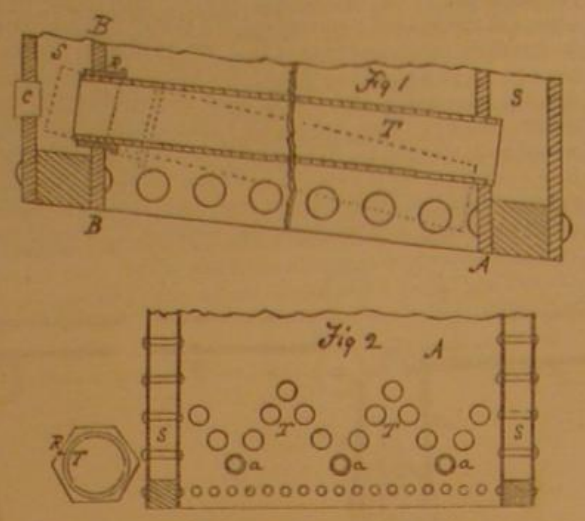
In your issue of June 24, you give us an engraving of fish hooks, etc., found in the stomach of a cod, by Mr. Frank Buckland. Some of our southern streams contain voracious fish. An acquaintance of mine caught a catfish in a lake on the Arkansas River, near Little Rock, some few years since, from the stomach of which was taken the larger part of an ox liver, twenty-three hen's eggs, three puppies, and a child's shoe. Whether the fish had swallowed the child whole, and it had been digested by the juices of the catfish's stomach, and the shoe alone remained to tell the child's sad fate, or whether the child escaped the jaws of the voracious fish, losing only its shoe in the *rencontre*, the evidence was not sufficiently clear to determine. But that the above enumerated articles were found in its stomach is undeniable; and I think this is enough to establish the fact that the catfish is also a voracious fish. ROBERT L. STEEL.

Rockingham, N. C.

The Water Grate.

To the Editor of the Scientific American:

It would seem that a series of wrought iron tubes, placed side by side, three fourths of an inch apart, would form a most appropriate and economical grate for every kind of steam generator, and especially for the furnaces of coal-burning locomotives, wherein the solid bars are so quickly destroyed. The few roads which have used the tubular or water grate have proved it to be highly economical and satisfactory in every way, as far as I can learn: and there seems to be no reason why it shall not eventually supersede the solid grate everywhere and for every kind of fuel. The only care necessary in its use is to keep the tubes free from sediment.



If the tubes, T, in the engraving, are sufficiently inclined, say from one to two inches to a foot, they will not clog, if they are of proper size, unless the water spaces around the furnace with which they communicate first become clogged. If the tubes are more than three feet long, they should not have less than two inches external and one and a half internal diameter. If more than six feet long, I would recommend not less than two and a half inches external and two inches internal diameter; and if more than four feet long, they should have a central support. An inch and a quarter screw plug, C, should be placed exactly opposite one end of each tube, for the purpose of cleaning the tubes in case they get foul. These plugs, in connection with the four two inch ones placed at the corners of the fire box, will afford ample opening for removing all filth which collects around the fire box and in the tubes.

There are several methods of fixing the tubes into the fire box; the best plan, all things considered, is to screw them into the front sheet, A, of the fire box and secure the other end in a copper or composition ring, R, screwed in the rear sheet, B, Fig. 1, about three inches of the rear end of the tube having been previously turned to a nice straight fit to the inside of the ring, so that the ring may be slipped on to the tube a little further than the position it is to occupy finally, in order to facilitate the entering of the screw end of the tube, as indicated by the dotted lines. After the tube and ring have been firmly screwed into the fire box, the corner of the ring may be set up to the tube with a steel set punch and a light hammer, to insure a steamtight junction between tube and ring. The holes for the reception of the tubes may be cut in the sheets before the fire box is riveted together; but the threading of the holes should be done afterward, and then it should be done with a tap having a stem long enough to extend across the fire box and rest in the hole opposite the one being tapped, in order to insure perfect parallelism of the tubes and rings while being screwed in, without any side strain.

The holes for the reception of the tubes are sometimes arranged zigzag across the sheets, as shown in Fig. 2, instead of in a straight line: the tubes, *a*, at the lower angle being movable, and not water tubes, to facilitate the cleaning out of the fire box. The Philadelphia and Reading Railroad, I think, first adopted this arrangement; some of their water grates are nine feet long. When the tubes are set in a straight line, a single movable tube will suffice for cleaning the fire box; this may be either the center one or one of the side tubes. It is desirable that these grates should be easily accessible from beneath, so that the fireman can see the state of the fire from below and carry the poker along between the bars and dislodge the ash and cinder without disturbing the fire above. To this end, there must of course be a door at the rear end of the ash pan.

Worcester Mass. F. G. WOODWARD.

[For the Scientific American.]

TECHNICAL EDUCATION IN THE UNITED STATES AS ILLUSTRATED AT THE CENTENNIAL.

The visitor who is interested in the methods of instruction adopted in this country can profitably spend a day at least in the examination of the educational exhibit at the Exposition. The writer, indeed, after a much longer study of these exhibits, finds his examination but partially completed. The chief point of interest to him, however, in this class, was the display made by several well known technical schools. The question as to the proper method of training engineers has excited great interest in professional circles of late, and numerous letters from your correspondents prove that information of these schools is desired by many of your readers. It is probable, therefore, that a few notes regarding the technical schools that are represented at the Exposition may not be unacceptable.

THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY.

Taken as a whole, the Massachusetts educational exhibit may fairly challenge comparison with the display of any other State, and the completeness of the exhibit is nowhere better illustrated than in the technical department. Many exhibitors seem to think that they have accomplished their duty by making an interesting display, apparently forgetting that, if they cannot furnish printed descriptions or attendants to give explanations, the true merits of their exhibits will rarely be appreciated by the visitor. The Massachusetts Institute of Techology, however, provides complete catalogues of all articles exhibited, with documents explaining the organization of the school and various other details of interest. The general plan of the institution is quite extended, embracing ten courses, each occupying four years, as follows: Civil and topographical engineering, mechanical engineering, geology and mining engineering, building and architecture, chemistry, metallurgy, natural history, physics, science and literature, philosophy.

How these subjects are taught is illustrated by the work of the students, consisting of theses, examination papers, drawings, models constructed by students, accounts of experiments made by them, results of operations in the laboratories, plans and descriptions of buildings, and a good collection of the apparatus employed in making investigations. It is worthy of observation that this exhibit is not made up of the work of the best students only, but is designed to be a fair representation of that done by the whole school. The visitor who makes a careful examination of this display will see that the students are encouraged to make experiments and original investigations, and that a prominent place is given in most courses to the subject of drawing. It is pleasing to notice, too, that the majority of the drawings are such as are required in actual practice, less attention being given to ornamental borders and titles than to the drawings themselves. Enough specimens of elaborate drawing are exhibited to show that the student can do this work if required. A fine illustration of this kind is a chart of the metric system, in which, however, it is to be regretted that the statement is made that all measures of the system, of length, surface, solidity, and capacity, are directly derived from the meter; for although this statement can be supported on the authority of United States law, it is none the less untrue as a scientific fact.

A hasty review of several of the theses shows exceptionally careful and thorough work on the part of the students. As is natural, in discussing doubtful questions, they are usually decided by reference to investigations at the Institute, which may not be generally regarded as possessing the authority of experiments made by other physicists; but taken as a whole, these theses contain much that can be read with profit by professional men and manufacturers. Occasionally, in glancing over the pages, some may regret that orthography was not embraced in the scientific course.

This institution opens its doors to members of the gentler sex, and it is pleasing to find an account of some thorough analytical work by one of the female graduates.

The school year is about 36 weeks, and the necessary expenses, including board and tuition, vary from $500 to $600 per school year, according to statements in the catalogues, the tuition fee being $200 per year. There are, however, several free courses of instruction. Much of the apparatus at the Massachusetts Institute of Technology is unusually interesting; and although some of the more novel features are not exhibited at the Exposition, they are fully described, and may be mentioned in a future letter.

WORCESTER COUNTY FREE INSTITUTE OF INDUSTRIAL SCIENCE.

The exhibit of this school is partly in the room adjoining that of the Massachusetts Institute of Technology, in the east gallery of the Main Building, and partly in Machinery Hall. The mechanical engineer will find much to interest him in this collection, which illustrates the results of a course of instruction, combining practical exercise in a well equipped machine shop with the technical training required by the thorough mechanic. A catalogue of the exhibits, drawings of the school, illustrative charts, and a compilation of various details are of great assistance to the visitor who wishes to make a thorough examination. The Worcester Institute has an annual income of $25,000. It was founded by John Boynton, and the machine shop was established by the late Hon. Ichabod Washburn. It has also received endowments from Hon. Stephen Salisbury and the State of Massachusetts. Tuition is free to all students from the county of Worcester, and also to 23 students from the State of Massachusetts, while to students from other localities the tuition fee is $100 per annum. The annual expenses, other than for tuition, need not exceed $300. The courses given embrace mechanical engineering, civil engineering, chemistry, physics, modern languages, and drawing. In professions where practical proficiency is required, it is imparted by practice. Mechanical students work for 5 months in the machine shop before entering the class rooms, and the subsequent course extends over a period of three years, in which 10 hours a week are devoted to practice in the machine shop for 10 months in the year, and 8 hours a day in the month of July. For other students, the course is 3 years. The work done in the machine shop consists of machine tools, models, and the drawing tables which are so well known. The manufactured articles are regularly sold in competition with those made in other establishments, and are readily disposed of. So far, the shop has not been established on a paying basis, the average annual excess of expenditures over profits being about $3,000. It is, of course, doubtful whether a shop conducted on this system can ever be made to pay expenses, if due regard is given to the other instruction required by the students, but this is a matter of minor importance. Numerous examples of the work of the students are displayed, including all their specialties; and having disregarded the request about touching the exhibits, the writer has become very favorably impressed with the general accuracy and the thoroughness of the execution. In Machinery Hall, which contains lathes, grinding machines, drawing tables, and models, manufactured at this school, one of the machine lathes is driven by a belt of

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twine, to illustrate the accuracy of the work. One of the most interesting exhibits of the school is the Willis apparatus for illustrating the principles of mechanism, with accounts of experiments made by students. In the case of a jack screw, it was found that the efficiency was but 23 per cent of the power applied, 77 per cent being required to overcome friction. With a crane, the efficiency was 67 per cent, and with a differential pulley, less than 32 per cent. The advantage of deriving a knowledge of simple machines from experiment rather than from a theoretical investigation, in which the enormous losses that occur in practice are ignored, is obvious.

THE STEVENS INSTITUTE OF TECHNOLOGY

The visitor will find this exhibit near post T, 67, in the Main Building. It may be a matter of regret to some that so much of the display is devoted to the apparatus of the Institute and the work of its professors, and so little to what has been accomplished by the students, while the want of a catalogue or any method of gaining information will be seriously felt by the casual visitor. The exhibit is, however, of great interest, including a fine collection of the physical and mechanical apparatus of the school, much of which is unequaled, together with accounts of the results obtained by, and illustrations of the apparatus used in, the experiments of Professor Morton on fluorescence, of Professor Mayer on sound, and of Professor Thurston on the strength of materials. There are a few drawings by students which are exceptionally fine, but they are hung rather too high to allow of a close investigation. The engineer will doubtless be much interested in the elegant drawing of the governor invented by Professor Thurston, and equally so in the illustration of Professor MacCord's theodontoscope, for testing the accuracy with which the teeth of gear wheels are cut, by observing the velocity ratio of two teeth at different points of contact. The reader of the SCIENTIFIC AMERICAN SUPPLEMENT does not need to be assured that the Professor of Drawing at the Stevens Institute is one of the ablest instructors in the country; but it is questionable whether this school would not have done well to have made a more general exhibit of the drawings executed in ordinary course by the students.

The practical work of the senior class is illustrated by one of Professor Thurston's well known testing machines. By disregarding the printed request, and touching this exhibit, it will be observed that the construction is not as accurate as in some of the machines described above. The specialty of the Stevens Institute of Technology is thorough instruction in mechanical engineering. The course covers a period of 4 years, the school year consisting of about 35 weeks. The annual expenses are about $500, the tuition fee being $150 per year

ILLINOIS INDUSTRIAL UNIVERSITY.

The display made by this institution will be found in the south gallery of the main building, among the educational exhibits of the State of Illinois. It consists of apparatus used in the school, models made by the students, records of some of their experiments in physics and the strength of materials, and drawings. One of the models, a flight of elliptical stairs, is an exceedingly creditable production. The specimens of machine work, being enclosed in a glass case, could not be examined very critically; but they do not appear to be as well finished as those exhibited by some of the other technical schools.

The Illinois university offers courses of instruction in agriculture, engineering, natural science, literature and science, military science, commerce, and domestic science and art, open to students of both sexes. In this instruction, practice plays an important part, and there is a machine shop in which articles are manufactured for the market. The catalogue of the university, which was given to visitors, was printed at the institution. It is perhaps only fair to say that this is not, in all respects, a first class piece of work. The complete course in any department requires 4 years, of 36 weeks each, and the annual expenses vary from $150 to $300, principally for living expenses, the tuition fees being merely nominal.

UNIVERSITY OF PENNSYLVANIA.

One of the alcoves in the Pennsylvania educational building is devoted to the display made by this university, which consists of drawings, text books, models, apparatus, and some examples of bridge trusses and gearing made by the students. It is not intended as a representative exhibit, visitors who are interested in the matter being referred to the university, which is located in Philadelphia, for further information. This university bids fair to become one of the most prominent technical schools in the country, being richly endowed, having spacious buildings, and an unusually fine collection of apparatus. One of the most important courses, that of mechanical engineering, has not yet been established, but it is probable that it will eventually form a very prominent department.

The above is a brief description of the exhibits of some of the more prominent technical schools of the United States. It will be observed that many well known schools are missing from the list; and it is a matter of regret that a full representation could not have been secured. The list might have been considerably extended by reference to the instruction in drawing and engineering, as illustrated in some of the general educational exhibits, but the limits of this letter will not permit such a wide range. The exhibits of foreign technical schools may form the subject of a future communication.

R. H. B.

Philadelphia, Pa

Brown, Purple, Green, and Yellow Ultramarine.

A Frenchman named Guimet has patented a new process for making ultramarine of these various colors. By the substitution of selenium for the sulphur in blue ultramarine, he obtains a brown and purple ultramarine. If in a similar manner tellurium be substituted for the sulphur, he obtains a green and yellow ultramarine.

Green and violet ultramarine are not new, having been in the market for some time. The method of manufacture has been kept a secret, and it is only through the careful analyses of Dollfus and Mieg that we have an insight into their composition. They analyzed three kinds, with the following results

	Green.	Blue.	Violet.
Silica	37·770	37·860	22·305
Alumina	31·499	24·285	12·790
Oxide of iron	0·181	0·180	0·420
Soda	13·401	12·009	6·855
Potassa	0·480	0·000	0·000
Sulphuric acid	0·693	1·104	1·004
Sulphurous acid	0·405	0·780	0·764
Hyposulphurous acid	0·000	0·621	1·742
Sulphide of sodium	8·592	6·582	1·255
Free sulphur	3·310	7·929	3·188
Gypsum	trace	trace	41·814
Water	4·884	4·904	11·537
Kaolin	6·526	3·039	4·546

It is evident that the violet was adulterated with plaster of Paris. Although there is much similarity in their chemical composition, their structure must be quite unlike, as evinced by their action towards reagents. All three are decomposed by dilute acids, with an evolution of sulphuretted hydrogen and separation of sulphur. This reaction is slowest and weakest with the violet. When green ultramarine is decomposed with hydrochloric acid, great heat is evolved. Concentrated acetic acid, which does not attack lapis lazuli, does not attack blue ultramarine, but evolves gas from the violet and green. Oxalic acid slowly destroys the color of the green and blue, but rapidly decomposes the violet, with an evolution of sulphuretted hydrogen at first, then of sulphurous acid. A boiling solution of alum does not attack the violet, but readily attacks the green and blue. Ammonia, caustic soda, and potassa do not act upon the green and blue, but turn the violet blue. Fused nitrate of silver attacks all sorts and makes them white. Bromine dissolved in hydrochloric acid decolorizes them all. Concentrated nitric acid decolorizes all, with evolution of red fumes.

At a moderate temperature the violet changes to blue, and at a greater heat it turns white or pearl grey. Green resists the action of heat better than violet, but after a time it takes on a bluish green color, and at a very high temperature turns white. When heated with arsenious acid, the green remains unchanged, but the blue turns green, and sulphide of arsenic sublimes. Heating with zinc dust decolorizes all kinds of ultramarine.

Stevens Institute of Technology.—Commencement Exercises.

The second annual commencement of the Stevens Institute of Technology, N. J., took place on the evening of June 30. After a short and appropriate prayer by the Rev. S. B. Dod, President Henry Morton spoke substantially as follows: "The occasion which brings us together this evening is memorable in many respects. The present graduating class of 1876 commences its independent life at a time which coincides with the great celebration of the completion of the first century of our nation's existence. Two trains of thought are suggested by this coincidence. First, that much of our material prosperity is owing to the mechanical genius of our people, who, by the aid of labor-saving machines, have been able, at so early a period, to surround themselves with the comforts and elegances of life. This progress is due, directly or indirectly, to the mechanical engineers. Secondly, that our nation is no longer in its crude and vigorous youth, but needs men thoroughly trained and educated, if it is to keep up in the race of progress with the other nations. It is to 'Stevens '76' and such as them that we must look to make our next century as prosperous as the past. Finally, let us all, faculty, *alumni*, graduates, and students, adopt the sentiment uttered by one of that great class of '76 in Philadelphia, a hundred years ago: 'Let us all hang together,' although we are not, as they were, exposed to the danger of all "hanging separately" in case we fail."

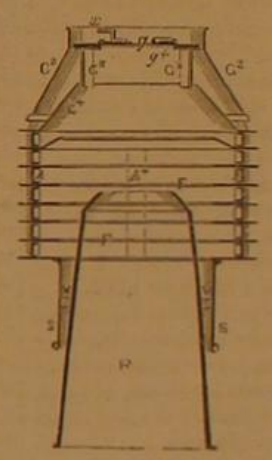
In the next place, the salutatory address was delivered by Edward B. Wall of the graduating class. Then followed abstracts of the theses: "Project for Erection of Two Blast Furnaces," by William Kent; "Transmission of Power by Wire Ropes," by Albert W. Stahl; "Manufacture of Illuminating Gas," by Alfred P. Trautwein; and "Theory of Windmills," by Alfred R. Wolff. These theses evinced considerable original work and research, the students having devoted several months to their preparation, during which they visited shops and factories, made experiments, and executed elaborate drawings. President Morton then introduced Mr. Reuleaux, Director of the Berlin Polytechnic Institute, and President of the German jurors of the mechanical section of the Centennial Exposition, as the representative of a sister institution

Mr. Reuleaux spoke a few words in very good English, in which he begged permission to use his own language, the German. He spoke as follows: "In addressing you as the representative of an elder sister, as your President has kindly styled our Institute, I would have it understood that I do not feel as though I could claim any other advantages than those of age, but am proud to greet you as an equal. Our aims are essentially the same, to combine thorough practical instruction with the advancement of true science. The steam engine, which is the type of our profession, is not a mere mechanical contrivance, but the expression of an intellectual conception. It is, as it were, an enlargement of man's powers over nature, a continuation of his faculties. Its study, therefore, when conducted in the proper spirit, is an ennobling one, and deserves to go hand in hand with science for the amelioration of human society. I have visited this institution, and am rejoiced to see that its professors are imbued with a sense of their high vocation, which cannot fail to produce the happiest results. The scientific researches, moreover, which are here made, rank with the best that have ever been made anywhere." Mr. Reuleaux concluded with a few words of good wishes to the graduates and exhorted them to maintain the dignity of their profession. His speech, though in German, was well appreciated and elicited hearty applause. Mr. Dod, President of the Board of Trustees, then conferred upon the class the degree of Mechanical Engineer, and the exercises concluded with an impressive valedictory address by J. Mather Wallis.

The theses not already mentioned were on the following subjects: "Centrifugal Pumps," Samuel B. Brewer; "Designs for an Overhead Traversing Crane," John O. Buerk; "Pumping Engines," James M. Cremer; "Suspension Cables of Brooklyn Bridge," Gustavus C. Henning; Design for a Paper Mill," Joseph Kingsland; "Design for Iron Foundery," Philip E. Raqué; "Screw Propellers, Principles and Practice," Adam Riesenberger; "Apparatus for Extinguishing Fires," Eugene L. Vail; "Principles of Car Framing," Edward B. Wall; "The American Beam Engine," J. M. Wallis; "Construction of the Steam Hammer," Edward L. Wells; "Design for a Steam Dredge," William F. Zimmermann

IMPROVED CHIMNEY COWL.

An automatic cowl for correcting smoky chimneys and ventilating buildings has been applied successfully to some public buildings in London. The action is continuous, and there is no mechanism to get out of order. The engraving shows a vertical section of the cowl. R is a truncated portion of tube which may be attached to the chimney pot. S is also a similar portion placed over the truncated tube, R.



The tubes or cones, R and S, are kept apart from each other by means of distance pieces, V. At the top of the tube, S, are placed a number of annular rings, superimposed, or perforated plates, F, separated from each other by means of distance pieces or blocks, *h*. Bands of metal —*h**, help to hold together the plates. These plates, F, are surmounted by a cap designed to prevent down drafts, which is constructed as follows: G* is a truncated conical cap, provided with upright supports, g^3, on the top of which is a flange or ring, g^*, so as to support a dome or door, G. Another conical cap or casing, G^2, is placed round the cap, G*, and rises above the flap or door, *g*. The outer conical casing, G^2, is secured to the uppermost of the plates, F, by distance pieces or nuts. A free passage for the air is left between the inner and outer casings. Sometimes the door or dome is a fixture, but, when movable, a bent piece of metal, X, acting as a spring, closes it, after the brush or instrument used for cleaning or sweeping the chimney has been withdrawn. This dome or door, besides preventing down drafts, also prevents rain, snow, or other matters entering the chimney. The action of the ventilator is claimed to be that the constant movement of the atmosphere, passing transversely between the plates, F, withdraws all smoke, gas, and vitiated or noxious vapors.—*Building News.*

Centenarian Birds.

It may not be generally known, says the *Wexford Independent*, that the eagle, raven, and parrot are each centenarians. An eagle kept in Vienna died after a confinement of 114 years; and in an ancient oak still known as the raven tree, the same pair of ravens are believed to have fixed their residence for a series of more than 90 years. Swans upon the river Thames, about whose age there can be no mistake —since they are annually marked by the Vintner's Company, under whose keeping they have been for five centuries— have been known to survive 150 years and more. The melody of the dying swan is mythological. Upon approach of death the bird quits the water, sits down upon the bank, lays its head upon the ground, expands its wings a trifle, and expires, uttering no sound.

Corn Cobs.

One of our city exchanges, says the Ohio *Farmer*, objects to using corn cobs for fuel. They are too valuable. He recommends covering them with a plaster of oil, meal, bran, etc., and feeding to cows. The plan is fully equal to that suggested by a correspondent of another paper, to keep shade trees out of pastures to prevent cows from getting lazy. One cheats the poor brutes into eating that which is unnutricious and unpalatable, and the other forces them to eat by depriving them of shelter from the hot sun: at least, that is the intention

IMPROVED STEAM GOVERNOR.

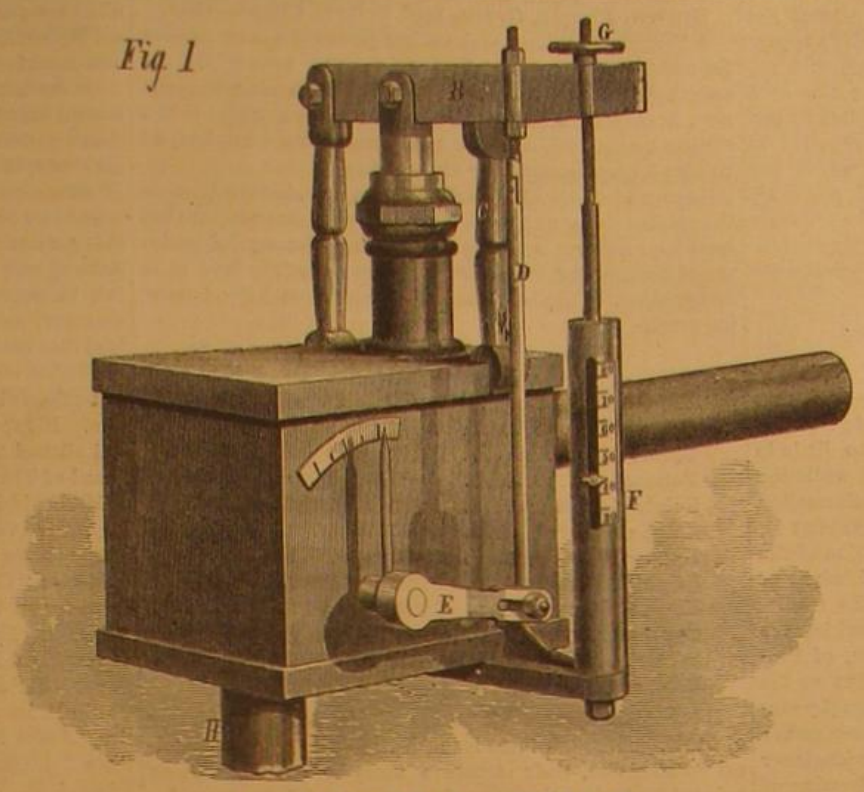
The invention herewith illustrated is a new automatic governor for regulating the influx of steam to the engine, by the steam itself. It is set to allow steam at a given pressure to pass; should that pressure be exceeded, a lever similar to that of a safety valve is lifted, and the steam valve by suitable connection therewith is closed sufficiently to allow less steam to go to the engine, so that the pressure admitted to the cylinder is in this way maintained uniform.

Steam from the boiler is led to the rotary valve, A, in the bottom of the steamtight box, Fig. 2. In the lid of the box is a pipe in which plays a plunger attached to the lever, B, Fig. 1. The latter is pivoted at its extremity in a support, as shown, rests on another support, C, and is connected by the rod, D, to a wrist in the end of a crank, E, which is secured to the shaft of valve, A. Above and below the rod, D, on the lever, are nuts to allow of lengthening or shortening the rod to adjust the valve, and said rod also has a joint in it to prevent cramping when the lever is forced upward. F is an indicator operated by a spring and connected to the lever by a threaded rod and nut, G. This answers the double purpose of holding the lever down and to show the steam pressure. The pointer attached to the neck of the valve exhibits, on the scale on the side of the box, the position of the valve within. Steam, after passing through the device, has its exit at the pipe, H. In adjusting the apparatus, the nut, G, is first screwed down until the indicator shows the desired amount of steam. When the pressure in the boiler reaches that point, the throttle is thrown open to its full capacity, said capacity being equal to that of the governor valve, A. As long as the steam is kept at the fixed pressure, the engine will run steady. When, however, the limit is transcended, then the pressure on the end of the lever piston will raise the lever, which in turn will rotate the valve, A, and so shut off a portion of the steam from the engine. The adjustment of valve, A, so as to cause it to close faster or slower, is effected by the wrist, which passes through a slot in the crank arm.

It will be seen that the device is independent of the motion of the engine, and thus, as the inventor claims, it governs the engine, instead of the engine governing the gover nor, as is usually the case.

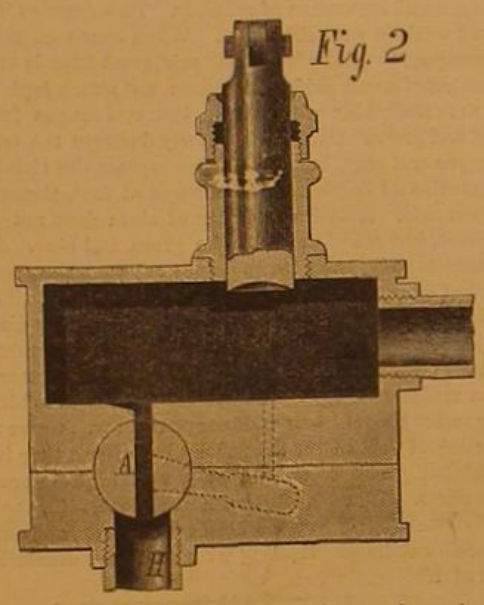
Patented May 23, 1876. For further information regarding sale of rights, etc., address the inventor, Mr. Josiah W. Clark, Iola, Allen county, Kansas.

Fig. 1



CLARK'S STEAM GOVERNOR.

Fig. 2



IMPROVED HYDRAULIC ANCHOR LIFT.

We illustrate herewith new mechanism for raising the anchors of spoon and other dredges by hydraulic power. To the framework of each dredge, adjacent to the anchor, a vertical metal cylinder is connected to a pump, so arranged that its power may be conveyed simultaneously to all the cylinders or to any one of them. In each cylinder is a plunger which, by water pressure, is forced upward, during which motion it gripes and lifts the anchor, releasing the same on its downward movement. The general construction of the device is strong and simple, and its action is mainly automatic. The engraving, Fig. 1, represents it as located at the stern of a dredge and engaged in lifting the storm anchor.

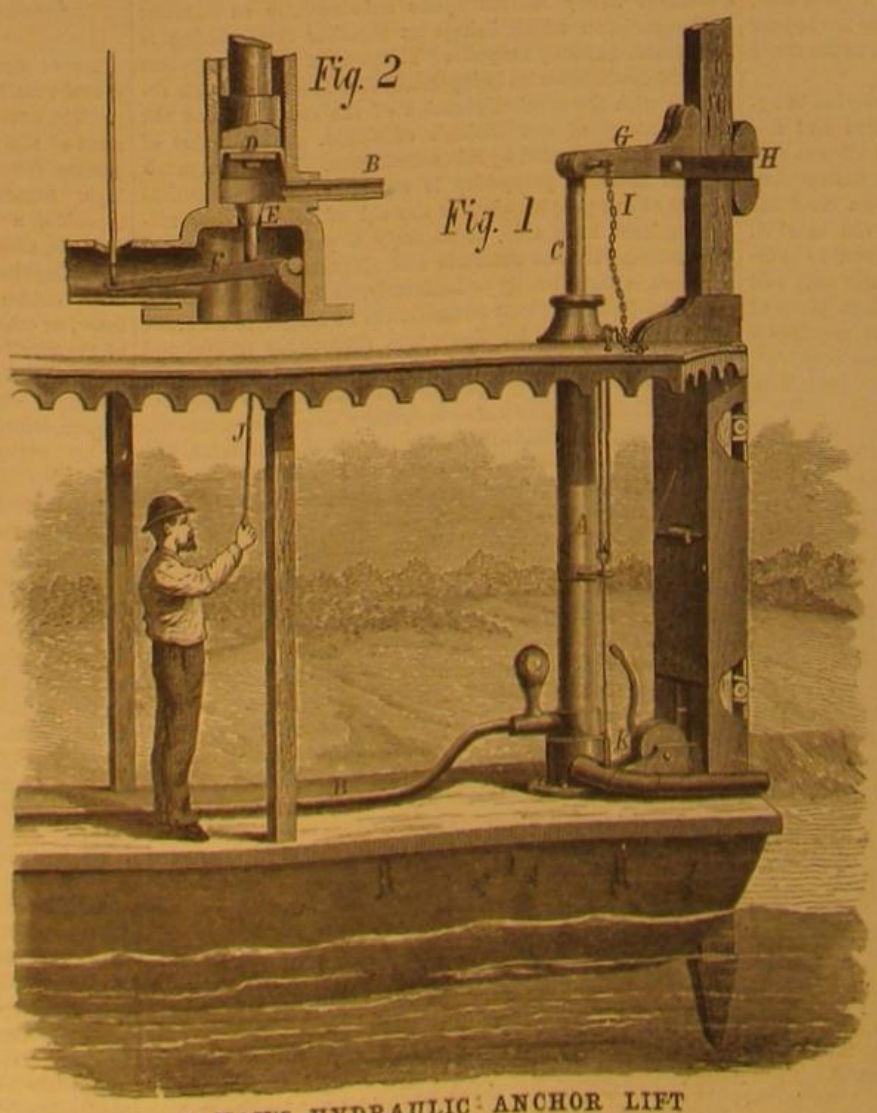
A is the vertical cylinder which receives its water supply from, the donkey or other pump by the pipe, B. Inside the cylinder is the plunger, C, the head of which, with cup-shaped packing, which the water pressure it self serves to keep tight, is represented at D, Fig. 2. The same figure shows, at E, a valve lifting upward, which is controlled by the lever, F, the end of which enters the outboard discharge pipe for the water.

At the upper extremity of the plunger rod are arms, G, having at their ends toes which press against the anchor. Surrounding the latter are straps which likewise embrace the cam piece, H. This arrangement is such that, when the plunger is force upward, the toe and cam bind firmly and the anchor is lifted. As soon, however,as the plunger has reached the end of its stroke, it pulls upon the chain, I, so lifts the lever. F; and the valve, E, being thus raised, the water escapes from the cylinder, while that still delivered from the pump passes at once overboard. The plunger cannot proceed any higher; and if its single stroke has with drawn the anchor, its work is accomplished. If, however, it is necessary to take another lift, the operator, as shown, holds the lever up by the cord, J when the plunger descends by its own weight to the bottom of its stroke. Mean while, to prevent the anchor falling back the cam, K, is thrown into action, and this, holds the anchor firmly until the device on the end of the plunger takes a new grip. The operation, as already described, is then repeated until the anchor is extricated.

The apparatus has been practically tested and adopted by Mr. John Brown and other well known Canadian contractors. It is notably labor-saving, and will do much to facilitate the now difficult labor of raising anchors by friction drums and chains.

Patented May 16, 1876, by Mr. James Canan, of Port Colborne, Canada. For further particulars address Messrs. Burrow, Chatfield & Co., 11 to 13 St. Paul street, St. Catharine's, Ontario, Canada.

Fig. 2



CANAN'S HYDRAULIC ANCHOR LIFT

The Frog.

Thus the perspiring editor of the Boston *Globe* discourses on the comfortable life of the frog:

"We feel impressed during these fervid days" says the writer, "that it would be nice to be a frog. So far as we know the frog never toils, and we feel quite certain that he doth not spin; but he goes in swimming whenever he feels like it, and he has a passion that way that the most restless schoolboy can hardly emulate. What could be more refreshing than to plunge to the bottom of a cool pond, when the summer sun grows fierce and vindictive, and there meditate on the advantages of amphibiousness? What a luxurious place would the bottom of a lake be for passing one's Fourth of July in peace and quiet! Oh! that we were a frog. And the youthful batrachian lives in a perpetual summer retreat, in sedgy streams and by purling springs, in the cool shade of the umbrageous trees and among tall grasses swept by the passing breeze. And he wears no exasperating fabric of wool or cotton, nor yet of insidious and sticky linen; but with the smooth coat of green and black wherewith Nature clothed him, he can enjoy the cooling shower, or sit in his bath by the hour, with no fear of ague and no sense of seething discomfort.

"Happy frog! He has no hours of labor, and he seemeth not to be oppressed with the necessity of sleeping at any set time. He can take his siesta at noonday, and his dreamy doze at early dawn, and in the cool of the evening he can sit and sing in the fullness of his joy! No mosquitoes annoy him, and he has an easy escape from pestiferous flies. As a singer he has few equals, and as a ventriloqnist he is absolutely unsurpassed. He can so modulate and entune his voice as to baffle the efforts of the most persevering boy to find his whereabouts, and without question he has rare sport in thus playing with the feelings of his chief enemy, the small boy. 'Tis not alone in the refreshing and invigorating element, water, that the frog has advantages of locomotion. He will leap you a hundred times his length at a single jump. If a man could do that, what fun it would be! How exhilarating would be the daily journey to town, with the opportunity of a leap from the bridge on the way!

"The frog has many other advantages that may well make one sigh for a lot like his. It is better than any corner lot in Boston. Who ever saw a frog that was lean, or that was reduced either to beggary or the necessity of labor? His natural food swarms in his favorite haunts, eager to be swallowed. And he has no occasion to be over fastidious, for he has no sense of taste and very little of smell. It may not be generally known to the unlearned that the frog, with all his fondness for water and dampness, never drinks. To some this may seem like a disadvantage. There are degenerate men who, if they were forced to take all their liquid refreshment externally, would covet the fate of that English prince who was drowned in a butt of Malmsey wine; or if they were to be frogs, they would wish for bowls of punch and lakes of liquor.

"The frog suffers occasionally from the 'cussedness' of the small boy and the voracity of the Frenchman, but he has few enemies. For the most part he passes a life of serene joy, and never fails to keep cool in summer, while in winter he dreams the months away in a state of ecstatic torpidity. He has no occasion for overcoat or arctic shoes, and cares not for the range of the thermometer or the prognostications of 'Old Prob.' The rain never spoils his picnic or postpones his evening's entertainment. He has his place too in literature. Even old Homer sung of his conflict with rapacious rodents, and Aristophanes made him a medium for wit and music in his dramas. How many a lesson has he taught the world, with Æsop as his interpreter! He is famous in song and story he is happy and jovial in his life, and above all he is forever cool. Happy frog!"

To Join Lead Plates.

The joints of lead plates may be made as follows: The edges are brought together, hammered down into a channel cut out of wood, and secured with a few tacks. The hollow is then scraped clean with a scraper, rubbed over with tallow, and a stream of hot lead is poured into it, the surface being afterwards smoothed with a red hot plumber's iron

THE JAGUAR OR SOUTH AMERICAN TIGER.

Among the many handsome and formidable creatures which are natives of the western hemisphere the jaguar is entitled to the first place for beauty, strength, and ferocity. In these particulars it rivals the royal tiger of Bengal, resembling it also in subtlety. It is occasionally seen in North America as far north as Louisiana; but the southern continent is its home. The natural history of this animal was given in detail on page 39 of our volume XXXIV.; and we herewith publish an admirable engraving, showing a fine specimen of the race, enjoying the coolness of the shade and the river in one of the tropical forests. The picture was drawn by Mr. Joseph Wolf, and engraved by the brothers Whymper; and it first appeared in "The Life and Habits of Wild Animals," published by Messrs. Macmillan & Co., of New York and London.

THE SIESTA.

The artist has well succeeded in portraying the ferocious beast in an attitude of perfect repose. But for the blinking eyes and the curl on the tip of the tail (which has evidently just touched the surface of the water) the animal gives no sign of life; and its watchfulness, even when at rest, is the only indication of its remarkable cunning, which never allows it to be surprised. In this state of rest, we can admire the immense muscles of the shoulders and neck, and the great size of the thighs and legs, as well as the exceeding beauty of the coat and the configuration of its spots. Of all the larger specimens of the tribe *felis*, the jaguar most resembles in countenance the domestic cat; and the likeness is very apparent in our engraving, the *pose* of the monster increasing the similarity.

A terrible tragedy took place some time since, in a monastery in Santa Fé, New Mexico, in which the strength and courage of the jaguar were forcibly shown. One of the brothers entered the sacristy, and found himself face to face with a large jaguar. The beast clutched him at once, and dragged him into a corner. The screams of the victim brought another monk to the room, whom the jaguar also despatched with promptitude; and another comer met a similar fate. A gentleman named Irondo attempted to approach the sacristy by another door, but unfortunately the jaguar had left the room through this door, and before Mr. Irondo could reach the spot he was saluted by the cries of a fourth victim. The doors were, however, finally shut upon the jaguar, and he was shot through a hole bored in one of them.

It seems to be a merciful dispensation of Nature that the most terrible quadrupeds are not gregarious, but hunt alone or in couples. If lions, tigers, and jaguars herded like wolves, whole provinces would be depopulated by their ravages, and man would hardly be able to hold them in any subjection. But by destroying them in detail, their numbers can be kept within bounds, and their depredations confined to their native forests and jungles

Facts and Simple Formulæ for Mechanics, Farmers, and Engineers.

Velocity of circular saws at periphery, 6,000 to 7,000 feet per minute. Rate of feed for circular saws, 15 to 60 feet per minute. Velocity of band saws, 3,500 feet per minute. Velocity of gang saws, 20 inch stroke, 120 strokes per minute. Velocity of scroll saws, 600 to 800 strokes per minute. Velocity of planing machine cutters at periphery, 4,000 to 6,000 feet per minute. Travel of work under planing machine, $\frac{1}{20}$ of an inch for each cut. Travel of molding machine cutters, 3,500 to 4,000 feet per minute. Travel of squaring up machine cutters, 7,000 to 8,000 feet per minute. Speed of wood carving drills, 5,000 revolutions per minute. Speed of machine augers, 1½ inches diameter, 900 revolutions per minute. Speed of machine augers, ¾ inch diameter, 1,200 revolutions per minute. Gang saws require, for 45 superficial feet of pine per hour, 1 horse power indicated. Circular saws, for 75 superficial feet of pine per hour, 1 horse power indicated. In oak or hard wood, ¾ of the above quantities require 1 horse power indicated.

The area of a safety valve should be ·006 times the area of the fire grate.

On railway car axles, 20 pints of oil lubricate 8 journals of cars for 5,000 miles, or 1 pint for 250 miles.

The following is the effective horse power for different water motors, theoretical power being 1: Undershot water wheels, 0·35; Poncelet's undershot water wheel, 0·60; breast wheel, 0·55; high breast, 0·60; overshot wheel, 0·68; turbine, 0·70; hydraulic ram raising water, 0·60; water pressure engine, 0·80.

The following are the ordinary dimensions of windmill sails: Length of whip, 30 feet; breadth at base, 12 inches; depth at base, 9 inches; breadth at tip, 6 inches; depth at tip, 4½ inches. The effective horse power is found by dividing the product of the total area of sails in square feet and the cube of the velocity in feet per second of the wind by 1,080,000.

Rule for speed of screws: Velocity in miles per hour = pitch of screw in feet multiplied by the number of revolutions per minute, and divided by 88.

With hydrogen gas, having a buoyancy of about 13·3 feet to 1 lb., the diameter of balloons = the cube root of 25·5 times the weight to be raised, including that of the balloon itself, or the weight = 0·0392 times the cube of the diameter.

The unit of heat is the quantity required to raise the temperature of 1 grain of water at its maximum density 1° Fah. The absolute mechanical equivalent thereof is 772 foot grains, and the thermal equivalent of the absolute unit of work = 0·000040224.

The proper proportion for the width or hoist of the American ensign is $\frac{1}{1.9}$ its length. The thirteen horizontal stripes should be of equal breadth and begin with the red. The blue field is 0·4 of the length of the striped portion, and is 7 stripes in depth. The 37 stars are ranged in equidistant horizontal and vertical lines.

The actual horse power of pumping engines = quantity of water raised per minute in cubic feet multiplied by hight elevated in feet, multiplied by 0·0023. The indicated horse power of engines is found by dividing twice the product of the area of the piston in square inches × the average pressure of steam in lbs. per square inch in cylinder × the number of revolutions per second × the length of the stroke in feet by 550.

Useful numbers for pumps: The square of the diameter multiplied by the stroke, multiplied by 0·7854, gives capacity of the pump cylinder in cubic inches; by 0·002833, in gallons; by 0·0004545 in cubic feet; by 0·02833, in lbs. fresh water.

Resistance in lbs. per tun on different roads, exclusive of gravity: Stone tramway, 20; paved roads, 33; macadamized roads, 44 to 67; gravel, 150; soft sandy and gravelly ground, 210

Climbing a Standpipe.

Some reparations having become necessary upon the standpipe at Spring Garden Station of the Philadelphia Water Works, among which the scraping and painting of the exterior, which had become weather-worn and rusted, was the most considerable task, the first step to be taken was obviously to construct a scaffold for the workmen; and as no means had been provided for the attachment at the top of the pipe of the blocks and falls from which a scaffold should be suspended, the climbing of the pipe for this purpose was an undertaking which preceded all others. This climbing was accomplished by Mr. George Robinson (a working rigger of this city in the following way: The standpipe itself is 127 feet of wrought iron shaft, above a square stone plinth, the shaft being about 6 feet in diameter at the bottom, and 4½ feet in diameter at the top (under the cap or head ornament, which projects 12 or 16 inches all round). At the foot of the plinth, a light ladder, 30 feet long, was set up, with the top to rest against the shaft. Climbing the ladder to the top, carrying a bow or ring of half an inch round iron rod, which was made to surround the shaft loosely, with the ends about 16 inches long, turned downwards, these ends were lashed fast to each side of the ladder. Next, a piece of rope (3 inches, equal 1 inch diameter) with an eye in one end, was passed also round the shaft, and was lifted to the top of the ladder, below the ring of iron, when the plain end of the rope was drawn through the eye and made fast, so that the rope formed a lashing, and the end of the fall, passed down between the ladder and the shaft, was made fast to the lower round of the ladder, and the ladder itself then hauled up to the lashing; and with its upper end steadied by the ring of iron, was placed vertically against the side of the shaft. Another ring of half inch iron was placed around the shaft at the bottom of the ladder, which ring was also lashed to the sides of the ladder, and steadied at the bottom whenever it was attempted to lift by the lower round. The ladder being elevated as described, and held in place by making the hauling side of the fall fast to something below, another lashing like the first one was taken to the top of the ladder (in point of fact, Robinson stood upon the top of the ladder each time it was hauled up, and took with him this second rope); and this rope was then converted into a second lashing like the first one only 25 feet higher up on the shaft. A second block was hooked into this second lashing, and the end of a fall from it was taken down behind the ladder to the lower round, and made fast, while the other end was hauled tight to relieve fall number one. Lashing number one was now cast off, and taken to the top of the ladder; and by means of the second fall, the ladder, with Robinson upon it, was lifted to the second lashing. At this point the operation merely repeated itself, except that, from the reduced diameter of the shaft, it was necessary to to bring the head of the ladder up to the lashing and make new ends; to the top bow of iron (which could be bent cold), twice in the whole climbing. The bottom ring it was not found necessary to reduce in dimension. Five fleats brought Robinson to the top of the shaft; and as the top of the ladder was then hung far enough from it, he was able to pass at once over the projection of the cap, and mount upon the

plates which covered the projection (a low ornamental railing surrounds the cap). Having reached the top, the other attachments became easy. The man Robinson, and another rigger to handle the rope, aided by one or two men, when a pull was required performed alone all the labors of the task. They came to the Spring Garden Works at about 10 A. M.; and in less than two hours (before 12 M.) the column had been climbed, and the ladder was sent down.—*Journal of the Franklin Institute.*

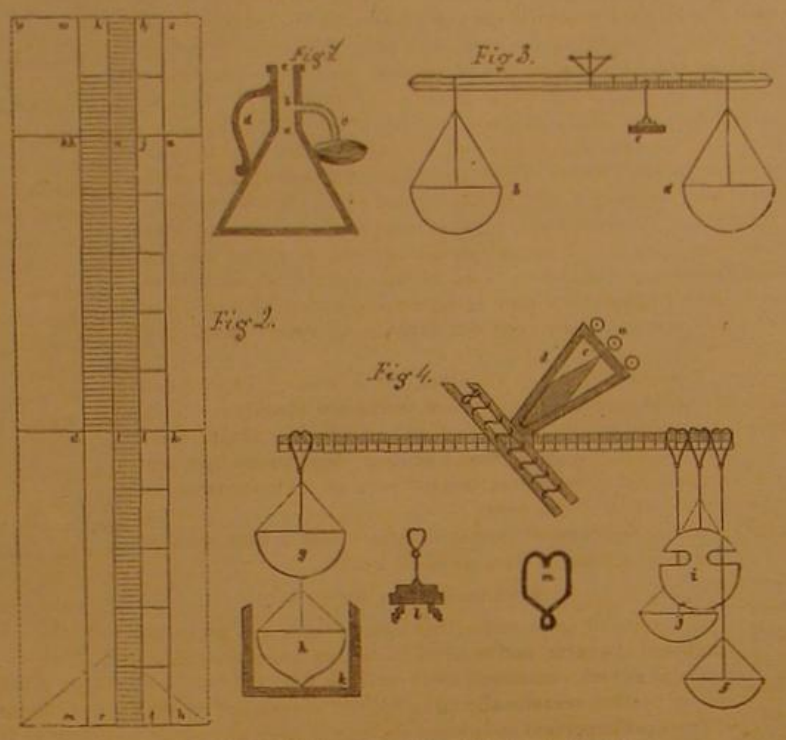
NEW YORK ACADEMY OF SCIENCES.

At a recent regular weekly meeting of this society, held at 64 Madison avenue, the following papers were read:

ON DETERMINATIONS OF SPECIFIC GRAVITY BY THE ARABIANS IN THE XII CENTURY,

by Professor H. C. Bolton, Ph. D. In this very interesting paper, the author gave various extracts from a book written by Al-Kharzini, about the year 1121. This remarkable book, called "The Book of the Balance of Wisdom," was first translated, in part, by the Russian minister, Khanikoff, into French, and afterwords translated into English and edited by the American Oriental Society. The perfect familiarity of these ancients with the methods of determining specific gravities, and the accuracy of their results, as shown by tables given in the work, and which Dr. Bolton copied on the board, are quite surprising. Al-Kharzini tells the story of Archimedes and the crown (see page 351, volume XXXIV, SCIENTIFIC AMERICAN), with some slight errors and discrepancies. Dr. Bolton quoted from Vitruvius the correct version of this well known but usually distorted anecdote. It seems beyond question that Archimedes solved the problem by filling a vase to the brim with water, immersing a ball of gold, one of silver, and the crown, successively, measuring each time the quantity of water displaced, or necessary to fill the vessel after the ball was removed.

The accompanying engravings are reproduced from Al-Kharzini's book. Fig. 1 he calls the conical vessel of Abu-r-Raihan; it differs but little from the specific gravity bottle of today. Fig. 2 shows the graduations on the hydrometer of Pappus, a Greek who lived in the fourth century. It resembles a Gay-Lussac hydrometer. Fig. 3 he calles the balance of Archimedes. It has two pans, *a* for gold, *b* for silver, and *c*, the counterpoise. Fig. 4 represents the "balance of wisdom." It has five scale pans, two aerial and one aquatic; *a* is the means of suspension, *c* tongue, *d* two checks, *f* and *g* air bowls, *i* winged bowl, *m* ring to suspend the bowls, *h* aquatic bowl, *l* counterpoise. The use and design of the ladder-like piece at the center is unknown. He seems to have known that the air had weight, and care was taken to measure density at a standard temperature, after careful purification. Not only does Al-Kharzini give the density of metals, alloys, and liquids, but also of soluble bodies, like tabie salt, with great accuracy. He also gives the density of mercury, but remarks that it is not a metal, but the mother of metals, as sulphur is their father. Al-Kharzini also describes a balance for leveling land, and another for weighing time, and it is probable that temperature was likewise determined by the balance.



ARABIAN PHYSICAL APPARATUS, A. D. 1121.

Professor B. N. Martin made some remarks on

A CHANGE OF THE EARTH'S AXIS AT THE CLOSE OF THE TERTIARY,

referring to Mr. C. B. Warring's paper on this subject and expressing his favorable opinion of that gentleman's view of the cause of the great climatic changes in that time. Dr. Newberry dissented from Mr. Warren's opinion, and gave his reasons for so doing, also referring to the fact that there were probably glaciers in the Permian and other periods.

On the Manufacture of Black Ink.

By the term ink, we understand a liquid mixture with which we can write and draw upon paper. The qualities demanded of a good ink are that it shall flow well but not too freely from the pen, shall fix itself properly to the paper, without, however, blotting or spreading, and preserve its own color permanently.

There are in existence at the present time an innumerable quantity of recipes for the manufacture of black inks, and yet we hear the general complaint either that the ink is too pale when written, and therefore injures the eyes when used continuously, or that when the writing gets old it fades or turns brown. James Stark, a Scottish chemist, has prepared about 230 kinds of black ink, and found, as he expresses it, only one to be recommended, namely, an ink made from myrobalanen.

The cause of black writing turning pale, and disappearing entirely when it gets old, is to be found in the iron it contains, in so far as the iron is changed to a higher oxide and is precipitated. Ink made with nutgalls is a special case of this kind; it is in a continual state of decomposition; when this process is ended, the ink in a short time becomes useless. Free sulphuric acid retards this rapid and complete destruction, hence sulphate of indigo is added.

A decoction of gall nuts contains tannic acid; this combines with protoxide of iron to form a tannate (proto-tannate of iron), which is colorless, but very greedy for oxygen, and strives to change itself into the sesquioxide salt. Finally the tannic acid changes into gallic acid, and a black protogallate of iron is formed. At last, when all the tannic acid in the proto-tannate of iron is converted into gallic acid, it continues to absorb oxygen and forms the tannate of the protosesquioxide of iron, which separates as a shiny precipitate. The sediment in the ink is continually growing thicker, and of course it can no longer be used.

In the manufacture of ink, any substance containing tannin may be used in connection with the iron salts, such as galls, tannin, divi divi, myrobalanen, extract of nut shells, etc. Black inks are also made of logwood and iron salts on the one hand, and neutral chromate of potash on the other. Alizarine ink consists of protoxide of iron and indigo solution; it generally has a bluish green color, and afterwards darkens beautifully; the more acid the ink contains, the slower this takes place. Slightly acid inks scarcely perceptibly attack steel pens, but spoil sooner, with the formation of a blue-black precipitate. They are usually and best prepared with madder, gall nuts, indigo carmine, and acetate or pyrolignate of iron.

It did not lie in the province of the above few lines to present a selection of the best ink recipes, but only to explain the phenomena which appear in the use of black inks. If such a recipe is introduced in the following description of its method of preparation, we only do it under the conviction that we meet the wishes of many of our readers by giving one that has been tested by years of experience, and which involves the least cost.

When black ink is made in large quantities, it is well to let it become clean in large barrels and afterwards put it into bottles and inkstands. It is believed that in this way an article is obtained which is less exposed to mold. To avoid this unpleasant feature, a small quantity of corrosive sublimate, or a few drops of carbolic acid, or some broken cloves, may be put into the ink.

Numerous experiments have shown that no salt of iron and no iron preparation equals the proto-sulphate of iron (the green vitriol of commerce) in the manufacture of ink, and also that the admixture of a salt of the sesquioxide, for instance the nitrate or chlorides, although it improves the color of the ink at first, renders it less durable. The most permanent of the common inks are those made of gall nuts, with green vitriol and gum arabic. The proper proportions of these constituents for the production of such a durable black ink are the following: Two lbs. bruised Aleppo gall nuts are digested in 2 quarts alcohol at a temperature of 104° to 140° Fah.; when about half of the spirits has evaporated, 3 quarts water are added; it is well stirred and strained through linen cloth. To the clear solution are added 8 ozs. glycerin and 8 ozs. of gum arabic with 1 lb. sulphate of iron dissolved in water. This mixture is thoroughly stirred from time to time for a few days, allowed to settle, and then put into well stoppered bottles for preservation.

Care should be taken to avoid the addition of too much sulphate of iron, as otherwise the ink soon turns yellow.

An ink prepared according to these directions will resist the action of light and air at least 12 months without suffering the slightest change of color. If this ink could be completely protected against precipitation of gallate of iron, we should have a perfectly permanent ink, retaining its beauty. The addition of sugar as well as of logwood decreases these properties.—*Victor Soclet, in Polytechnisches Notizblatt.*

Formation of Anthracite Coal.

A correspondent writes: The Supplement to the SCIENTIFIC AMERICAN, No. 17, April 12, contains an article from the *Shenandoah Herald*, giving an account of the formation of anthracite coal from apparently pure spring water in a pipe used for draining the Indian ridge shaft of the Philadelphia and Reading Coal and Iron Company. It appears this coal forms in about four months by exposure to the air, thus scattering to the winds all the geological theories that coal takes thousands of years and heavy pressure to form it. We recommend this discovery to the notice of the authors of "The Recent Origin of Man," and "Light as a Motive Power."—*London Mining Journal.*

How the Wind goes through Brick Walls.

Mr. A. Cluss, in a letter to the *American Architect and Building News*, gives a description of Professor Pettenkofer's experiment on the porosity of brick walls, as published with the "Records of the Royal Academy in Munich."

Pettenkofer caused to be erected, upon a cast iron plate, a section of wall two feet high, two and a half feet long, and twelve inches thick (the bricks he used were twelve inches long). It was put up with bricks carefully laid in lime mortar. After the brickwork was thoroughly seasoned, the two faces of the walls, containing five square feet each, were plastered with a floated brown finishing coat. This being well dried, the edges were pargetted with plaster of Paris. Time was again given for evaporation, when the plaster of Paris was overlaid with a coating of wax, oil, and resin. Next, metal plates with flanges turned over the edges were cemented to both faces of the wall, firmly clamped, and screwed tight. In this manner the rims and margins of the metal plates were fitted and secured to the wall, the whole being airtight, while there remained thin layers of the air inside the margins, between the faces of the wall and the metal plates. Both metal plates had holes in their centers, of one third of an inch in diameter, and to these short tubes were soldered. If air was impelled through the tube attached to one metal plate, it had to penetrate the wall before it could be discharged through the tube of the opposite metal plate. The neat area of each metal plate, facing the air cushion between it and the wall, was three and a half square feet. A lighted candle was placed directly in front of the open tube on one side, and, by blowing in the open tube on the opposite side, the air would pass through the wall, and extinguish the light, without any trouble whatever. The current of air had, of course, much more velocity in the tubes than in the wall, since the exposed area of the wall was 2,860 times larger than the area of the tubes. Assuming that a light wind of ten feet velocity per second had acted on the open tube, this velocity, though much diminished within the porous wall, would regain its original speed when passing through the other tube, and no doubt suffice to extinguish the light. Supposing the solid particles of bricks and mortar occupied three fourths, and the pores one fourth part of the exposed surface, the air would have moved $\frac{2860}{4}$ or 715 times slower in the wall than in the tube, and a velocity of ten feet would have been reduced to about $\frac{1}{100}$ of a foot. Now, our nerves being insensible to a motion in the air of one foot and over, it is clear that a motion of seventy times less speed will go on without our being aware of it.

It will be very easy for the institutes of technology or others to repeat this, and make similar experiments with various facing materials, and observe these phenomena, of supreme importance for a clear understanding of hygienic problems met by the practising architect.

South Pass Jetties.

Captain J. B. Eads, who is building the jetties at the mouth of the Mississippi, has become involved in an unfortunate and unnecessary dispute with Major Howell of the United States Engineers, who was, with General Humphreys, one of the advocates of the Fort St. Philip Canal. The grant obtained by Captain Eads from the government (one of the least objectionable that ever passed through Congress) stipulates that nothing is to be paid him unless he succeeds in securing twenty feet of water through the South Pass to the Gulf within the specified time. Now, Captain Eads declares that the work is going on in the most encouraging manner, that he has already got sixteen feet, so that the largest coasting steamers have been sent to sea over the bar, on which scarcely eight feet of water could be found last year. Major Howell, on the other hand, declares in a published letter that there are only twelve feet of water at the South Pass, that the nucleus of a new bar exists in front of the jetties, that a shoal is making out to this nucleus, and in short the jetties are doing no good. Against all this Captain Eads brings certificates from his engineers that Major Howell's statements are unfounded, and he protests against his enterprise being embarrassed by officers having no immediate connection with the work, and has written a letter to the Secretary of War, begging that any further interference on the part of such officers be prevented, and that instructions be issued, to the inspecting officer authorized by the Jetty Act, to furnish him directly with any information as to the result of the work he may need, and that he be ordered to report to the Secretary of War instead of to the Chief of Engineers. Whether this is desirable or not we do not know; but it is certainly a great mistake to allow engineer officers in the employment of General Humphreys, who is known to have no faith in the jetty system, to write letters to the newspapers ridiculing the experiment when the department of the service to which they belong stands in a judicial attitude to the undertaking. This, at any rate, ought to be stopped.—*The Nation.*

HARD GLASS.—We shall never, we fear, hear an end of new methods for hardening glass. R. Mensel, of Geiersthal, uses as a tempering bath a weak solution of glycerin and mucilaginous or gummy substances, such as a decoction of linseed. The glass is tempered while still on the pipe, and is then put into a moderately heated oven. The inventor puts great stress on the properties of the tempering bath.

THE INDUSTRIES AND RESOURCES OF JAPAN.

We have already alluded to the magnificent display made by Japan at the Centennial, which, for completeness, even to the smallest *minutiæ* capable of affording useful information relative to the industries and resources of the country, certainly transcends the exhibit of any other nation. This, perhaps, is due to the fact of Japan having entered into the spirit of the enterprise with a heartiness, born of a natural pride in her rapid progress, and in no small measure owing to the knowledge that, in that progress, the people of the United States have been most nearly concerned. Prior to the Vienna Exposition of 1873, the Japanese had never participated in any World's Fairs, and even at the Austrian show the contributions were mainly purchased and forwarded by the Japanese government, private individuals neither appreciating the advantages of the display nor being willing to send their goods over so long a journey. For the Centennial, however, a different feeling has been manifested. As early as the summer of 1874, it was definitely decided that Japan should participate, and at once the most thorough measures were set on foot for securing the superb collection now here. Provincial authorities were instructed to do their utmost to induce the leading manufacturers to prepare exhibits and to assist them with money and advice. Those who had acquired experience at Vienna were called upon to give the benefit of it to their countrymen. The government set an example by spending $30,000 for its official collection, and appropriating a further sum of $70,000 in making advances to various manufacturers so as to assist them in the production of such pieces of workmanship as would do credit to Japanese art and industry. In addition to this, the sum of $300,000 was set aside for general expenses, including the cost of transport and freight; and lastly, the government charged itself with the traveling expenses of all such exhibitors as might wish to accompany their goods to Philadelphia. Certainly no government has ever manifested greater liberality toward its people in any similar enterprise; nor can such munificence be regarded otherwise than in the light of the highest of compliments to the people of the United States and their Exposition.

A general description of the exhibit of Japan has already appeared in these columns. Lately, however, the Japanese Commission has issued a work, modestly termed an official catalogue, but which is really very much more, since, out of a hundred and thirty pages, thirty only are given to the list of articles, and the remainder are devoted to a series of excellently written descriptions of the principal resources and industries of the country. With this volume the visitor can study the entire exhibit intelligently, for he has before him the details of the manner of production of all curious and elegant articles displayed. We shall make copious extracts from the pages of this work, beginning with the subject of

MINING AND METALLURGY.

Very little is known about the origin of mining in Japan. It is, however, a fact that several mines were being worked during the latter part of the eighth century (Japanese period Dia-Do); and the large number of old abandoned adits, which are to be found in the metaliferous districts, leave no doubt as to the fact that mining was in a flourishing condition centuries ago.

The system of working mines has changed but little since olden times, and consists simply in driving one or several adits from places where a vein or seam appears on the slope or top of hill; the vein is followed as far as possible, and, when necessary, lower adits are driven, until in the end it is found impossible any longer to overpower the water with the very imperfect machinery used for pumping and draining. Many mines have had to be abandoned after a longer or shorter period of prosperity, solely on this account. In certain instances great efforts have been made to avoid this misfortune, and adits have been driven for the purpose of draining off the water. Thus in the lead mines of Hosokura, in the province of Rikusen, a draining adit may be seen of 8,370 feet in length; nevertheless the mine has been almost entirely abandoned, and the actual working places are at present far below the level of the water adit in question. In the mines of Udoge, where the rock is very soft, a water adit 13 feet high and 10 feet wide was commenced a few years ago. Ever since the earliest times the timbering of the adits has been known and effected with all the necessary skill; and as the wood is both abundant and cheap in most places, it has not been spared. The dimensions of the adits vary greatly; in some mines they are so narrow that it is almost impossible for a full-grown person to pass through, and consequently children have to effect the transport of the mineral. The latter is usually packed in strong sacks, made of matting, which are fastened to the child's back by means of a rope. In many places the passage becomes so low that the child has to crawl along on all fours, dragging the sack of mineral behind him. The ladders, used for getting from one adit to another on a different level, are simply trunks of trees with steps cut into them.

The means employed by the miner for attacking the rock consists merely in the use of hand tools, namely, the pick, the gad, the hammer and chisel. Gunpowder has only been brought into use for blasting purposes in latter years, and its introduction is chiefly due to foreigners.

The apparatus used for removing the water is composed only of small wooden hand pumps, buckets, and occasionally of a kind of water wheel with scooping paddles, and moved by treading; the water pipes are either made of bamboo or wood. As regards the ventilation of the mines, it is often realized with more or less of perfection, by connecting two adits of different levels, and in some cases by running an air channel, made of wooden planks, throughout the whole length of the adit, so as to allow the air to circulate through the adits and this channel. In the lowest adits, however, the absence of sufficient ventilation has in many cases caused them to be abandoned or else to be worked on a very small scale only. The lighting in the mines is either effected by torches of dried bamboo or oak wood, which latter is beaten until it becomes soft enough to burn easily; or by iron lamps in the shape of saucers with a double suspension. Sometimes the lamps consist merely of a kind of murex shell containing vegetable or fish oil. The wick is made of the pitch of soft rush (*juncus effusus*), which is also used for wax candles and ordinary lamps.

The annual production of the mines of Japan, in gold, silver, copper, iron, lead, tin, coal, and coal oil, was valued in 1875 at $3,687,275.

Of late years the government has made great efforts to improve the condition of mining and metallurgy, the principal shortcomings of which are: 1. The insufficiency of machinery for pumping out the water. 2. The imperfect system of attacking the rock with only hand tools, which, together with the custom of leaving the mine to be worked entirely by contracting miners, without any system and under no control, has not only the effect of causing a great part of the vein to be left untouched, but also in many cases the future of the mine has been endangered by the total absence of any well combined plan. 3. The imperfection, and consequently the expensiveness, of the processes employed for dressing, preparing, and smelting the ores. Some mines, however, such as the Takashima coal mines, near Nagasaki, are now being worked according to the modern system and are provided with the necessary steam power.

The working of several other mines is being improved in the same manner, and the new works are already in course of erection at the silver and copper mines at Ikuno, Sado, and Ugo. The government mining department has also commenced the construction of several high furnaces for the smelting of iron ores.

It will be observed that an excellent field is here open for improved mining inventions of all kinds.

MINERALS, ORES, ETC.

The veins of gold and silver ores in Japan are generally composed of quartz, native silver, silver ore (argentite and antimonial silver), containing more or less gold and iron and copper pyrites, occasionally mingled with blende and galena.

The most important and almost the only iron ore worked till now is the magnetite, found either in the shape of solid masses or in that of sand. In general the magnetic ores contain from 62 to 65 per cent of metal. The magnetic sand and the solid ore are the only materials used for smelting iron; however, iron glance and brown hematite, with 56 to 60 per cent of iron ore, are also found in Japan.

Copper ore is found in many places, and may be considered as a rich ore, since it contains on an average from 10 to 15 per cent of metal. It is composed mostly of copper pyrites, together with more or less iron pyrites, and is found chiefly in clay slate. The principal mines are situated in the northern part of the island of Nippon, but ores are also found in more southern provinces, as for instance in Bichiu. Sometimes the ores are much richer than has been stated, and contain 25 to 35 per cent, even up to 55 per cent, of copper.

The lead ores which are found in Japan are mostly galenas, with 40 to 80 per cent of metal, and sometimes a small quantity of silver. Tin ore is found in Satsuma, Suwo, and Bingo.

In later years, attention has been drawn to other minerals, such as gray antimony and bioxide of manganese; but they are, as yet, without great importance. A cobaltiferous mineral, which is found in the shape of small pebble conglomerates in the bed of certain rivulets, has been known for many years. After the raw material has undergone a certain process of powdering, washing, and calcining, it is used for blue porcelain paintings.

COAL, ASPHALT, PETROLEUM.

The most important coal fields are those in the northwest of the Island of Kiushiu, in the district of Karatsu; and also in the Island of Takashima, near Nagasaki. The total yield of the Karatsu district may be estimated at 80 to 90 tuns daily, which is sold at neighboring ports at $4 to $5 per tun.

The working of the rich seams in the island of Taskashima, about eight miles west of Nagasaki, has been commenced on the modern system, with improved machinery. This mine, actually the property of a Japanese company, is now very prosperous, and produced 78,000 tuns in 1874. In the island of Amakusa, on the west side of Kiushiu, a sort of coal is found, which is very much like anthracite.

As the industry of the country is being developed by the introduction of new methods and machinery, so will the demand for mineral combustibles increase, and mining will be effected on a much more extensive scale.

Petroleum is found in the districts to the northwest of Tokio, as, for instance, in Yechigo, Shinano, Ugo, etc. In the first of these provinces oil was discovered 300 years ago; and it has always be counted among the seven wonders of Yechigo that a natural combustible gas issuing from the ground in certain places, and could be brought through bamboo pipes into the interior of the houses and used for illuminating purposes, as it is now used for heating the small stills for refining the crude oil. Although the presence of the oil has been known for a long time, the people of the country only began to use it forty-six years ago. Since then, no less than 508 wells have been sunk.

BUILDING MATERIALS.

Although building stones are by no means scarce, yet they have been seldom used for houses, but mostly for foundations, temple stairs, gateways, sea walls, and battlements, which latter are sometimes of enormous extent: as for instance in Tokio and Osaka, where some granite stones of 30 feet in length by 18 feet can be seen. The battlements and walls are generally made of well dressed blocks of irregular shape, built up without the use of mortar. The chief materials used for these different purposes are granite, trachyte, and trachytetuff.

All kinds of colored mixtures of sand, clay, and lime, and mineral colors, are prepared for plastering the inner walls of the houses, and a very fine black stucco is used for the exterior of the fireproof warehouses. In order to give the plaster more solidity and coherence, paper fibers (prepared by boiling old paper) and the gluish decoction of a fucus, called *fu*, are mingled with the powder.

CLAY, KAOLIN, SILEX, ETC.

Minerals used for pottery of all kinds, such as clay, kaolin, silex, etc., are very abundant in Japan, and are spread over all the country. In the small town of Arita, province of Hizen, the head center of the porcelain manufacture in Japan, within a very limited circuit, not half a a mile in diameter, there are found, imbedded in the rock at different places, all the materials necessary for the biscuit, for the coating of the ware before glazing, for the glaze, for the *craquelé*, etc., the best being of such good quality that, after being powdered and decanted, it is used without any further mixture for the finest ware, the so-called egg shell porcelain. In the central part of Nippon, where granite is the principal constituent of the mountains, in the province of Owari, Yamashiro, and the island of Awajishima, opposite Hiogo, beds of petuntse, very much like the Bohemian material, are to be found. When used for porcelain, this material is mixed with silicious felspathic minerals from other places. A thorough mineralogical and chemical examination of these minerals has not yet been made, but would, no doubt, prove to be of great interest. Graphite has been discovered in Satsuma and Rikuzen; certain very pure samples have been found fit for such purposes as the manufacture of pencils; but in this case it would have to be washed and ground with an addition of clay. Whetstones, grindstones of all qualities, are very abundant, and are in the hands of every artisan, who, on account of the softness of his cutting tools, is frequently obliged to have recourse to the whetstone. Garnets are used for grinding and polishing hard materials.

Naval Items.

The naval appropriation bill, which became a law on July 1, reduced the rank and file of the United States navy to 7,500 men. To conform to this reduction, all enlistments and re-enlistments have been stopped; and since the beginning of the month more than 1,000 men have been discharged.

In consequence of the smallness of the appropriations, orders were issued by the Department, on July 11, to suspend all work for the government which was in progress, under contract, at the various private machine shops in the Eastern and Middle States.

NAVAL ENGINEER CORPS GAZETTE.

July 11 Passed Assistant Engineer Geo. P. Hunt and Assistant Engineer A. B. Willits were ordered to the monitor Wyandotte. In addition to their duties on board that vessel they will have charge of the machinery of the other monitors at Norfolk, Va.

Passed Assistant Engineer I. R. McNary and Assistant Engineer A. F. Dixon were, on the same day, ordered to the monitor Ajax, at Port Royal, S. C. They are to have charge also of the machinery of the other monitors at that station

The tractive force of horses is as follows:

Rate in miles per hour: 2 3 3½ 4 4½ 5.

Tractive force in lbs.: 166 125 104 83 62 41.

DECISIONS OF THE COURTS.

United States Circuit Court—Western District of Pennsylvania.

SHOUP *et al. vs.* HENRICI AND LENZ.—PATENT OIL WELL TUBING.

[In equity, No. 15.—May term, 1877.]

In a proceeding for infringement of a pump patented and designed for use in oil wells, the defendants proved the existence of a pump used in a salt water well, consisting of the identical combinations claimed by complainants, and the results produced by the latter pump were the same: Held, that although subsequently the whole combination in the latter pump was not used, it was not such an abandoned experiment as would allow the complainants to recover.

Where, in a defense to an action for infringement of a patent, the defense proved the existence of the same combinations in a device used for analogous purposes, and in which no change of mechanism was needed, and the operation of such device was successful, it was: Held, that the patent upon which the suit was brought could not be sustained, although the use of the device shown in defense was altogether discontinued.

This would only leave it open to the public to use it. No subsequent inventor could take it up and appropriate it exclusively.

MCKENNAN, C. J.:

The complainant's patent is for a combination of a pump tube, an outer or larger tube or casing, and a seed bag outside of the latter. It is designed for use in oil wells, which are usually of great depth and small caliber, and its object and operation are to allow the escape of gas from the bottom of the well through the space between the pump tube and the outer tube or casing, so that it will not necessarily pass through the valves of the pump chamber and obstruct the operation of the pump.

The defendants admit that they have used the combination described in the patent, and justify such use upon the ground that the patentee was not the first and original inventor of the combination claimed by him, but that it was known to and used by others before the date of his alleged invention.

I am satisfied that this defense has been maintained; but I do not propose to state at length the reasons upon which this conclusion is founded, or to advert in detail to all or any of the proofs in the cause which have induced it.

It will suffice to refer to one instance of its public and notorious use before the date of the alleged invention of it by the patentee. This occurred at what is called the Donelly well, and years before the patentee ever conceived the idea of his invention. It was a well of small caliber, and sunk to a considerable depth to obtain salt water. The devices used in it for that purpose consisted of an outer tube or casing, with a seed bag outside of it and next to the wall of the well, and a pump tube inside of the casing, with a space between them. A large volume of gas was evolved in the well, and it escaped freely in the interval between the casing and the pump tube, without passing through the pump valves. It is hardly disputable that these devices and the patentee's invention were substantially identical in their construction and arrangement, and that they operated alike in furnishing a vent for the gas.

But in the Donelly well the double casing was found so to contract its caliber as to greatly diminish the supply of salt water, and for that reason it was abandoned after a brief period of use, and the single tubing was restored. It is therefore claimed to have been an unsuccessful and abandoned experiment.

It was said before that the combination in both cases consisted of the same elements, and that they were arranged and operated in substantially the same way. But was the purpose for which the patentee's invention is intended to be used effectuated by the devices employed in the Donelly well? There is no doubt about this. The useful result contemplated by the invention in question is the avoidance of the effect of the gas upon the pump valves by supplying an avenue of escape for it between the pump tube and the casing. The Donelly devices furnish the same means for the escape of the gas and the relief of the pump valves, and they were used sufficiently to illustrate and test their complete efficiency in that direction. What more was required to demonstrate the completeness of the device as a means of accomplishing the result contemplated by the patentee? No change in mechanism was needed, and it was successful in operation. This is all that is required to take it out of the category of abandoned experiments. Its use might be altogether discontinued; but this would only leave it open to the public to use it. Certainly no subsequent inventor could take it up and appropriate it exclusively. What was said by the Chief Justice in Galoff *vs.* Wilder, 19 How., 471, is decisive on this point.

We do not understand the circuit court to have said that the omission of Conner to try the value of his safe by proper tests would deprive it of its priority, nor his omission to bring it into public use. He might have omitted both, and also abandoned its use and been ignorant of its value; yet, if it was the same as Fitzgerald's, the latter would not, upon such ground, be entitled to a patent, provided Conner's safe and its mode of construction were still in the memory of Conner before they were recalled by Fitzgerald's patent.

The bill must be dismissed with costs.

(*George Harding* and *Weir & Gibson*, for complainants. *Henry Baldwin, Jr.*, and *C. S. Fetterman* for defendants.)

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED COMBINED TIME AND COMBINATION LOCK.

Franklin McDuffee, Rochester, N. H.—By the chronometer locks now in general use, no entrance can be made to the safe except at certain hours, however imperative the necessity, as, for instance, an approaching fire. This objection is completely obviated, as, by this invention, the proper persons arriving can open the lock at any time without waiting for the action of the clockwork to release the bolt. The objects of the invention are secured by the following method: The tumblers, all on the same spindle and operated by one dial, are so arranged that they can be locked on two separate combinations set by two individuals, each person being ignorant of the combinations, except his own. For instance, suppose the president and cashier of a bank are the persons intrusted with these combinations, the cashier can set his own part of the lock without the presence of the president, and he can always unlock the lock at such hours as the clockwork permits, and at no other, and can do so without the presence of the president. He cannot be compelled to open the safe, as he cannot open it alone until the proper hour arrives, yet after that hour he can open without help. This may be done for years without calling on the president. But should the clockwork stop at any time, or should it become necessary to enter the safe at any unseasonable hour, the cashier has only to summon the president, who, using his combination in conjunction with that of the cashier, can open the lock. Neither can open at such time alone.

IMPROVED ROTARY PUMP.

Robert Burns Reynolds, Stockport, N. Y.—This consists of two rotary pistons on parallel axes, both turning in the same direction, so that they have a wiping action on each other instead of the rolling development of one on the other, as has always been the case in pumps of this character.

IMPROVED RAKE TOOTH LATHE.

Sylvester Bisbee, Sumner, Me.—Sliding on the main frame, in guides, is a reciprocating carriage. Mounted on one end of the carriage is a long cylinder, at the other end a short cylinder, each of which contains eight grooves. These cylinder receive, in addition to the reciprocating motion, a rotary turn of one eighth of a revolution, so as to present the empty grooves to the feeding devices, and those containing the rods and blanks to the devices for forming the teeth in proper order, said feeding and forming devices consisting, essentially, of a feed plate, setting knife, cutter head, set-back, saw, ejector, projection, and feed hook, together with the devices for turning the tenon.

IMPROVED SCALE BEAM.

Hiram L. Grisell, Pennville, Ind.—This is a contrivance of tables with the beams and weight of a scale, for the computation of the values of fractional quantities. Example: If fifteen cents' worth of an article worth twenty cents a pound is required, the weight is moved along the beam until it arrives at fifteen on the line marked twenty at the end, when it will show twelve ounces as the required quantity.

IMPROVED PORTABLE RAILROAD TRACK.

Manuel De M. C. Y Martinez, Havana, Cuba.—This is an arrangement of railway track in short sections, that can be easily handled to put down and take up. The parts are adapted to be laid on the natural surface of the ground, and to be kept in position with but little labor and expense.

IMPROVED RAILWAY CAR TRUCK.

Georg O. Eaton, Warren, Me.—Cars frequently require to be used upon and run from a narrow to a broad gage track, and *vice versa*. To enable this to be done, it has been heretofore requisite for railway companies to construct and keep on hand, at the junction of the different lines, two sets of trucks, one adapted for a narrow gage, and the other for a broad gage, so that, when a car was required to be changed from one track to the other, it was jacked up, the trucks removed, and others substituted. The expense and loss of time incident to this method constitute serious objections to it, and to obviate them is chiefly the purpose of this invention. To this end, it consists, broadly stated, in making the wheels of the truck adjustable laterally or towards and from each other. The truck is therefore an improvement in that class in which the several wheels are mounted on short independent axles. For particular construction and arrangement of parts, see patent.

IMPROVED COMBINATION LOCK.

Thomas McClanahan Seaton, Parsons, Kan., assignor to himself and John Adams, same place.—This invention consists in making the tumblers of a lock with points that work in the slot of the bolt, and causing the disk knob to slide in a slot of the plate.

IMPROVED MECHANICAL MOVEMENT.

Charles Sandermann, Elizabethport, N. J.—This is for changing reciprocating rectilinear into continuous rotary motion, and is applicable to revolve the shaft of screw propellers, and for other purposes. A reciprocating carriage has hinged stops at both sides, that act on movable cam rollers, traversing on the shaft sections, with spiral twists or grooves in opposite direction, so as to produce continuous rotary motion of the shaft by the reciprocating motion of the cam rollers.

IMPROVED ROTARY ENGINE.

Bruno Brauer, Bremerhaven, Germany, assignor to himself, Friedrich A. Schilling, Sr., and Friedrich A. Schilling, Jr., same place.—This is an improved rotary engine, in which the steam acts directly on the piston shaft, allowing the use of the same with variable expansion, and the ready reversion of the engine. It is not possible to afford a clear idea of the mechanism, which embraces several new and ingenious devices, without the aid of drawings.

IMPROVED LIFTING MACHINE.

August Ficht, Bellasylva, Pa.—This consists of a lifting bar, toothed on opposite sides, between guide ribs, for keeping it in gear with a couple of toothed wheels on a pair of shafts mounted on the top of a frame. Said shafts have cranks or levers to work them, and ratchet wheels provided with pawls to retain the weight at any hight. The invention also consists of the supporting frame for the rollers, for working the lifting bar, contrived in two readily detachable parts, to facilitate the application of the machine to a stump or other object to be lifted.

IMPROVED DEVICE FOR DECOMPOSING WATER FOR FUEL.

Milton W. Hazelton, Chicago, Ill.—This consists of a tight pan under the fire grate, into which an air pipe from a fan blower and a water pipe enter below holes of conical form for driving water spray through the holes into the fire above. The inventor supposes that, by the heat of the fire, the steam will be desiccated, and that the hydrogen can be burned as fuel. The invention may prove useful for increasing the draft of furnaces.

IMPROVED DEVICE FOR CLOSING GATES.

John D. Reed, Greencastle, Ind.—This consists simply of a horizontal shaft, journaled to the gate post and rotated by a descending weight attached by a cord to a drum on the shaft. On one end of the latter is bevel gearing communicating with the gate, which is thus shut when the weight descends.

IMPROVED SPEED REGULATOR.

Nathaniel U. Metz, Norritonville, Pa.—This consists of a disk on the driving shaft to be regulated, carrying a pair of centrifugal weights, which are thrown out against the flange of a stationary disk. The friction of the latter is made to move out bake shoes with great force against the flange, to arrest the motion of the shaft in case the belt runs off, or the engine or other power runs too fast.

IMPROVED PAPER-CUTTING MACHINE.

John P. Dunwald, New York city.—This consists mainly of a combination of the swinging and balanced cutting knife with the clamping mechanism of an adjustable cutting gage and of a sliding feed or set gage of special construction. The set gage may be detached entirely, as well as the side guide piece, when the same is not required, or when the paper is to be cut at different angles.

IMPROVED EXCAVATOR.

John P. Bonnell, Elizabeth, N. J.—This is a machine which is movable on wheels along the ground, and contains an endless chain of buckets, which dig the earth and carry it up to a laterally working endless discharger. The buckets are fed up to the work by the power which moves the machine along the ground. The essential part consists of a machine arranged on feeding or propelling wheels as a fulcrum, with a contrivance for elevating and lowering the buckets in advance of the fulcrum to gage the machine for grading ascending and descending inclines, also for running it into and out of the ground in using it for ditching purposes. The buckets are extended outward, at each side, beyond the ends of the drum, over which the said chains work to cut their way in advance of the carrying wheels sufficiently wider than the latter and their housings to enable the apparatus to run freely.

IMPROVED PROPELLER WHEEL.

William S. Wootton, Scottsburg, Va.—This wheel is designed more particularly for the shallow rivers of the West, and is intended to operate either as a paddle wheel, or by grappling the bottom of the river, being provided with flukes for this latter purpose, which catch in the river bed and urge the boat along. It is automatically adjustable to the irregularities of the river bed; and instead of having a central axis, is provided with internally projecting teeth upon its periphery, which engage with and receive motion from one of the pinions of two supporting shafts, of which shafts, the one that transmits the power is stationary, and the other is movable to regulate the elevation of the wheel when employed as a paddle wheel.

IMPROVED MACHINE FOR MAKING BARRELS.

Samuel P. Hodgen and John W. Yelton, Neosho, Mo.—This consists of a circular vertically adjusting follower, arranged over a platform, on which the lower head of the barrel is placed to nail the staves on. The follower is hooped with a band of iron for clinching the nails driven against it, and is employed as a gage, around which to set the staves, and for clinching the nails used in nailing on the hoops. The follower also has a box securely attached in its centers, so that the rod or shaft will pass through it without binding, and at the same time hold said follower perfectly true as it is raised or lowered.

IMPROVED PACKING FOR BALANCED PISTON VALVES.

David Dale, Millerstown, Pa.—This is a contrivance of radial plugs in the pistons, on which steam is caused to act to push out the packing ring, one of the said plugs acting by a wedge between the ends of the ring to expand it, and another, or more if desired, acting by a stiff spring, which bears at its ends on the packing ring and distributes the pressure upon two points.

IMPROVED FEED WATER HEATER AND FILTER.

Georg F. Jasper, Freeburg, Ill.—The purpose of this invention is to still further improve and simplify the feed water heater and filter for which letters patent were granted to the same inventor heretofore, under date of December 1, 1874, and June 8, 1875; and the invention consists in the arrangement of a double water box in the heating tank, in connection with the filtering receptacle below. The exhaust steam is allowed to act at the bottom and top sides, while acting only on the bottom of the upper box, so as to impart a higher temperature to the water in the lower box than in the upper.

IMPROVED RAILROAD GATE.

Harmon Graybill, Cassville, Wis.—This is an improved railroad, farm, or other gate that extends across the track and is automatically opened and closed by the trains. It consists of swinging lateral gate sections, that are thrown up to the outside of the track by the depression of the bearing rails.

IMPROVED HOSE COUPLING.

Calvin L. Martin, Portland, Me.—This consists of two or more spring catches on one section to spring over a flange on the other. The said catches have a lever and a cam rocker, by which to detach them from the flange readily when the hose is to be uncoupled.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED SOLDERING IRON FURNACE.

Edward G. Adams, Cohoes, N. Y.—This consists of a vertical fire box with a center flue and a hood, so arranged over the fire bed that an open space is provided in the coal for the irons. The heat is thus made to pass directly against the irons, so as to warm them quickly.

IMPROVED CARBURETER.

James T. Stewart, Los Angeles, assignor to himself and James Wilson, of same place.—This consists of an air drum moving in a water tank, and forcing the air through a connecting pipe into a float filled with gasoline. The gasoline pan is placed into a gas holder filled with water, that raises the pan to keep the air pipe always in the gasoline.

COMPOSITION OR CEMENT FOR PRESERVING FRUIT, ETC.

Charles A. Dards, New York city.—This is a composition employed for the purpose of sealing a soft wrapping paper that has been rendered airtight by a mixture of oil and alum around the fruit, vegetable, or other perishable article. The articles are then packed into boxes, filled with sawdust, and kept in a fresh state for any length of time. The composition consists of starch, a suitable fat, salt, carbonate of ammonia, a suitable vermifuge, alum, citric acid, and water.

IMPROVED MECHANICAL LEDGER.

Otto Sallbach, Pittsburgh, Pa., assignor to himself and Charles Ruhe, of same place.—This invention consists of a series of revolving strips, with numerals indicating dollars and cents, which strips are moved by an adjustable friction roller and shaft, the whole being enclosed in suitable manner. The amount is kept for each customer by entering his name to a certain number on an inside slate, and setting the printed strips to the exact number of dollars and cents by setting, first, a friction wheel to move the lower strip, and then to the upper. The amount due will then be visible through the corner glass plate and indicate to the customer the state of his account, his number and date of last purchase only being placed on the outside. When the account strips have been adjusted, the friction wheel is released from contact with the strips, so that no accidental changing of the same is possible.

IMPROVED BAG HOLDER.

Lealand H. Bristol, Lawrenceville, N.Y.—This invention consists in combining a sliding spout with a bench strap and screw, and also with a wedge-shaped rest, the latter serving to graduate the bag from the spout down to the bench.

IMPROVED BOOT LACE FASTENER.

James McDonald, Campbelltown, Province of New Brunswick, Canada, and F. A. McDonald, Durham, Province of Nova Scotia, Canada.—This invention relates to the ready, secure, and convenient fastening of lace boot strings by means of two plates, one being on each side, and the string being passed through as well as between the plates, before being clamped, so that escape is almost impossible.

IMPROVED WIRE FENCE BARB TOOL.

Homer W. Prindle, Fort Dodge, Iowa.—This is a tool for forming barbs on fence wires, having its lower end bent over to one side to form a hook, and having a slot or notch formed in its edge, close to its lower end, to adapt it for use.

IMPROVED FOUNTAIN PEN.

Robert Douglass, Buctouche, Canada.—This invention consists of a spoon-shaped termination of the back portion of the fountain holder, in the cavity of which is the opening for the issue of the ink, and over which the pen is attached, so as to receive the ink at suitable distance above the point. There is a cock in the ink passage from the bottom of the fountain to this issue, to regulate and shut off the flow of ink at will, and at the top of the fountain is a vent to admit air, for allowing the ink to flow out properly.

IMPROVED HORSESHOE.

Charles D. Rattray and Alexander Robertson, New York city.—This is an improved ice shoe attachment for horses, which may be readily and firmly applied over the common shoe and to the hoof, so as to be used whenever required, and taken off without difficulty. It consists of an ice shoe with sharp calks that is fitted over the common shoe, and attached to the hoof and shoe by curved outer pieces passing through the attachment, and by interior binding pieces and screw nuts screwed on the inner threaded ends of the curved binding pieces.

IMPROVED RUBBER BOOT.

James A. Bates, South Abingdon, Mass.—This invention consists of a rubber boot provided with a leather counter, applied over the lining of the same.

IMPROVED METHOD OF LABELING MINERAL SPECIMENS.

Charles W. Cannon, Helena, Montana Ter.—Plaster of Paris is mixed with water to the consistence of thick cream, and applied to the specimens in sufficient quantity to form a space large enough to receive the desired inscription. The specimens are then jarred to cause the cement to set with a smooth surface. After the cement has set and become sufficiently dry, a small pointed brush is used for putting on the inscription with India ink.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED STATION INDICATOR.

Charles M. Sexton, Aurora, Ill., assignor to himself and Orlando O. Wormwood, of same place.—This consists of a polygonal roller, that carries the slotted name boards on raised ribs or lugs near the end. The lugs and slots of the boards are alternately set at greater or less distance from the ends of the roller to take up the boards in regular manner. The roller is revolved by a loose pulley and pawl, actuated by a connecting band and spring.

NEW HOUSEHOLD INVENTIONS.

IMPROVED DEVICE FOR HEATING AIR FOR FURNACES.

Charles Thonger, Courtright, Canada.—The object of this invention is to utilize some of the waste heat of a boiler furnace for heating the air supplied to the furnace for the support of combustion. As applied to a locomotive boiler, the smoke passes through the boiler flues to the smoke box, as usual, thence back in a casing, covering and surrounding the upper part of the boiler. The tubes terminate in a breeching, from which the smoke escapes in vertical tubes, which form the smoke pipe, and are surrounded by a casing, down which the air for feeding the furnace passes to the casing on the boiler containing the smoke pipes, and to a jacket at the rear. Thence it passes along the boiler to the ash pit.

IMPROVED GAS BURNER.

Victor Zeis, New York city.—This consists of a carbonizing and pressure-regulating attachment for gas burners, made of a hollow vessel of copper, with a socket to attach to the fixture. A gas tube extends from the socket up to the upper part of the interior; and there is a burner at the top, and a tube extending from it nearly to the bottom. A bell-mouthed tube extends from a point near the top of the burner down through the cap into the carbonizing chamber, for the purpose of deflecting the gas, and causing it to descend and mix with the hydrocarbon vapor before passing through the perforations of the pipe leading to the burner.

IMPROVED AIR COOLER.

William E. Richardson, Buffalo, N. Y.—This consists of a pan or tube to contain ice, arranged in a surrounding case of non-conducting material. There is a space between the two, into which cold air from within the pan may pass through openings in the sides in the bottom of the latter, and also from a coil of pipe entering the pan from outside, and discharging into said space. From the space it may be conducted to cellars or other rooms or places for cooling. It is adapted to many purposes for which low temperature is required, effecting a great saving of ice. The inventor claims that he can cool a room 40x40 feet and 10 feet high, with about 1,500 lbs. ice per twenty-four hours.

IMPROVED IRONING APPARATUS.

James Ashton and Rheuben H. Metz, Kent, Ill.—This consists of rollers, on which the cloths to be ironed are rolled, together with a table, on which the rollers are laid, and a heavy plate lying on the rollers, and having a forward and backward motion lengthwise, for rolling and pressing the clothes smooth. The table and the rolling plate are provided with chambers, in which heaters may be placed.

IMPROVED DROP CHANDELIER.

Henry Prescott, Keystone, O.—This chandelier may be readily raised and lowered, and set to any hight. There is a grooved extension rod sliding in an inclosing tube of a stationary pipe, and connected with the connecting pipe section of the chandelier by a spiral coil of rubber hose, and a spiral spring. The extension rod may be readily set to any length by a set screw.

IMPROVED DOOR CHECK.

James H. Swift, Evansville, Ind.—This consists in attaching to the door frame an arc bar having a series of bolt holes, and so arranged as to pass through a slot of the bolt case. The spring bolt is connected, by bell cranks and wires, to a knob, so that, by turning the knob, the bolt will be pulled out of the bar, to allow the door to swing.

IMPROVED BURGLAR ALARM.

John S. Mace, Chillicothe, O.—This invention belongs to that class of burglar alarms in which an alarm is sounded upon a bell by a hammer, set in motion by a clock spring and spur gear by the opening of the door or window to which it may be applied. The improvement consists in the particular construction and arrangement of a pivoted stop rod with slide spring, and locking devices whereby the alarm is rendered more reliable in its operation, and readily set and adjusted either to give an alarm or not, as may be desired.

IMPROVED COOKING APPARATUS.

Mrs. John M. Goldsmith, Great Mills, Md.—This invention consists of a rectangular frame to be inserted in the oven of a cooking stove. In the frame are pivoted several spits, below which, on the bottom of the oven and within the base of the frame, rests a large pan. Above the spits the frame is arranged to hold one or more dripping pans, provided with small tubes in their bottoms for the purpose of causing the gravy to fall, drop by drop, upon the food cooking below, and thence into the lower pan, from which it may be returned to the ones above. The spits and pans may, if desirable, be removed and a coffee roaster, broiler, or other cooking utensil be substituted.

IMPROVED WARDROBE HOOK.

James E. Bryan, Humboldt, Kan.—This invention consists of a wardrobe hook so constructed that it will neither stretch nor tear the garments suspended from it, and will also permit them to be readily detached, without the necessity of raising them vertically, as required in the ordinary construction, in order to free the projecting end of the hook. The bar from which the garments are suspended is curved downward at the end, and a spring clamp bar, which presses upon the suspending bar, is curved in the opposite direction.

IMPROVED THUMB LATCH FOR DOORS.

Henry C. Hill, Norristown, Pa.—The thumb lever is pivoted to lugs on the fulcrum plate, which is attached to the door, and the lower part of which is so formed as to fit over the upper end of the upper lug piece of the handle, so that they both may be secured by the same screw. The handle is made with a bend or offset, to enable it to be placed sufficiently near the edge of the door to operate the latch, and leave space for the hand between the handle and the door casing.

IMPROVED WASHING MACHINE.

Thomas McC. Wilson, Venice, Pa.—This washing machine is so constructed that the space between the stationary rubber and the movable rubber may be regulated as desired, and that the movable rubber can be conveniently raised out of the way, when desired, to give convenient access to the interior of the suds box.

IMPROVED SMOKE BELL FOR GASALIER.

John Fox, New York city.—This invention consists of a bell-shaped body, with exit tubes radiating from the upper part, the stem of the smoke bell being insulated from the part of the gasalier from which it is suspended by being cemented into a socket with a non-conductor of heat.

IMPROVED MUSIC REPOSITORY.

Jerome C. Ward, Hillsdale, Mich.—This is a stand in which sheet music and music books may be conveniently stored away below the piano, and readily be taken out for use. Vertical rods extend from the lower to the upper shelves, and prevent the books in the swinging leaves from sliding down and interfering with the music on the shelves.

IMPROVED WEATHER STRIP.

S. Adam Rankin, Mulberry, Mo.—This strip is so constructed as to be raised by its own weight to a level with the lower edge of the door when the door is opened, and to shut down closely upon the threshold when the door is closed.

IMPROVED SASH HOLDER.

Joseph R. Payson, Chicago, Ill.—This device is claimed to lock window sashes securely in position when closed, or, when opened to any desired extent, to tighten them so that they will not rattle in the wind; to support them when not balanced by weights or otherwise; to be applicable without notching or defacing the casing or sash; double acting, to prevent the sash from being raised or lowered; reversible, so that it can be applied to either the upper or lower sash, or to either the right or left hand: adjustable, so that it will act upon the sash whether loosely or closely fitted to the frame, and when not in use can be withdrawn entirely within the edge of the sash, so that it will not impede its movements, or rub against the casing.

IMPROVED HEATING DRUM.

Joseph R. Wieand, Allentown, Pa.—This consists of a heater, made of one or more sections connected by pipes that admit either direct or circuitous passage of the fire gases. Each section has a horseshoe-shaped partition forming flues.

IMPROVED SASH BALANCE.

William Cooper, Strathroy, Canada.—This is an improved device for attachment to a window, to enable the sashes to be raised or lowered together or separately, as may be desired. The upper sash descends by its own weight, and may be secured in any desired position. It is raised by turning a crank to wind up cords. The two sashes may also be raised and lowered together.

IMPROVED STAIR ROD.

George W. Hill, Brooklyn, N. Y.—In applying the device, the rod is placed in the angle between the projecting edge of the step and the upright board, with the points of the pieces entering the lower side of said projecting edge. There is a second rod which fits into the angle between the top of one step and the upright board of the other. The two rods are then held apart by spring devices.

IMPROVED WASHING MACHINE.

Joseph Gramelspacher, Jasper, Ind.—This consists of elastic rubbing fingers, of cotton or other like fibrous material, fitted so as to project from the surface, in combination with a stationary concave rubbing bed, which is extended along up an incline to the top of the tub, to afford an auxiliary hand rubbing bed, for convenience in rubbing out things which cannot be as well treated by the cylinder.

IMPROVED KNOB FOR VESSEL LID.

Charles Goldthwait, South Weymouth, Mass.—This serves to insulate the heat, and admit the ready handling of the cover without burning the fingers. The knob of wood is applied to the lid by a shank encircling tube, of suitable sheet metal, that is soldered by an exterior base flange to the lid. The shank of the knob is made somewhat shorter than the tube to produce a small insulating air space between the lid and knob.

IMPROVED LAMP BURNER.

Jacob Engle, Jr., Sharon Springs, N. Y.—The wick tube and the gas tube is extended sufficiently above the base of the burner to enable the outside case to be elongated downward from the flame to serve the function of a chimney, to regulate the air current, so that when it comes up to the flame it will be steady and strong, increasing the combustion and the illuminating powers.

IMPROVED SASH FASTENER.

Peter Meyer, Iowa City, Iowa.—This relates to such improvements in the sash fastener, for which letters patent have been granted to same inventor under date of June 22, 1875, that the same may be more strongly and reliably attached to the sash, and retain it at any desired hight. The device consists of a curved and perforated latch, that swings on a suitable pin of a metal case attached to the sash, and is automatically forced by a spring against the locking pins of the window frame, so that the hole of the spring latch locks the sash at any desired hight.

IMPROVED COFFEE POT.

Christian Vanderbeck, Rock Falls, Ill.—This is an improvement in the class of coffee pots or machines composed of two parts or receptacles, and adapted to be connected in such manner that the ground coffee will be subjected to the action of hot water as it passes from one pot or receptacle into the other. The invention relates particularly to providing the inner cylinder or receptacle with strainers of different degrees of fineness.

IMPROVED FASTENER FOR THE MEETING RAILS OF SASHES.

Joseph R. Payson, Chicago, Ill.—This improves the construction of the window sash lock for which letters patent were granted to same inventor January 4, 1876, to make it more secure against being opened from the outside of the window, and to draw the sashes together more firmly. The locking arm is pivoted at or nearly at an angle of 45° with the length of the meeting rails of the sash, and secured by suitable fastening devices.

IMPROVED LAMP BURNER.

James Curzon, Darien, Conn.—This invention relates to lamps having four wicks in a circle; and it consists of the wick tubes arranged radially to the center of the circle from top to bottom, with two ratchets at right angles to and crossing each other for working them, instead of the parallel arrangement of the tubes at the lower end and parallel ratchets heretofore employed. The invention also consists of a secondary bottom to the burner for screwing into the lamp top. Between these two bottoms is applied a packing of non-conducting material to protect the lamp from the heat.

IMPROVED ASH SIFTER.

Numa J. Felix, New York city.—This consists of a hinged and locked screen arranged in the upper part of a sliding box, from which the ashes are carried along a hinged gate into a bottom drawer, while the coal is dropped by swinging the gate over to the other side into an adjoining drawer, on the release of the screen, which is locked again to the box by the swinging back of the gate.

IMPROVED TABLE LEAF SUPPORT.

James Pleukharp and Samuel M. Shilling, Columbus, O.—This is an improved table leaf support that holds the leaf firmly in place, and raises it always to the same level without straining the hinges so as to render repairs necessary. When the leaf is folded, it is also held in rigid position. The invention consists of a forked spring arm with side notches, hinged to the leaf, and locking to a recessed guide hasp attached to the table.

IMPROVED CHRISTMAS TREE BRACKET.

August Dahler, New York city.—This is an improved bracket for Christmas trees, by which two candles may be supported on the same bracket, so as to balance each other. The device consists of a symmetrically bent band with central spring part, and with candle holders at both ends.

IMPROVED WINDOW SHADE FIXTURE.

John E. Dohen, Brooklyn, N. Y.—In the lower end of the shade is placed a bar of sufficient weight to hold it straight and to unroll it when released. The upper end of the shade is placed in a longitudinal groove in the roller, where it is secured by a key fitted into the said groove. The key has a longitudinal groove formed in its under side to fit upon a tongue of the roller in the bottom of its groove. It is held in place, clamping the end of the shade, by two tubular caps placed upon the ends of the roller, and in the sides of which, opposite the edges of the key, are formed slots for the edge of the shade to pass through. To the caps are attached pivots, which work in brackets attached to the window casing.

IMPROVED DOOR CHECK.

Thomas Hill, Portland, Me.—This invention has for its object to provide an adjustable fastener for both hinged and sliding doors, which shall be adapted to allow the same to be opened more or less and at the same time secure them against the ingress of parties from without. To this end, the inventor employs a notched and slotted bar, which is pivoted to the door jamb, and a sliding bolt, which is attacked to the door, the arrangement being such that the head of the bolt works in the slot of the bar.

IMPROVED BED LOUNGE.

Ferdinand Braun, New York city.—This consists of a lounge with folding seat section, provided with a swinging sideboard, that is extended at the ends to form the supporting legs. The sideboard is hooked by a pivoted rod to the hinged head section, that locks, when folded back, securely to the back of the lounge. The lounge is readily changed to a bed, and *vice versa*, in an easy and convenient manner, by swinging out or folding the parts described.

IMPROVED COFFEE POT.

George W. Hubbard, Windsor, Vt.—This consists of an inverted funnel, in combination with a filtering cup, to cause the water to flow up and filter down through the coffee. The said funnel has a curb extending upward from its base around and above the bottom of the filter in order that the water, after passing down through the coffee, and on its way to the bottom of the pot, shall be made to flow upward at this place, leaving its sediment on the top of the funnel at its junction with the curb. The tube by which the water is conducted up into the filtering cup is perforated so as to deliver the water upon the coffee in jets.

IMPROVED WEATHER STRIP.

Theodore G. Plate, Hackettstown, N. J.—This is a weather strip in a groove in the bottom of a door, to be closed down on the threshold automatically when the door closes by contact with the door jamb, and having springs to raise it. It consists of a strip suspended from a striking rod by toggle-jointed bars, which are made to thrust the strip down by endwise movement of the rod, which is caused by contact of the end of the rod with the jamb. It also consists of an adjustable screw stud in the jamb, to be screwed out and in to regulate the movement of the strip, so as to insure its closing properly. It also consists of a novel arrangement of the springs, and also of the manner of supporting and grinding the striking rod.

IMPROVED ASH SIFTER.

John H. Raymond, Syracuse, N. Y.—This invention consists in an outer receptacle having circular guide grooves in connection with a swinging cover of arch form, and having lateral end flanges. When the cover is closed over the drum the same is revolved, so that the ashes are separated from the coal particles and dropped to the bottom of the receptacle.

IMPROVED BABY TENDER.

Thomas Shaw, Morris, Ill.—This is a device to hold a baby and allow him to jump, swing, and walk, without danger of falling. It is a kind of swing or seat for the child, suspended at the extremity of a horizontal bar. The child's feet rest upon the floor, so that he may jump or swing himself about as he may wish.

NEW AGRICULTURAL INVENTIONS.

IMPROVED FENCE.

Ambrose E. Balliet, Limestoneville, Pa.—This invention consists in a portable fence, formed of the horizontal boards, halved at their ends, the cross bars and pins arranged so that the pins pass through holes in the ends of the boards of the one panel across the outer side of the cross bar, and are attached to the ends of the boards of the other panel.

IMPROVED HARVESTER.

Joseph Miller, South Bend, Ind.—This invention is an improvement in the class of reapers which are provided with a traveling rake for conveying the cut grain up an elevator and delivering it on to a binder's table or into a receptacle from which it may be removed by hand or discharged by any suitable mechanical means. The improvement relates to mounting the reel upon a sleeve which revolves upon the rod or shaft by which the reel is adjusted with relation to the cutter bar; to the arrangement whereby the reel is adapted to be adjusted while revolving; to the arrangement of an endless traveling rake carrying chains; to providing certain links of said chain with lateral flanges to adapt them for attachment of the toothed rake bars; to the arrangement of the driving wheel shaft and the tubular shaft of the crosshead carrying the gears which mesh with and thus communicate motion from the driving wheel to the pinion of the supplementary driving shaft; to the manner of stringing the beveled and shouldered cutter plates upon a wire cable, and to the construction of the driving pulley.

IMPROVED BAG HOLDER.

Isaac E. Shumaker and John S. Moorhead, Kellersburg, Pa.—This consists of a sliding bag-holding frame, that is adjustable to different widths and lengths of sacks, and raised and dropped during filling by a hoisting double lever mechanism.

IMPROVED SULKY PLOW.

John W. Grimes, Appleton City, Mo.—This invention is an improvement in the class of sulky plows in which the plow proper is suspended from the wheeled frame in such manner as adapts it to be raised and lowered at will, for the purpose of changing the depth of furrow, or for holding the plow entirely off the ground while being transported from one point to another. The improvement relates particularly to the construction and arrangement of parts whereby the plow beam is held steady while in use, adapted to be raised and lowered bodily, by means of a single lever, while in operation, and also without changing the horizontal position or angle of the plow beam, and whereby the draft is applied in a direct line with the plow beam whatever be its adjustment.

IMPROVED PLOW.

Joseph Shickel, Bridgewater, Va.—This invention consists in connecting a moldboard and plow point by a projection on the former, and a countersink on opposite sides of the latter, in addition to the ordinary clamping bolt, thus enabling the point to be fastened, after reversal, with equal security and facility as before.

IMPROVED TILE-LAYING MOLE PLOW.

Stephen H. Reynolds, Hillsborough, Ind.—This relates to the construction and arrangement of a lever for laying and adjusting the drain tiles or tile sections, and the means for adjusting the pitch of the furrow tube and regulating the depth of the furrow. The implement lays the tiles without opening a permanent ditch.

IMPROVED SULKY PLOW AND CULTIVATOR.

Eli W. Russell and John N. Russell, Ashley, Mo.—This machine may be readily adjusted for use as a plow or as a cultivator. The plow is free to turn upon the axle, while a collar keeps it from lateral movement upon said axle. By adjusting the collar, the plow may be adjusted to cut a wider or a narrower furrow, as may be desired.

IMPROVED PLOW.

Francis R. Bell, Marshall, Texas.—This improves the construction of a moldboard for which letters patent were granted to the same inventor May 18, 1875, to make it more effective in preventing the black lands of Texas, and other sticky and waxy soils, from adhering to it. The invention consists in a wooden moldboard faced upon its rear side with metal, having a recess between it and said metallic facing, and perforated with numerous small holes.

IMPROVED PORTABLE FENCE.

Tilmon A. H. Cameron, Petra, Mo.—This invention is a portable fence, designed to form a yard or enclosure for stock. It is composed of sections or panels, which are hinged together, mounted on casters, wheels, and provided with braces for holding the panels in the desired relative position. The fence is thus adapted to be readily shifted from one part of a field to another, and to be adjusted in a hollow square or other form, according to the nature of the field or configuration of the grazing surface. The invention further relates to providing supports for an awning, the same being self-adjusting and folded together with the panels.

IMPROVED SELF-DISCHARGING MANURE SPREADER.

Thos. A. McDonald, Durham, Nova Scotia, Canada.—This consists of a wagon for transporting manure and spreading it broadcast or in drills. The bottom of the wagon is in the nature of an endless traveling belt, or apron, supported upon polygonal shafts, one of which is geared with, and derives motion from, the rear axle. The latter is provided with a spring clutch mechanism, by which it may be thrown into and out of gear with the endless apron at the will of the driver, in order to thus regulate the discharge of the manure. The means immediately employed to throw the clutch out of engagement are pivoted levers, operated by connecting rods and a lever under control of the driver. The manure is discharged from the end of the wagon by the endless apron, and broken up or pulverized by a toothed roller.

Business and Personal.

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

Notes & Queries

J. C. will find directions for stereotyping by the paper process on p. 363, vol. 30.—W. N. can French polish his pianoforte by following the directions on p. 11, vol. 32.—J. N. will find that paraffin varnish is a good non-conductor of electricity. See p. 91, vol. 21.—J. C. W. will find some information as to the nature of electricity on pp. 195, 228, vol. 30.

(1) C. S. asks: How long is it since the first chilled plow moldboard was cast? A. A patent for chilled plowshares was taken out in England in 1803. In making them, they are cooled as rapidly as possible.

(2) I. D. & Co. say: We have a home telegraph line, and use 1 gallon stone jars for batteries. We fill with water to within 1 inch from the top. The vitriol will soon form a coating over the entire outside of the jar; it has the appearance of coming over the top of the jar. Can you tell us how to prevent it? A. There is no perfect remedy except frequent attention. Telegraph men usually paint a ring around the inside of the jar at the top; this mitigates the trouble in a measure. Some greasy substance is best.

(3) C. F. S. asks: Can small iron castings, such as sewing machine parts, be casehardened with prussiate of potassa? My machinist says it cannot be done. I say it can. Which is right? A. You are.

(4) J. S. D. says: I wish to construct an electro-magnetic motor, for the purpose of running a jig saw. The magnet to be 7 inches long and 3 inches wide, and ¼ inch thick, revolving in coils, the opening in which will be 7¼ inches long, 1¾ inches wide, and 7 inches deep. The outer coils and those surrounding the magnet will be composed of 4,000 feet copper wire, No. 21, American gage. The machinery is to be run by 3 cells Bunsen's battery. Will it give me sufficient power to run a jig saw at 600 strokes per minute? A. You had better use larger wire, say about No. 16. But it is doubtful if three ordinary cells will do the work.

(5) K. & D. say: 1. Can electricity be conducted into a cylinder to be discharged at will? A. Yes; the Leyden jar is used for this purpose. 2. Can a glass be invented that will enable a person to see through a fog? A. No. The electric light, however, can be advantageously employed during fogs.

(6) F. E. B. says: What is the horizontal force of terrestrial magnetism for New York, in magnetic measure? I have worked it out (by a formula given in Kohlrausch's "Physical Measurement") by the galvanometer, and make it 2·33, and desire to know whether this is correct, and if there is much difference between New York and other places in the United States, say Chicago or San Francisco. It is a question of some importance; for if there is a great difference, the values by a given galvanometer would vary in proportion at different places. For instance, the horizontal force at some places in Europe is only 1·88, or nearly half what I make it. A. Kohlrausch's table is hardly applicable to this hemisphere. Measurements made last summer at Newport made the horizontal force for that point, approximately, 1·65 in the meter-second system. We have just learned, also, that recent determinations at Philadelphia (measurements made this month), place it at 1·88 or 3·92 in English units. You can probably get full information from the Coast Survey Bureau.

(7) A. H. asks: What is the difference between a low and a high pressure boiler? A. A boiler with less than 21 lbs. of steam is usually called a low pressure boiler. With a pressure above that figure, it is called a high pressure boiler.

(8) I. M. H. says: Please give me the recipe for applying nitrate of copper to small castings (to represent a bronze) with the battery? A. Brown bronzing of various shades may be obtained by coating the object with copper and then proceeding in one of the following ways: (1) Moisten with water, to a wineglass of which five or six drops of nitric acid are added, allow it to dry, and then heat till the desired shade is obtained. (2) Rub well in and cover with finely powdered peroxide of iron (jeweler's rouge and red hematite ore); heat till nearly red. (3) Darker shades may be obtained by mixing the peroxide of iron with black lead, ground to a fine paste with spirits of wine. The copper is to be brushed well. When the color is obtained, the objects should be warmed and polished with a cloth which contains a little beeswax, and all excess of this removed with a clean cloth. A very good effect is also obtained by first bronzing to a deep color and then lightening the projecting parts by touching with a piece of leather moistened with ammonia.

(9) E. A. McG. asks: 1. How are razors ground and polished? A. Razors are first ground on grindstones, and then polished on emery wheels and buff wheels with crocus. 2. Is a rubber polishing belt the best for the purpose? A. Leather is better than rubber.

(10) P. S. says: I have made a Rhumkorff coil, with 160 feet No. 20 plain copper wire for the primary, which I insulated by winding with cotton twine, insulating each succeeding layer. For the secondary, I put on ½ lb. No. 35 cotton-covered copper wire. I have insulated the secondary from the primary coil with oiled linen. The core consists of a bundle of fine soft iron wire, about ¾ inch in diameter. I get only a little shock from it, and no spark. Must the fine wire be wound regularly and even, like thread on a spool? A. The length of secondary is hardly sufficient to give a spark of any size, but you should get a fair spark with proper battery power. The wire of the primary might be heavier and the insulation lighter.

(11) J. S. F. says: In your issue of June 3, Mr. Rose calls the tool illustrated on p. 357, vol. 34, a bevel square. Is not a sliding bevel the correct name? Is there such a thing as a bevel square? A. When the blade stands square, the tool is a square; when otherwise, it is a bevel.

What is black coffee? A. Black coffee is a very strong infusion of coffee, taken without milk.

(12) F. C. J. says: I built a model engine of the four cylinder pattern; but thinking it of no use, I took it apart and destroyed all but the cylinders. The cylinders were 2 x 3 inches, with reversible link motion. All the machinery was entirely ought of sight, with no joints except those needed for the reverse gear. My boiler was upright, 18 x 36 inches, with 151 ¾ tubes, 9 inches long. My intention was to put it into a steam carriage. Would it do for this purpose? A. The machinery would probably answer, if the boiler is strong enough for a high steam pressure.

(13) H. N. asks: 1. What does a buff consist of, and how is it made? A. Buff wheels are made of wood covered with leather, or of solid leather, such as walrus hide. Wheels are sometimes made of loose disks of cloth or rag. 2. Is there any secret about polishing tinware? A. The wheel of disks of rag would probably answer the purpose, if used with some dry polishing material and run at a high speed.

(14) E. S. N. says: 1. We wish to carry steam 1,500 feet to run a 13 inch cylinder. Is a 3 inch pipe large enough? The piston will run at about 400 feet per minute. A. A 3 inch pipe will probably do, though a 6 inch one would be better. 2. It is proposed to return the exhaust steam in a 5 or 5½ inch pipe, surrounding the 3 inch steam pipe, the whole enclosed in a wooden box containing some non-conducting material. I say that the exhaust steam will necessarily have a lower temperature than the live steam, notwithstanding its protection, and will therefore condense the live steam. I tell them to put them both in the same box, but keep them separate. Will you please give your opinion? A. Your view is correct.

What part of the area of a slide valve is to be considered in balancing the valve? A. The area of a slide valve requiring to be balanced depends largely upon its shape, size, and fit to its seat.

(15) C. M. N. asks: Is a bent magnet, with the ends of core at right angles with the main part of core, more apt to hold its magnetism after the current of electricity is broken than a straight core magnet? It is for a telegraph sounder. A. No.

(16) F. A. (query No. 42, July 15) is informed that the ordinary lifting injectors, of Nathan and Dreyfus, this city, draw water from 18 to 20 feet perpendicularly.

COMMUNICATIONS RECEIVED.

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

On the Quadrature of the Circle, etc. By W. H. W.

On Locusts. By ——.

On Meteors. By E. B.

Also inquiries and answers from the following:

P. L.—D. H. W.—N. W. O.—J. D. K.—C. H. H.—C. S.—D. C.—T. C. B.—B.—E. L. C.—H. E. B.—C. S.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent; "Who makes phosphor-bronze castings? Who sells water rams? Who sells machines for molding paper boxes from pulp? Who sells artificial tobacco leaves?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

June 27, 1876,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Air spring, W. Wells 179,240
Alarm, burglar, J. F. Gilliland 179,187
Alarm, burglar, J. S. Mace 179,336
Axle set and gage, W. C. Carlton 179,264
Bag fastener, A. Rihn 179,340
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Bag holder, B. B. Gurley 179,301
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9,349, 9,350.—EMBROIDERY.—E. Crisand, New Haven, Conn.
9,351.—CARPETS.—E. Daniel, Paris, France.
9,352.—STATUARY, ETC.—J. W. Fiske, New York city.
9,353.—FOUNTAINS.—J. W. Fiske, New York city.
9,354.—COFFIN HOOK.—G. S. Graves, Bainbridge, N. Y.
9,355.—CARPETS.—J. Hamer, Dutchess county, N. Y.
9,356.—FLOWER STANDS.—J. Kintz, West Meriden, Conn.
9,357.—PRINTERS' BRACKET.—S. Simons, Chicago, Ill.
9,358.—NEEDLE STAND, ETC.—E. C. L. Swindler, Magnolia, Ill.
9,359.—PHOTOGRAPHIC MOUNT.—I. W. Taber, etc., San Francisco, Cal.
9,360.—FAN.—B. Walker, Niagara Falls, N. Y.

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The inexperienced purchaser of a patent does not generally appreciate the importance of having its claims examined, and their validity and scope defined by some person experienced in such matters, before parting with his money. It is not unusual for the assignee, just as he is commencing the manufacture of articles under his recently purchased patent, to find that it is an infringement upon some previously issued patent, and that he has not only made a worthless investment, but that he is likely to get mulcted in damages if he proceeds with his manufacture. Cases are continually coming to our knowledge wherein parties have made purchases in good faith, and paid considerable sums of money on the assurances of the patentee and a mere glance at the patent, presuming that all that the drawing of the invention showed was protected by the claims, when, in fact, the point covered was almost infinitesimal. Another manner in which purchasers are sometimes deceived is that the claims, although broad enough and worded properly to cover the invention, contain a single element protected by some prior patent, which covers the very part in the new machine which is necessary to insure its efficiency. The Howe sewing machine patent illustrates this. It protected but little that any of the manufacturers cared to use, except the one small part essential to all sewing machines; and all manufacturers had to pay Howe a royalty, and he derived from that apparently trivial item an immense income.

We therefore recommend any person who is about to purchase a patent, or about to commence the manufacture of any article under a license, to have the patent carefully examined by a competent party, and to have a research made in the Patent Office to see what the condition of the art was when the patent was issued. He should also see that the claims are so worded as to cover all the inventor was entitled to when his patent was issued; and it is still more essential that he be informed whether it is an infringement, as above suggested, or not. Parties desiring to have such searches made can have them done through the Scientific American Patent Agency, by giving the date of the patent and stating the nature of the information desired. For further information, address MUNN & CO.,
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Vol. XXXV. No. 6. [NEW SERIES.] NEW YORK, AUGUST 5, 1876. [$3.20 per Annum. [POSTAGE PREPAID.]

STEAM HAND CAR--MINIATURE RAILROAD TRAIN.

A new steam hand car has recently been designed and constructed by Mr. Jay Noble, master mechanic for M. M. Buck & Co., of St. Louis, Mo., which is excellently adapted for the use of division superintendents, road masters, and others whose duty requires them to make frequent inspection of railway lines. The machine, as shown in the engraving, resembles an ordinary hand car, except that the propelling power is steam and not muscle. The floor is about 10 inches from the ground, and is beneath instead of above the axles. The boiler, which is about 3½ feet in hight with a diameter of 18 inches, is placed in the center of the car, while the cylinder, which is horizontal, is at the right hand side and near the floor. The cylinder is 3½x6 inches, and the boiler is intended to carry a pressure of 140 lbs. of steam. The body of the vehicle rests on rubber springs and rides very easily without lateral motion.

Seats are arranged in front and rear, of sufficient size to accommodate six persons. The water tank occupies a space under the back seat and holds about a barrel of water, which is sufficient to run the car 40 miles. On the left of the boiler, the coal pan is arranged in a space about 2 feet wide, and carries all the fuel necessary for a day's run.

On a recent trial trip, the run from St. Louis to Carondelet, a distance of seven miles, was made in fifteen minutes. The general design of the car, which is quite tasteful and at the same time well adapted to withstand severe usage, is plainly represented in our illustration. The idea developed in this miniature steam car might be adapted to other purposes than the one designated. We should think every railroad company would find such a steam car useful for various purposes.

STEAM HAND CAR.

The inventor states that under ordinary circumstances the cost of fuel will not exceed 75 cents per day. The general arrangement is excellent and reflects much credit on the designer.

Professor Bottger's Experiments with the Radiometer.

The much-talked-of radiometer, which Professor Crookes believes to be set in motion by the mechanical action of light, has fallen into the hands of that skillful experimenter, Professor Rudolph Böttger, editor of the *Polytechnisches Notizblatt*, at Frankfort on Main. In a communication to the Berlin Chemical Society, he described some of these interesting experiments. The radiometer employed by Dr. Böttger was made by Geissler in Bonn. The plates attached to the revolving arms were made of mica, rendered white by heating, and blackened on one side. This instrument was provided with a leaden foot to cause it to float upright in water.

When this little instrument was exposed to the direct light of the full moon, or to the light of strongly phosphorescent Geissler tubes which have been illuminated by burning magnesium wire, the arms do not show the slightest motion. If the apparatus is placed at a distance of 10 inches from a bright luminous gas flame, and a clear plate of alum 0·2 inch thick fastened in the center of a pasteboard screen be interposed between them at the same hight, there will be but a very slight revolution of the arms, showing that the easier radiation of heat by the blackened side of the mica plates than by the bright side, in a space which is not an absolute vacuum, although ever so rarefied. Dr. Böttger compares it to the Segner water wheel.

If the radiometer is taken into a room where the temperature is about 15° C. (59° Fah.) and placed near a luminous gas flame, the arms revolve from right to left, that is, with the bright side of the mica in front. While the arms were still in motion, this little instrument, with its leaden foot, was placed in a glass cylinder filled with water at 45° C. (113° Fah.) so that it was entirely immersed; the motion of the wheel was retarded, it stopped, then began to turn in an opposite direction, namely, from left to right, the blackened side of the mica being in front. In a short time, when the glass bulb and its contents had acquired the temperature of the surrounding water, the wheel came to rest.

Dr. Böttger repeated these experiments with a radiometer made by Mollenkopf of Stuttgart, and with somewhat different results. When this instrument was placed in warm water while in motion, it did not change its direction of revolution like that from Bonn.

If both instruments are set in motion by a feeble light and ether allowed to drop on them, causing quite a decrease in temperature, no retardation was observed in the apparatus from Stuttgart, while in that from Bonn the motion of the arms was strikingly slower. The experimenter thinks it probable that this difference in the action of two apparently identical apparatus was due to the vacuum being more perfect in one than in the other.

It would be interesting to make some experiments with an instrument where both sides of the mica or aluminum plates are blackened, also where both are bright. Such an instrument should be motionless when exposed to the action of radiant heat.

The Intercollegiate Boat Race.

The intercollegiate boat races took place at Saratoga, on July 19, and were all won by the Cornell University crews. The University race, in which Cornell, Harvard, Columbia, Union, Wesleyan, and Princeton colleges competed, was gained by Cornell in 17 minutes 1¼ seconds—distance three miles. The freshman race, against Harvard only, was won in 17 minutes 23½ seconds, and the single scull race in 13 minutes and 42 seconds. The time is not considered remarkable, but the victory was fairly gained; and coming, as it does, in direct succession to the honors won by Cornell last year, it will secure for the students of that college the highest reputation for athletic culture.

We have already expressed our opinion relative to races of this kind, and need not repeat it here. It may be noted, however, that there were fewer cases of fainting or other signs of physical overwork observable during the races which have just taken place, than appeared last year. As the men were all tried hands at the oar, many having rowed in other trials, their experience then gained, doubtless, prevented any over exertion, a fact indicated by the time made.

Public interest in these races seems to have greatly decreased, the attendance having considerably fallen off this year, and it is considered doubtful whether another large regatta will soon again occur.

An Asbestos Exposition.

An interesting exposition of asbestos has recently been held at the Simonetti Palace in Rome, the material being exhibited under all forms, from the crude state as mined to its highest industrial preparations. The *Gaceta Industrial* states that there were samples of thread made from the mineral which were stronger than the best English cotton; cloth, from coarse bagging to a fabric as fine as linen; paper for writing, printing, and sheathing buildings, and pasteboard. The asbestos paper is made at Tivoli, Italy, and costs about 40 cents per lb. It is especially useful for important documents which it is desired to preserve from fire. To test the fireproof qualities of the pasteboard, a case made therefrom was filled with ordinary paper, another case of pasteboard, not containing asbestos but otherwise exactly similar, was likewise filled, and both were thrown into a fire. In the space of five minutes the unprepared pasteboard box and its contents were wholly consumed, while to that period the asbestos box remained uninjured. Nearly all the asbestos mined in Italy finds its market in the United States.

Naval Items.

On July 19 Passed Assistant Engineer C. J. Habighorst was ordered to the Powhattan on August 1 next, and ordered to report to the Superintendent of the Naval Academy at Annapolis, Md., on August 20, for duty as an instructor in the department of steam engineering.

The Board for the examination of candidates for admission and promotion in the engineer corps, lately in session at the navy yard, League Island, has adjourned until September 1.

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(Illustrated articles are marked with an asterisk.)

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With Fifty-Four Illustrations.

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WORKMEN AND THEIR INSTRUCTORS.

That there is a gulf between the purely practical man and his teacher the theorist is one of the misfortunes of our day; and that there exists between them a lack of appreciation, one of the other, is painfully apparent to anybody who comes into contact with them both. Neither will allow that a goodly store of the knowledge and experience possessed by the other would not be a decisive benefit to him. But the theorist well knows that the efforts he may make in purely practical pursuits, however successful from a mechanical point of view, are sure to be, comparatively, financial failures: or, in other words, the expert workman must as a rule look for financial success in the same degree as he abandons his practice and enters the domain of theory. It is a very easy matter to quote examples of great men, who, like Galileo, threw their whole life and soul into their studies, and, rising to the pinnacle of fame, made the world their debtors; but how would it have been if Galileo had known that, so soon as he had advanced to a certain hight in knowledge of *his beloved science*, he must, to advance any further, abandon it and enter an arena new to him? And this is the precise position of the expert workman. The day has gone by when fame alone is a sufficient reward for labor or skill. Diogenes would in our day find his tub kicked into the street, and himself under lock and key as a vagrant. Galileo would be sneered at as a visionary; while ordinary good breeding prohibits enthusiasm, which is now-a days considered an attribute of youth or inexperience. The ordinary mechanic of to day is a child of to-day, with its ruling passions well developed in him. Among those passions a desire, a greed almost, for money is not the least; and he naturally takes the readiest course to obtain it. Now what is that course? Is it to become a skillful, practical mechanic? By no means: it is to learn the most commonly known method of doing work, the principles, so far as generally known, governing the manipulation or construction of the work or machine, as the case may be. In fact, since to take charge of others is his aim, he only exerts himself to gain sufficient knowledge to enable him to do so. The shop manipulation, knowledge of business, force of character, mathematics, mechanical drawing, etc., necessary to the attainment of his object, he strives to master. The better his education, the more sure he is to rise; so that a really intelligent and well educated man, with ordinary exertion, is rarely found in the working mechanic, even if he has had ten or twelve years of experience. As he drifts away from his position as a workman, he drifts away from its elements; as a working foreman, his studies are less practically manipulative; he has spent perhaps five years at his business, and during that time his attention has been divided between two things, one to become as expert a workman as he can, the other to gain the extra knowledge necessary to bring him into notice and make him capable of managing and directing other men; and so soon as he makes the first step of advancement, his progress in acquiring manipulative skill is cut short. This is of course unavoidable; but it leads to consequences, as we shall presently see, that are not unavoidable, but are on the other hand very deplorable. As a superintendent he enters a new field, in which his purely practical knowledge is of comparatively little value to him; yet he is the representative head and front of the purely practical man, and will often aspire to a superior knowledge of even the practical workmanship. The expert workman, who has spent from 12 to 20 years in the workshop, and who, in addition to being naturally and mechanically skillful, has made the work his study, looks around him in the workshop and sees here a machine running too slow, there a workman who would do double his quantity of work if a little of that inside *information*, which old and skillful mechanics always possess, were imparted to him. Then he thinks how much more work could be got out of the same amount of men and machinery if they only knew what he knows. He smiles to himself, and dismisses the subject from his mind, feeling that in his sphere of knowledge he stands alone: conscious, perhaps, that he could not fill the position of even a foreman, but conscious at the same time that money is being thrown away, and that, so far as the practical workmanship is concerned, those above him do not know their business, at least not as he knows it. He has not only no enthusiasm, therefore, for those above him, but he has innately a poor *opinion of* them, and inwardly rebels at his own position. There is his field of usefulness a comparative waste; and his mechanical advancement is impossible, because: Here we may pause and repeat a woman's reason: Because. The truth is that he is not supposed to know anything, and for the simple reason that his judges were never in his element. They might have attained to his knowledge, but they left his field of study and do not know that it takes twenty years to become, on light work only, an expert workman at the lathe, machine, and vise.

What are the chances of combining in one man, first, a mechanic sufficiently expert as a workman to stand legitimately as an authority and teacher to a large shop of workmen, secondly, one with sufficient judgment and command to govern them, and thirdly, one who shall also be an expert theoretical engineer? Let us see. Out of every 100 turners, there will be found not more than 2 of the highest order of efficiency. Out of 100 workmen, not more than 5 at most are capable of taking charge of men. Out of 100 men, not more than 5 are expert at the planer as well as the lathe; then again, not more than 5 in 100 are capable of explaining even what they do know. Out of every 100, there may be also 5 who have a knowledge af mathematics sufficient to make the calculations absolutely necessary to their work, if required to do so; then, perhaps, 5 per cent of workmen can make a decent mechanical drawing. But, on the other hand, 5 per cent are unsteady, 5 per cent are comparatively untutored, and so on; so that the chance of finding the above-mentioned combination in one man is somewhat small. It becomes apparent, then, that as a rule it is not the most useful workmen who are promoted into better positions, for the reason that the requisites to fill those positions include requirements other than manipulative skill; which requirements in the aggregate give practical expertness a comparatively small place in the general qualification of the foreman. Thus it happens that we may find a hundred cases wherein the workmen of a shop have a profound respect for some particularly expert workman, while only one case in which such respect is entertained by the workmen for the foreman of a shop; and it generally happens that, where such respect does exist, it is a bar to the advancement of the expert for the reason of the impossibility of his assuming control over men with whom his relations have been so intimate. That this should be so is not at all unreasonable, because his superiority is brought before them almost every day of their lives. He is to them, to a certain extent, a mystery in and upon a matter in which they themselves are, to themselves, masters; for of what does the ordinary mechanic assume to know more than of the trade at which he spends his days from morning till night, year in and year out? When a mechanic exerts himself to his utmost, when he puts forth the whole strength of his muscles as well as of his mind, when he calls to his aid all his experience, all his knowledge, all his determination, and all his strength, and then fails, and meets another who, with the same tools and under the same conditions, can perform vastly more and superior work, he knows that this capability is not due to either advantages of brute force or school education, but to some indefinable qualification known as skill. This seems to him to set education, perseverance, and strength at defiance; then respect creeps in, and the skill becomes a shrine, and its possessor an idol. An example of this kind occurs to our mind. A tall strong man, with brawny arms and with muscles hard and well developed, was engaged in filing up some parallel bars; he had the work by contract, and had filed up scores of them. He was an experienced mechanic, and had gotten himself into trouble for working so quickly as to get those men who chanced to have the same work to do by day's work into disrepute, because of their inability to compete with them, even in cost, let alone in time. On one occasion, however, a somewhat delicate looking workman, who worked near, challenged him to file up a bar in competition with himself (the challenger). The gauntlet thus thrown down was accepted, and for three hours the contest raged. Each was allowed new rough, second cut, and smooth files; and the excitement among the other workmen, of whom there were eight, ranged along the side of the same bench, was at a high pitch. The challenger finished his work first, and it was examined by his opponent and pronounced well executed; but a repetition of the trial of skill was requested, and made, with the same result. It was in winter; the workshop had no heating apparatus of any kind, and, though it was freezing, the contestants were in their shirt sleeves, and yet were perspiring. Then the challenger was thus addressed by his opponent, who had ceased working and had been engaged a few moments in apparent deep thought: "I cannot understand it; I can only accept and respect it. I have nearly twice your strength, and have had ten years more experience. I can look clear over your head, and can hold you with one hand; and yet I am beaten, beaten at my own job too; and worse than all, I cannot for the life of me tell how it was done." He surveyed himself, held out his strong arms and looked at them, then shrugged his shoulders and went on with his work. He might look within himself, and find, so far as his understanding was capable of judging, every element of superiority, except in that mysterious, intangible, indescribable qualification known to him under the cognomen of skill, which the closest scrutiny of the most experienced eye cannot detect save in its results.

ANCIENT GRECIAN GLASS.

Among the rare objects discovered in ancient Grecian burial places are some curious ones of glass, mostly found in the graves of women. Frequently these consist of vessels with long necks, drinking vessels (without handles and round at the bottom), and of flat and open dishes. All these glass objects appear to have been articles of luxury, and not domestic utensils. According to the recent investigations of Professor Landerers in Athens, this gloss is usually a silicate of soda, sometimes of potassa; but it is always very rich in lead oxide. These wonderful ancient productions often show the most magnificent rainbow colors, with a metallic luster like polished gold and silver, and the material of which they are formed may be split up into very thin layers. That this peculiar appearance is the result of old age, which has produced a change in the material, may be seen in the glass vessels preserved in the Metropolitan Museum of Art, in New York city, which are of still older date, having been procured from the island of Cyprus, by General Di Cesnola. These objects belong to a period of time intermediate between the ancient Egyptian and the Grecian periods; and the coloring operation is the same as that which takes place on the surface of glass panes in windows exposed to continuous changes in moisture and dryness. But it is found in its most complete result when, in the course of centuries, the action of time penetrates the whole mass, forming layer upon layer, shining with the colors of soap bubbles or mother-of-pearl, but with much greater intensity.

Among the rarely occurring objects are some of a deep green or black brown color, which are called vulcanic glass, and are made of obsidian ; but to these the ancients added oxide of lead in the form of massicot, so as to make the mass more easily fusible.

Colored glasses have also been found in the ancient Grecian burial places; the yellow colored (which, however, had become almost opaque) contained a silicate of alumina colored with oxide of iron ; probably ocher was used in these, mixed with the pulverized glass before the melting, so that the color was obtained after the fusion. A blue glass, which contained streaks of blue of various shades, contained oxide of copper ; and in producing this effect the ancients used probably the malachite and azurite (both mineral carbonates of copper) or other green or blue colored copper ores, or the so-called *cæruleum*, which in Egypt was made of copper, sand, and salt, and was used to color the cases in which the mummies were preserved. A specimen of white glass, resembling opal, but showing thousands of cracks, was undoubtedly made of milky half opal, which is found in Greece in the island of Mylos,and which was fused to make objects of the peculiarly colored appearance.

These and other modern investigations continue to prove that the so-called lost arts of the ancients, which some persons grossly exaggerate, trying to make it appear that the ancients surpassed the moderns in knowledge and civilization, did not amount to more than laborious attempts to produce a few of the richer objects which modern industry produces with the greatest ease and in the utmost abundance, placing them, for reason of their low price, at the disposal of every industrious man, even of the comparatively poor laborer, who, thanks to the inventive genius of the present day, enjoys comforts which the working man of ancient Greece would never think himself worthy to enjoy.

MECHANICAL VIBRATION AS A SUBSTITUTE FOR ANÆSTHETICS.

The application of anæsthetics in cases of surgical operations is of comparatively recent date. Dr. Morton discovered that the ethers, inhaled to a sufficient extent, produced a general anæsthetic state, during the continuance of which operations, which otherwise would be most painful, might be performed without the knowledge of the patient. The surgeon availing himself of anæsthetics is enabled to perform operations with greater deliberation and with greater precision, not having to contend with the writhing and shrinking of the patient; but certain dangers which accompany general anæsthetics, whatever the agent employed, have induced experiments for producing the effect locally.

For minor operations, surgeons have had recourse to refrigeration produced by a spray of very volatile liquid, or by the application of freezing mixtures. Intense heat induced by a galvanic current has also been employed, and various other agents have been tried with more or less success; but barring this danger, chloroform and ether stand thus far unrivaled. The desirability of an agent that will produce local anæsthesia cannot, however, be questioned.

Dr. Livingston records a remarkable instance of general nervous insensibility, which, although produced by an undesirable agent, proves that the nerves may be thrown into an insensible state by a means quite unlike the ordinary administration of anæsthetics. He says: "I saw the lion just in the act of springing upon me. I was upon a little hight ; he caught my shoulder as he sprang, and we both came to the ground below together. Growling horribly, close to my ear, he shook me as a terrier dog does a rat. The shock produced a stupor similar to that which seems to be felt by a mouse after the first shake of a cat. It caused a sort of dreaminess, in which there was no sense of pain, nor feeling of terror, though quite conscious of all that was happening. It was like what patients, partly under the influence of chloroform, describe, who see all the operation, but feel not the knife. This singular condition was not the result of any mental process. The shake annihilated fear, and allowed no sense of horror in looking round at the beast." In describing his injuries, he says: "Besides crunching the bone into splinters, he left eleven teeth wounds on the upper part of my arm."

The often related circumstance of the man who went into a sawmill and tried to see how near he could put his finger to the revolving saw without touching it, and on looking, found to his surprise that his finger was gone—and who, a few moments afterwards, illustrated to the proprietor of the mill how he lost his finger by putting one from the other hand so near the saw that he lost that also—although ludicrous, suggests a principle and a line of experiment which might, if investigated and followed out, result in a blessing to humanity.

The principle seems to be this : That rapid vibration, or a series of sudden concussions, even though slight, and not painful of themselves, will produce, in the part subjected to the treatment, a numbness or insensibility in the nerves, which may be immediately followed by a surgical operation without pain or inconvenience to the patient. The means for carrying out this principle are subjects for experiment. A square stick, having rounded corners, rapidly revolved, will produce insensibility in a finger placed so that it may be vibrated by contact with the corners of the stick. It may be a question whether this effect is produced directly by the rapid vibratory motion of the parts, or whether it is due to a compression of the nerves, the effect of which is prolonged by repeated concussions; in any case, it would appear that experiment might bring out a means for producing local anæsthesia or insensibility of the nerves by causing the parts to be vibrated rapidly by some mechanical device.

CANNED MEATS POISONED WITH MERCURY.

In our paper of May 27 we published the statement of Professor Falke, of Manhattan College in this city, to the effect that, on opening a can of cooked corned beef, bearing the stamp of a Chicago company, which he had recently purchased at a respectable grocery here, he noticed some globules of metallic mercury ; and on examination of the meat, found additional quantities of the poison in the form of albuminate of mercury. Professor Falke mentioned the matter before the Academy of Sciences, and the can was examined by the members. After some discussion the conclusion reached was that the presence of the mercury was accidental, caused doubtless by the accidental breaking of a thermometer bulb in testing the heat of the can, etc.

This statement having met the eye of one of our esteemed correspondents at the West, he wrote to us, stating that it was common at some establishments in his vicinity to seal the cans with mercurial solder, and that possibly that had something to do with the case in question. We deemed it hardly possibly that intelligent parties engaged in supplying the public with canned food would venture to make use of so dangerous a material in such a connection; and we therefore wrote to our correspondent, asking him to send us a specimen of the solder in question. He did so, and we caused the solder to be analyzed at the laboratory of Professor A. R. Leeds, Stevens Institute. We were surprised at the result, showing, as it did, that the solder contains a large quantity of mercury, which is at once liberated under the heat of the soldering iron, and is readily condensed in metallic form. This appears to be a sufficient explanation of the presence of free mercury and of albuminate of mercury in Professor Falke's case ; and warrants the conclusion that the many cases of sickness from partaking of canned meats, reported in the papers, may be due to the same cause.

Mercury is mixed with the solder in order, doubtless, to make it run and seal more easily ; but it is a dangerous and subtle poison, and its employment in connection with canned foods should be prohibited under severe penalties. We hope our legislators will promptly move in the matter.

In the meantime, we caution our readers to avoid the use of foods that are put up in *mercury-soldered cans*.

Any chemist or intelligent person, by a few simple tests, can quickly determine the presence of mercury in the solder. In the specimen sent to us, the mercury is revealed by simply heating a bit of the solder in a small test tube over a lamp flame. The metal condenses on the interior of the tube, and a bright globule may be soon collected.

THE CENTENNIAL EXPOSITION.

We noted, not long ago, the excursion of the 4,000 employees of the Singer Sewing Machine Company to the Centennial. The admirable example thus set has been followed by other large employing concerns, and it is to be hoped that parties of working men will be despatched from all our great manufacturing establishments. Employers will find it directly to their interest to encourage these excursions, and to grant the men the necessary holidays. To examine the Centennial, even rapidly and cursorily, is to receive almost insensibly a vast amount of useful information. Besides, as we have already suggested, the advantages thus to be gained will be enhanced if the workmen are required to make some report of what they have seen relating to their own trade, on their return. A suitable reward might be offered for the best report, and thus many might be induced to observe more closely than they otherwise would. Those who stay at home might be constituted the jury for decreeing the reward, and thus, being obliged to hear all the reports, they as well as the excursionists will share in the advantages of the journey.

Of course, the hot weather has kept away large numbers of people from Philadelphia. Still the attendance is reported to be large and to yield remunerative returns. This certainly is encouraging, as no one would have been surprised had the receipts fallen off seriously during the heated term. The rush will probably begin about the first of September; and from that date until the Exposition closes, the buildings will be thronged. Those, however, who saw the grounds just before the present hot weather set in, probably saw them at their best, as the vegetation has been sadly injured by the drought, and the asphalt pavements, becoming melted, have lost their smooth surface.

As a market, the Centennial as proved a great success. Our people have bought out whole foreign departments, and in many sections it is hardly possible to find an object not ticketed "sold." The foreign buyers of American goods have likewise purchased liberally. The New England exhibitors of cotton and wool machinery have found some good customers in the Brazilian staple and fleece displays. The *Boston Commercial Bulletin* reports that probably two large mills, from Yankee plans and Yankee fittings, will be built in Brazil. Over a hundred and fifty thousand dollars worth of pumps, engines, blowers, and drills have thus far been sold to South American buyers. Boot and shoe machinery is also, we learn, meeting a splendid foreign sale ; and even in objects of art—notably furniture—the sale of a fifteen thousand dollar suite to a Parisian house shows that American art industry is by no means unappreciated. Those who have made a study of the business aspects of the Exposition predict an enormous trade in the fall ; but it is stated that exhibitors manifest too great carelessness in selecting the persons who explain their exhibits. There seems to be almost a dearth of smart salesmen, while all such on hand are said to be succeeding beyond all expectations. There is one manufacturer who exhibits his own machine in a way that may serve as an example for general emulation. The device is a very ingenious safety lock for elevators, and under ordinary circumstances would probably be shown in the model. The manufacturer, however, decided to exhibit the invention on a full sized working elevator; and when the judges came to examine the device, he had everything in readiness. Entering the car, which he had previously loaded heavily with pig iron, he was lifted to a hight of about thirty feet ; then he coolly reached upward and began to hack at the supporting rope with his knife. Consternation speedily became manifest among the judges. Some implored him to come down, that they were satisfied, and did not want to see him killed. The imperturbable inventor went on hacking at the rope, which suddenly parted. The spectators turned away so as not to see the rash man dashed to pieces ; but instead of gratifying their anticipations, the elevator car was instantly caught, and actually jumped up a couple of inches above the marked point for its stoppage. From the expressions of the judges, that exhibitor may expect a favorable report ; and as he adopts the same startling plan for attracting visitors' attention, it is needless to say that a crowd always surrounds his exhibit.

So much has been said and written about Japan that her neighbor,

CHINA,

through the general similarity of the exhibits, has come in for little or no attention. And yet the Chinese display embodies some articles as marvelous in their workmanship as the Japanese lacquers and bronzes. At the entrance of the section is erected a large massive door of a temple, curiously ornamented with Chinese characters and oddly contrasting colors. The same general design is followed in the show cases, which have roofs like pagodas, terminating in graceful peaks and spires. In lacquered ware products, Japan excels ; but in the more minute arts of carving and inlaying work, the Chinese are the superiors. Certainly, some of their carvings in ivory and mother-of-pearl reveal a patience and delicacy of touch nothing short of marvelous. Commencing on the west side of the section, the attention is attracted by a large display of ancient vases and ornaments. Some of these are of immense age ; and they are of the highest value, as showing, probably, the earliest efforts of Chinese art. The designs, which are strikingly original, consist of strange looking birds, and animals, and natives engaged in various occupations. There is one pair of enormous vases, ornamented with handles fashioned to represent elephants' heads. On the eastern side of the section are shown handsome screens, elaborately ornamented with pictures of Chinese ladies in beautiful costumes woven in silk. Near, there are cases of curious ornaments cut out of ivory; and adjoining are superb displays of porcelain. Then come specimens of wood carving. By this means, the Chinese give us an idea of their habits and customs, as there are a large number of curious groups, in processions and ceremonials, in which all the figures are carved with the utmost minuteness. There is a multiplicity of carved picture frames, brackets, doors, cabinets, and like objects. Perhaps the most prominent article in the entire display is a bedstead made of fine grained wood, every inch of which is covered with carving of the most wonderful delicacy. The canopy is semicircular, and arches from foot to head. It is made of the finest and thinnest silk—a mere film—and on this are embroidered in silk the most exquisite designs in birds and flowers. It can well be believed that the bed represents the labor of years. Another bedstead, less elaborately ornamented, has been sold for $1,600. There are, beside, numerous exhibits of work and jewel boxes, made of highly polished and costly wood, together with card and chess tables of every form, inlaid with ivory and mother-of-pearl. The specimens of silks are of the finest quality. The colors, especially orange, maroon, and green, are exceedingly lustrous, while the parts that are embroidered exhibit exquisite skill. The rear portion of the Chinese section is filled with china and lacquered ware in endless variety. The department is always full of visitors, and the people seem never to tire of looking at these evidences of the strange civilization of the Orient.

New Caledonia Nickel.

Through the explorations of M. Garnier, New Caledonia now yields a green mineral, consisting of hydrosilicate of nickel and of magnesia, which appears destined to acquire considerable industrial importance. The mineral is found in the midst of very abundant masses of serpentine at various points of the island, and in association with euphotides, diorites, amphibolites, and other magnesian rocks. Sometimes this combination of nickel shows itself on other rocks in the form of a fine green covering; at others, it penetrates the rocks and colors them intensely ; and again it is found in both filaments and in nodules. As might be expected, the nickel is accompanied by iron, cobalt, and chromium, almost invariably. The metallurgical treatment proposed by MM. Christophle and Bouillet is quite simple. The material dissolved in hydrochloric acid is precipitated by lime under form of a nearly pure nickel oxide. Reduction by charcoal easily gives a metal 99 per cent fine, incomparably purer than that obtained from the sulphuretted and arsenious ores hitherto employed. It is not, however, in the free state that the metal is best used. As combined with copper in the proportion of 15 per cent nickel against 85 of copper, a white malleable and very fine alloy is produced, excellently suited for all metallurgical manipulations.

A rod of brickwork = 272 superficial feet, 1½ bricks thick, or 4,350 bricks average work. One yard of paving = 36 bricks flat or 52 on edge. There are 384 bricks to a cubic yard, and 1,000 bricks, closely stacked, occupy about 55 cubic feet.

COMPRESSED AIR AS A STREET CAR MOTOR.

M. Louis Mékarski, of Paris, has recently devised a novel mode of using compressed air as a motive power, which he has applied to a street car now in operation in the French capital. The mechanical portion consists in four parts: the reservoirs, the heater, the regulator, and the propelling gear.

The reservoirs, A, Fig. 1, are cylindrical receptacles, made of plate iron, 16 inches in diameter, and are perfectly air-tight. The reservoirs are connected together by copper pipes, and are divided into two series; one constitutes the main or working portion, while the other, of one third the capacity, constitutes the reserve. On leaving the reservoirs, the air passes through a column of hot water, by means of which it becomes saturated with steam at a high temperature, which column is contained in the apparatus shown in Fig. 2. The air enters by a central tube through the rose, C, bubbles up through the water (which is previously injected into the heater at a temperature of 356° Fah.), and finally accumulates in the upper part of the receptacle, forming a mixture with the steam at the pressure of the reservoirs. Instead of allowing the gaseous mixture to enter the cylinders at the reservoir pressure, which is constantly varying, it is caused to pass through a special appliance called the regulator. A conical valve, *c*, Fig. 2, is guided in its travel by the rod, *t*, at whose upper end is mounted the plate, *p*. An air spring, that is to say, a certain quantity of compressed air inclosed in a space, A, and whose pressure is regulated by the movement of the piston, P, exerts upon the plate, *p*, through the medium of the movable india rubber diaphragm, *d*, an action which tends to determine the flow or discharge on lowering the valve, *c*, and to maintain also a corresponding pressure in the chamber, B, which communicates with the motor cylinder by the distributing cock, R. The valve follows automatically the variations of the discharge, closing completely the orifice as soon as the latter stops. The intermissions which result from the employment of the expansion have, therefore, no influence.

For insuring, during the filling of the heater, the closing of the valve, which does not then bear upon its seat with great pressure, while working, the spring, *s*, is employed.

Finally, to prevent the leakages which may be produced through the packing, *g*, traversed by piston, P, the said piston is only made to act directly upon the air spring by means of an interposed cushion of water which it causes to flow in the annular chamber, A. This water, which fills the central space wherein the piston moves when the latter is at the top of its stroke, is admitted by the funnel cock, *e*. The air itself is delivered into the chamber, B, by means of the three-way cock, *v*, which permits, by a very simple movement, the filling of the space, A, with air already having a certain tension. A gage is mounted on this cock. The piston, P, is actuated by the pressure screw, V, which is controlled by a wheel, and which passes through a nut, E, attached to the apparatus by three iron standards.

The hand wheel is worked by the driver. The pressure of air and steam allowed to enter the cylinders is, *therefore, regulated* automatically to a given point, notwithstanding the variation of pressure in the reservoirs, while, at the same time, this pressure is variable at the will of the driver. On leaving the regulator, the gaseous mixture enters the cylinders, where it acts upon pistons connected with gear more or less like that of a locomotive.

This self-propelling tram car, designed by M. Mékarski, is, as far as the mechanical portion is concerned, quite different from any other motor. On account of the use of air saturated with steam, a high degree of expansion permits of a long run being made with a small quantity of air, the expenditure of which, at a pressure of 25 atmospheres on an ordinary tramway, was less than 11 cubic feet a mile. The working is noiseless.

The principal feature is the ease with which the car may be handled, the operations of reversing, slackening, or increasing speed, and stopping suddenly being performed with far greater ease than with a pair of horses.

At one end of the tramway must be erected some powerful expansive condensing engines, working pumps for compressing the air to a pressure of 25 to 30 atmospheres, and forcing it into the tram cars while they are standing, the excess being stored up in fixed reservoirs. Each tram car, after having completed its double journey, receives its charge of compressed air, while the heat lost during the run by the water in the heater is restored by steam led through a flexible hose. The same system may be applied to engines for drawing ordinary cars after them.

The most important result of this invention is the possibility of storing the air in carriages at a very high pressure (twenty-five atmospheres or higher), permitting a long journey without recharging the reservoirs; nevertheless, in certain cases where it is desirable to reduce the dead weight in diminishing the number or size of the reservoirs, the charging may be effected more frequently by means of supplies of air arranged along the road at suitable distances, and attached to tubes or passages fed by the compressing works.

Fig. 1.

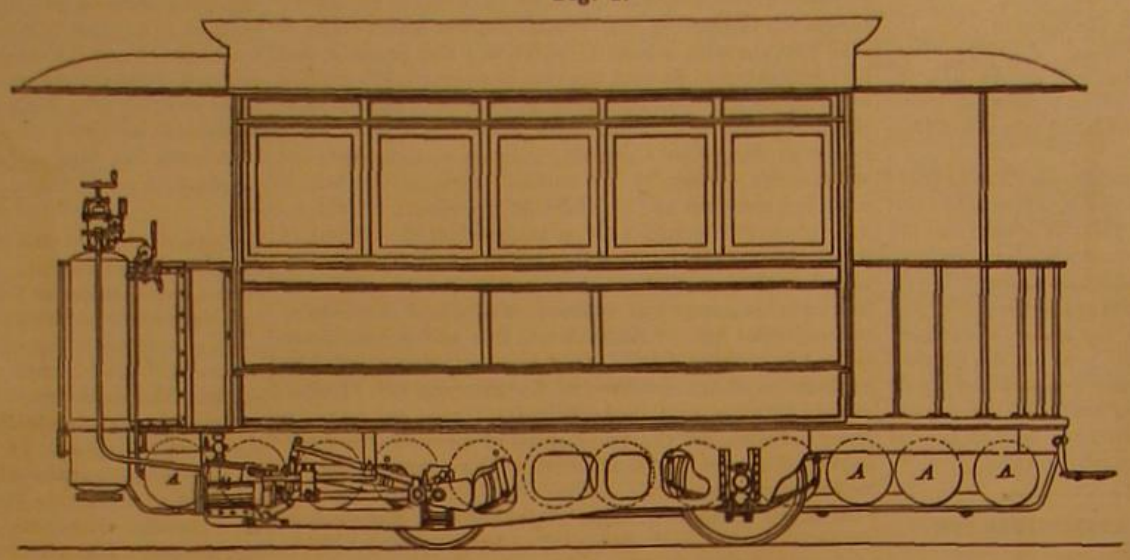
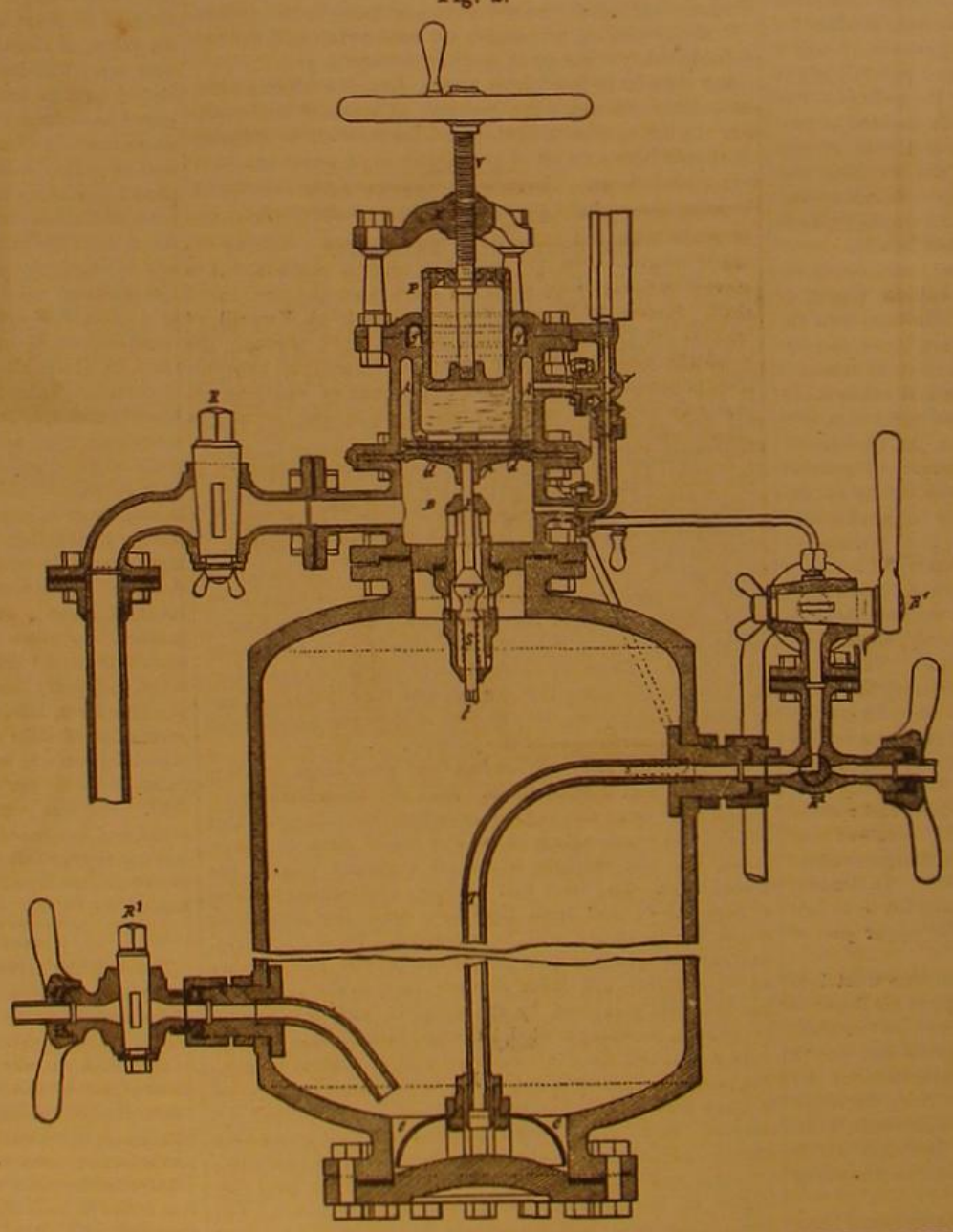


Fig. 2.



MEKARSKI'S DEVICE FOR USING COMPRESSED AIR FOR MOTIVE POWERS.

Causes of the Increase of Nervous Disease.

There is a general belief on the part of physicians that nervous diseases are on the increase, and a strong suspicion among many of them that insanity is growing in prevalence.

There is little doubt but that the immense and augmented use of alcohol and tobacco has much more to do with these facts—for facts we hold them to be—than the much-talked-of pressure of modern life, competition, over-brainwork, etc. Insanity from alcohol is observed where this competition is at a minimum, in Guiana, for instance. Dr. J. S. Donald, in a late article on lunacy there (in the *Journal of Mental Science*), observes:—

"With regard to the etiology of insanity in this colony, I cannot say that I find it in any way depending on, or modified by, the nature of the climate. One of the most fertile causes is intemperance. I have noticed this more particularly among Creoles and Portuguese, and in many cases I have been able to trace alcohol as the direct agent.

"Among the lower classes rum is mostly used, and frequently in the form of high wines, rum 40 over proof. It can easily be understood that this in time seriously interferes with the bodily health, and, acting as a poison, eventually produces cerebral lesions."

Not less certain is it that tobacco brings about the same result. Some years ago the French government directed the attention of the Academy of Medicine at Paris to this subject. A scientific statistician with an imperial commission was empowered to collect facts and data for a report, and a commission was appointed to enquire into the influence of tobacco on the human system. The report stated that a large number of the diseases of the nervous system and of the heart, noticed in the cases of those affected with paralysis or insanity, were to be regarded as the sequence of excessive indulgence in the use of tobacco. M. Jolly said that "tobacco seems primarily to act upon the organic nervous system, depressing the faculties and influencing the nutrition of the body, the circulation of the blood, and the number of red corpuscles in the blood." Attention was also called to the bad digestion, benumbed intelligence, and clouded memory of those who used tobacco to excess.

Dr. B. W. Richardson, of London, observes that "smoking produces disturbance of the blood, of the stomach, heart, and brain, of the organs of sense, and of the nervous filaments of the sympathetic and organic nerves." Again, he states that "tobacco smoking arrests oxygenation of the blood, and thus interferes with the full development of the structures of the body, especially in the young."

For all this, it is ominous to note that in Great Britain, from every fresh return compiled, the use of tobacco is fast increasing, even when due allowance is made for increase of population. A recent report of the Inland Revenue Commissioners shows that, in the year 1841, 23,096,281 lbs. weight was cleared in the United Kingdom, giving 13¾ oz. per head of the population; while in the year 1874 the weight cleared was 46,991,590 lbs., being at the rate of 1 lb. 7 ozs. per head.

In the United States, France, and Germany, the same is apparent.

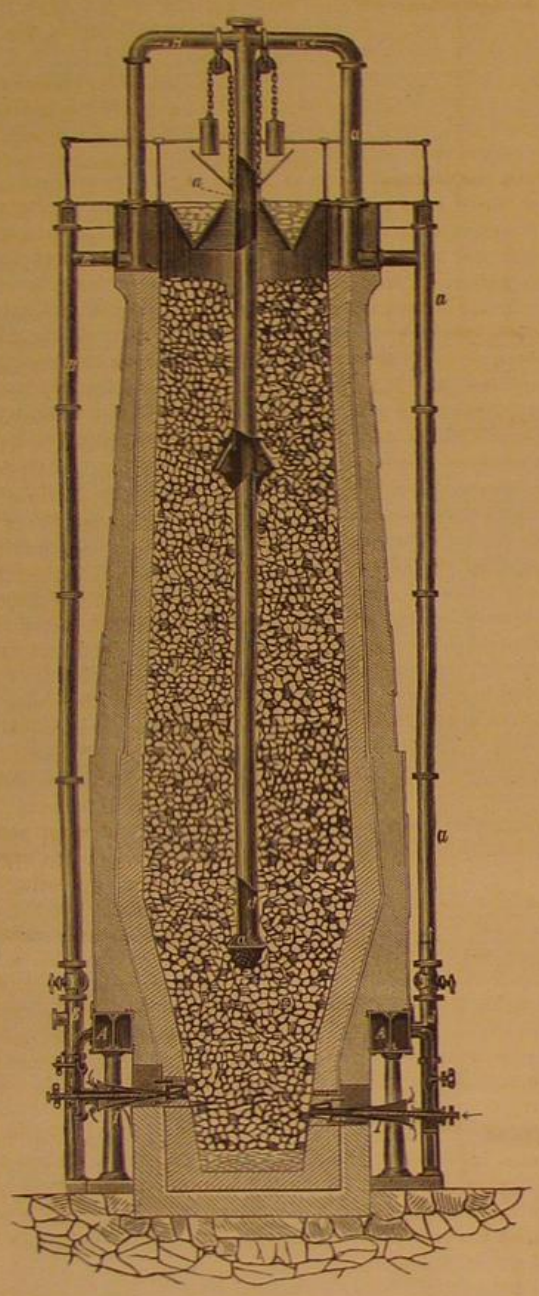
In this connection, it is noteworthy that Dr. A. F. W. Lyle states, in the Cincinnati *Lancet and Observer*, that sassafras counteracts the injurious effects of tobacco on the nervous system. This, he adds, was first pointed out by Dr. Thompson, of Nashville, Tenn. A few drops of oil of sassafras, mixed with smoking tobacco, will, he asserts, render it innocuous.—*Medical and Surgical Reporter.*

COCKROACHES may be driven away by putting Scotch or other high-dried snuff round their haunts.

LINSEED OIL VARNISH.—Boil linseed oil, 60 parts, with litharge, 2 parts, and white vitriol, 1 part, each finely powdered, until all water is evaporated. Then set by. Or, rub up borate of manganese, 4 parts, with some of the oil, then add linseed oil, 3,000 parts and heat to boiling.

THE UTILIZATION OF PETROLEUM AND NATURAL GAS IN BLAST FURNACES.

The siderurgical value of petroleum depends greatly on its composition, and necessarily varies therewith. According to an analysis made by Professor Wurtz and published in the *Moniteur Industriel Belge* (from which journal we translate and condense the following), the composition of crude petroleum is: Carbon 84, hydrogen 14, oxygen 2—100. Or supposing that the 2 per cent of oxygen is combined with the hydrogen: Carbon 84, hydrogen 13·75, water 2·25—100. If the petroleum be incompletely burned, so that the carbon is transformed into the oxide and hydrogen into water, the siderurgical value of the petroleum may be calculated as follows: 34 lbs. of carbon require 112 lbs. of oxygen to effect the formation of carbonic oxide, and 112 lbs. of oxygen correspond to 4,306 lbs. of atmospheric air, the latter being considered to contain 26 per cent of oxygen. The products of combustion will then be formed of 196 lbs. of oxide of carbon, 126 lbs. of water, and 631·75 lbs. of nitrogen. De-



termining the number of calories (French) disengaged by the transformation of the carbon and hydrogen, subtracting the latent heat of the water, we obtain 592,507 calories as the heat produced by 100 lbs. of petroleum incompletely burned. This corresponds to a temperature of combustion of 3,205·4° Fah. By similar mode of calculation it is found that, when the combustion of petroleum is complete, carbonic acid and water being the results, the temperature is 1,272·6° Fah. greater, or 4,478°.

While the incomplete combustion of petroleum may thus serve for the fabrication of iron, it becomes obviously desirable to insure the complete combustion. The most important question to resolve then is what quantity of petroleum is necessary to produce a tun of iron (2,240 lbs.) This will naturally vary according to the nature of the ore employed. In the northwestern part of Pennsylvania, the cold blast furnaces absorb about 90 bushels of Connersville coke, containing 3,260 lbs. of carbon, to produce a tun of iron with magnetic oxides (or about 1·43 tuns of coke to 1 tun of iron). The ore necessary to produce 1 tun of iron contains 853 lbs. of oxygen, which require 640 lbs. of carbon to effect transformation into carbonic oxide. With these data the author finds that the consumption of petroleum per tun of iron is, for reduction, 256 lbs.; separation of the oxygen from the metal, 239 lbs.; fusion, waste, etc., 157 lbs. Total, 652 lbs., or about 97·5 gallons. He also makes similar calculations with regard to natural gas, such as is derived from the wells in Pennsylvania, Ohio, and elsewhere. The composition of this gas may be considered as carbon 64·01, hydrogen 21·31, water 0·26, nitrogen 4·31, carbonic acid 10·11—100. Considering first complete combustion, developing carbonic acid, the calorific value of gas per 100 lbs. is fixed at 1,136,561 calories, corresponding to the temperature of 4,262° Fah. Incomplete combustion producing carbonic oxide gives a calorific value per 100 lbs. of gas of 773,048, or the temperature of 3,275·6° Fah

It has been proposed to practically utilize petroleum in blast furnaces by vaperizing it by means of superheated steam and then introducing it into the combustion zone with the blast. Thus employed, however, the hydrocarbon is but incompletely consumed, and the temperature practically gained is not sufficient to insure the advantageous working of the furnace.

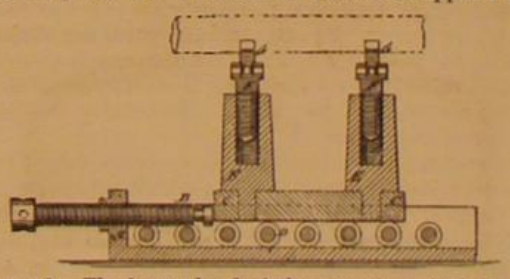
To avoid this difficulty the author, Mr. Charles Plagge, has devised a new apparatus whereby the influx of petroleum is divided, so that there is led into the combustion zone only that portion necessary to meet the reduced iron and the scoriæ; while the remainder of the petroleum, which roasts, reduces, and carbonizes the metal, is conducted into the upper or reducing zone of the furnace. The annexed engraving is a section of this device. The petroleum and the blast necessary for roasting are led by a central tube, which plunges into the reduction zone to a depth determined by experiment. In order to protect this tube from the heat, it is enveloped in a larger tube. There is thus formed an annular chamber for the circulation of hot and cold air, which enters from above and leaves the outer tube by special apertures, to pass into the furnace a little below the upper surface of the charge, a hight at which the petroleum enters the reducing zone. This air serves, in addition to preserving the tube, to burn all the gases and vapors, arising from the oil, which have not been utilized by the reduction and the fusion of the iron. The free oxygen, which enters the furnace above the zone of reduction, oxidizes the injurious impurities contained (sulphur, phosphorus, etc.); and the heat produced contributes in expelling the carbonic acid and combined water of the ore, and to heat the latter before its entrance into the reducing zone.

The author claims that by this means more iron can be produced daily, owing to the large quantity of ore with which furnaces can be charged through the absence of solid fuel, and also that the metal produced is of greater purity, owing to the elimination of impurities, as above noted, before it enters the reduction zone. The metal reduced at low temperature cannot be injured by deleterious matters in its passage from the zone of reduction to that of fusion, since it encounters only neutral gases, but very slightly oxidizing or reducing in nature, and since it is submitted to the purifying action of carbonic acid, which transforms into sulphurous, silicic, and phosphorous acids the small particles of sulphur, silicon, and phosphorus which the reduced metal may have absorbed.

A NEW COMPOUND ENGINE JACK.

When locomotive engines run off the track, it is a matter of much labor and difficulty to replace them. Raising the heavy weight vertically presents no especial obstacle, but to move it sideways requires much more labor and mechanical skill. Messrs. William C. Taylor and Rudolph Vampill, of Mullins, S. C., have patented, June 6, 1876, through the Scientific American Patent Agency, an ingenious improvement in compound engine jacks, by means of which an engine may be raised vertically, and then moved laterally to place it upon the rails.

In the annexed engraving, A is a cast iron box, open at the top and at one end, and in the closed end of which is formed a screw hole to receive a screw, B. The screw, B, is operated by means of a wrench or other lever applied to its



outer end. The forward end of the screw is swiveled to the end of the iron block, so that the said block, C, may be moved back and forth by turning the screw. The block, C, or its lower part, fits into the box, B, and rests upon the rollers, D, placed within said box, so that it may be moved easily, even when supporting a great weight. Into the upper side of the block, C, near its ends, are attached two posts, E, the upper parts of which are perforated longitudinally with screw holes, into which enter screws, F, which are turned by a wrench. To the upper ends of these are swivelled cross heads, G, having half-round notches formed in their upper sides. Several posts, E, of different lengths are provided to avoid the necessity of blocking up the jack.

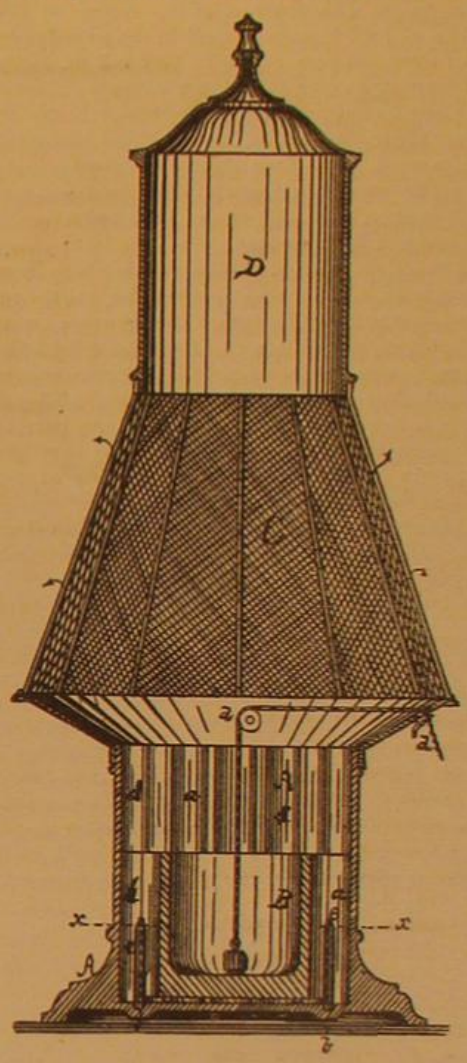
In using the device, it is placed beneath and parallel with the drive axle of the engine; and the screws, F, are turned up until the heads, G, come in contact with the drive axle and raise it enough to let the wheels pass over the rails. The screw, B, is then turned, moving the engine laterally, until the wheels are over the rails. The screws, F, are then turned down, lowering the said wheels upon the rails.

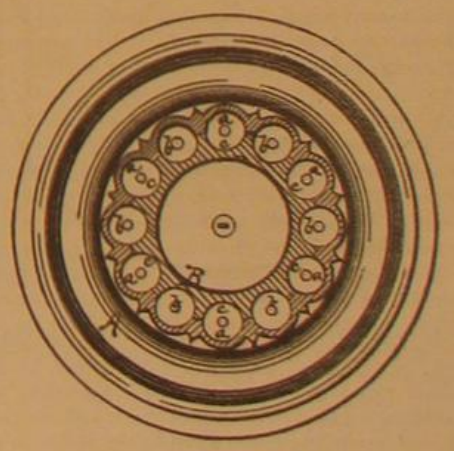
The Washington Monument.

There is a probability that the unsightly pile of stone called the Washington monument, in the national capital, will soon be pushed forward to completion. It is now 174 feet high. The amount required to carry it up to 485 feet and surround it with a terrace 25 feet high and 200 feet in diameter, is estimated at $500,000. This sum there is an effort on foot to raise by public subscription, mainly through churches; but the patriotism of the people so far seems not to have resulted in very liberal donations. The Senate, however, has recently passed a bill declaring that Congress should assume the finishing of the work; and it will, therefore, if an appropriation be made, be paid for out of the national treasury instead of from the pockets of private citizens.

BARTLETT'S OZONE MACHINE.

The novel feature of this invention consists in the construction of the parts by which ozone is generated in separate tubes, and then purified as it passes from the machine into the atmosphere through the chemically prepared stuffs and wire walls. A is a hollow glass vessel having its inner sides formed into a series of half tubes, *a a*, and with sockets, *b*, in the center of each in the bottom. B is an inner cylinder, also of glass, having corresponding semicircular cavities, *c c*, formed on the outside, which, when the plunger is in position (inside the outer vessel, A), will form, in conjunction with the other parts, *a a*, a series of tubes around the interior of the vessel. This vessel, A, comprises the generating chamber. The plunger, B, is made hollow





with a closed bottom, and will be raised or lowered by a cord. The bottoms of the tubes, *a a*, receive phosphorus sticks, which stand up about two thirds of the length of each tube. The sticks are made flat and thin, being from one eighth to one quarter of an inch in thickness, and one inch in width, according to the size of the machine, and the upper part or combustion point is flattened or sharpened, thus giving the best oxidizing point. The object of raising and lowering the inner cylinder, B, is to regulate the hight of water around the phosphorus sticks, and thus graduate the combustion. By this simple arrangement any length of stick desired may be exposed for quick or slow combustion; and the machine may be left for days to run itself, the only attention required being to graduate the water by raising or lowering the plunger. Above the generating chamber is arranged an ozone chamber, C, the walls being formed of two thicknesses of wire cloth, the inner one being of much finer wire than the outer one. Between the two, and surrounding the entire chamber, C, is a porous fabric, which is first treated with an alkali, so that the fumes rising from the oxidizing phosphorus will be caught therein, and the acids and other impurities retained or neutralized by the chemicals having an affinity therefor. An expansion chamber, D, is set above the ozone chamber, C, to receive the surplus products of oxidation and allow them time to become separated from the ozone.

The apparatus is the invention of Mr. F. W. Bartlett, of Buffalo, N. Y., and was patented February 15, 1876.

Correspondence.

A Few more Words About Locusts.

To the Editor of the Scientific American:

In late numbers of your journal I notice several short articles on the Rocky Mountain locust, especially a note from J. F. Dunwoody, of Louisiana, Mo., taking exceptions to some of the statements and opinions of Professor Riley on the subject, and a brief reply from Professor Riley to Mr. Dunwoody. Frequently two men will take different sides of a question; and, to sustain their opinions, each will quote facts which appear to conflict, and yet the statements of both may be correct. I am convinced, from my own experience, that such is the case here. I have known one instance, very similar to the one mentioned by Mr. Dunwoody, where the locusts were hatched after the eggs had been covered for weeks with water. In the spring of 1868, vast quantities of locusts were hatched in the counties along the Missouri river, between Nebraska City and St. Joseph, Mo. In the following June or July, I saw myriads of locusts that had not been hatched a week, on an island in the Missouri river, just above Brownville, Neb., where the ground had been submerged by the river during the greater part of the spring. This was several weeks after the grasshoppers on the main land on both sides of the river had arrived at full growth and had flown away.

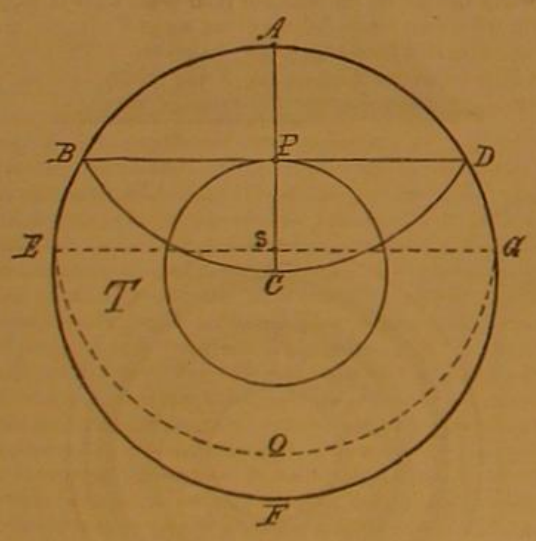
It is a prevalent opinion, among farmers who have tried the experiment, that plowing the ground where the eggs are deposited does not destroy them. But in some instances it does. I noticed, in the spring of 1868, one field that was plowed early, and that contained tuns of grasshopper eggs, many of which were exposed to the surface. They did not get hatched, but gradually changed color and putrified, till the field smelt like a dried-up pond. Why they perished, whether from repeated freezing and thawing or from the heavy rains that washed the cement from the eggs in their new and exposed position, or from the bright sun shining on them, I cannot say. But I did not see any young grasshoppers during the entire season on that field.

Lawrence, Kan. J. R. FISHER.

Weight on and in the Earth.

To the Editor of the Scientific American:

I supposed the "body in a hollow sphere doctrine" had been repudiated, but I find it endorsed by Professor Young in a recent lecture. There can be no doubt as to the falsity of this theorem. Olmstead embodied it in a proposition in his philosophy; and singularly enough, further on he said: "A body lowered toward the center of the earth would lose in weight in proportion to its distance downward." The



hostility between these propositions is unmistakable. A body upon the surface of the earth weighs, say, 24 lbs.; if lowered half way to the center, it passes, according to this queer theorem, seven eighths of the mass, and weighs then but 3 lbs.; but, according to the second proposition, it weighs 12 lbs., having lost 12 lbs. If this latter proposition be true, and there can be much evidence produced in its support, the former at once falls to the ground. In truth, a body would as eagerly fall to the center from any point within a hollow sphere as if the sphere were solid.

A body on the surface, at A, would be attracted by the whole mass toward C; but if lowered to P, the mass above the plane, B D, would attract it toward A, and neutralize the downward attraction of a corresponding inverted volume of matter, B D C. Then it is the lenticular mass, A B C D, that has been rendered neutral in its effect upon the body, at P, instead of the shell, T, as erroneously set forth by this absurd theorem; and the weight of a body, or vibrations of a pendulum, at P, would be due to the amount of matter in, and distance of, the cup shape fragment of earth from which the neutralized mass may be supposed to have been taken. Were the body lowered to *s*, it would be attracted toward C only by the thin and distant shell, E F G O, the rest of the mass being neutral: which shell would disappear as the body reached C. There is much to disprove this theorem, it being little less than a philosophical monstrosity. Theoretically, every solid body would balance in any position if suspended from its center point of gravity. Guided by the theorem in question, we should expect a hollow sphere to so balance, if suspended from any possible point within the void. E. B. WHITMORE.

Rochester, N. Y

Production of Silkworms' Eggs in Italy.

Great attention is being paid in Italy, as stated by Consul Colnaghi in his report upon the yield of cocoons in 1874, to the restoration of the native breeds of silkworms, and apparently with every hope of success. Government stations for microscopic examination are established in various provinces, and private individuals are not behindhand in experimental studies, which, in some cases, have assumed an important industrial aspect. At Albiate, in the province of Milan, there exists the important Cascina Pasteur for the production of silkworms' eggs, founded about 1868-69, and conducted by M. Guido Susani. The Cascina Pasteur has been continually increasing its production of grain under cellular selection, and in 1874 furnished 18,000 ounces (of 25 grammes each) of eggs, a quantity that could be greatly increased on the receipt of early commissions.

Microscopic examination of the moths, and not of the eggs, is the foundation of the system of selection. While, however, this examination is a certain safeguard against the corpuscular disease, or, as it is usually termed in Italy, *la petrina*, it is of no avail against other sicknesses. Here the remedy is found in a series of physiological selections, costing both time and money, and requiring more than two years to be certain of effect. M. Susani has obtained equally good results with regenerated Italian breeds as with the green and white Japanese, which he has reproduced for the last seven years without requiring to renew the stock from Japan. In Lombardy these Japanese reproductions are preferred, and are the only ones generally used. They have given of late better results than the Japanese cards, which are found every year to be more and more infected with disease. In Central Italy the yellow Italian breeds are more usually cultivated. These, when ill attended and if the season is unfavorable, suffer from *flaccidezza*, and this is why the Lombard peasants prefer the cellular selections of the more hardy green Japanese race. Among the Italian breeds M. Susani prefers the old *brianzola* and the *biona*, which he has regenerated, for hill cultivation, or at least for dry localities, and where sufficient care is taken; for the lowlands he prefers a commoner quality.

On a smaller scale than M. Susani's, but very complete in its arrangements, is an establishment in the immediate neighborhood of the small town of Arezzo (Tuscany) overlooking the Val Tiberina, and founded by Count Polidori and Co., three years ago, also for the special purpose of producing silkworms' eggs for sale. M. Colnaghi mentions that he recently had an opportunity of visiting this establishment. A convenient two-storied building has been erected in a garden in which a plantation of young mulberry trees is growing. The rooms in which the silkworms are reared are light, airy, and well ventilated; the open fireplaces are of brick; and by a simple system of tubes communicating with the outer air, a constant supply of fresh air, warmed in its passage through the stoves, is brought into the rooms, the foul air being carried away by means of ventilators. Light wooden frames are raised in each room, leaving sufficient space for the attendants to walk round them. On the frames trays are laid in rows, each tray measuring 30 inches; the hight between the rows of trays is 18 inches. To rear 1 oz. of eggs 72 trays are required—a superficial area of 600 square feet—and they may be placed in a small space if it is well aired. The bottoms of the trays are of string, over which a piece of white gauze is laid to support the worms. Twenty-six microscopes are in use to examine the moths. A power of 560 diameters is considered the most suitable. Sixty women are in constant employment, varying according to the season, in examining the moths and rearing the worms.

The system of microscopic selection used in Italy is that of Pasteur, modified slightly by the experiments of Cornalia and Cantoni. The moths (male and female), themselves carefully selected, are placed in a small gauze bag, where they couple—the female depositing her eggs—and die. After death they are taken out of the bag, the wings carefully stripped off, the bodies pounded, with a little water, in a small porcelain or glass mortar. If on examination under a microscope no sign of corpuscules are found, the eggs are considered healthy. The examination of the eggs themselves is not required, being superfluous if the moths are healthy, and useless when they are not, as the germs of the disease may be contained undeveloped in an apparently sound egg. The healthy eggs are suspended in the little bags in a cool and airy place. For the due hatching of the worms in the following spring, it appears to be absolutely necessary for the eggs during the winter to be exposed to the influence of frost, or at the least to a certain degree of cold.

Count Polidori and Co. rear worms enough to produce 3,000 ozs. (of 28 grammes each) of grain, for which about 270,000 couple of moths have to be examined under the microscope. The breed of the worms at present obtaining the preference at the Anghiari establishment is the French Roussillon, which produces a small but compact and well made cocoon, contracted in the middle, yellow in color, with a slight roseate hue. The silk is elastic and lucid. The cocoon resembles that of the well known brianza breed, of which it is probably a descendant. The yellow Tuscan breed, although it has been preserved in the province throughout the the silkworm disease, is said to be weakly; the cocoons do not spin well. The Novi breed (white cocoon) yields a beautiful silk. A race of worms from Sardinia, with a roseate cocoon, was of good promise, as also a French breed from the Var, of striped worms, and producing a nankin-colored cocoon.

With reference to the product of the various breeds, on an average 1 oz. Japanese grain yields from 35 to 45 lbs. of green cocoons; 1 oz. of Japanese grain, reproduced in Italy, yields from 85 to 95 lbs. green cocoons; 1 oz. of Italian green yields about 130 lbs. yellow cocoons; 1 oz. French striped breed (Var) yields about 78 lbs. nankin cocoons; and 1 oz. of Roussillon yielded last year 175 to 190 lbs. yellow (roseate tinted) cocoons; but this was a maximum, and cannot be taken as the average.

Electric Conductivity of Carbon.

"The following simple method of exhibiting the conducting power of carbon was brought to my notice by my friend Mr. W. J. Ward, of the metallurgical laboratory of the Royal School of Mines, as having been shown to him several years since by Dr. von Kobell, of Munich. As I have not found any account of it published, I have ventured to bring it before this society.

"A fragment of the substance to be tested, whether charcoal, coke, anthracite, or other form of carbon, is held between the jaws of a pair of tongs formed by bending a strip of zinc into a horseshoe form, and immersed in a solution of cupric sulphate. If the carbon is a non-conductor, the copper salt is decomposed, and deposit of copper only takes place on the immersed surface of the zinc; but when it possesses a high degree of conductivity, a zinc carbon couple is formed, and deposit of copper takes place on the surface of the carbon as in ordinary electrotyping.

"Of the different forms of carbon experimented upon, the most rapid results have been obtained with some American anthracites, and coals that have been subjected to the action of intruded igneous rocks. The most remarkable of these is an anthracite from Peru, which contains a large amount of sulphur in organic combination, and is found in a nearly vertical position, interstratified in quartzite, in the high plateau of the Andes, about 13,000 feet above the sea level, near Truxillo. It is probably of secondary age, the metamorphism having taken place at the time of the great trachylic outbursts which form the gold and silver bearing rocks of the adjacent mining district. This is coppered by immersion almost as readily as graphite. The anthracite of Pennsylvania possesses the same property, but not in quite such high degree. The heathen coal of South Staffordshire, when altered by the intrusion of the white rock trap, is more slowly coppered; but this is probably due to the resistance interposed by the numerous laminæ of calcite filling the fractures in the mass of the coal, which renders the conductivity less perfect. A specimen of coal from Bengal, altered in the same manner by intrusion of igneous rocks, behaves much in the same way as coke, being coppered directly. This is rather remarkable, as this coal is a very impure one, and contains such a large quantity of water, very intimately combined, probably as a hydrated silicate interspersed through the mass, as to decrepitate explosively when suddenly heated.

"The ordinary Welsh anthracite does not appear to be a conductor by this method; but after having been heated to a full red heat, it conducts electricity freely. The lowest temperature at which this change takes place appears to be somewhere between the melting points of zinc (806° Fah.) and silver (1832° Fah.), as fragments of anthracite packed in a thin clay crucible and plunged into molten zinc were not found to be altered, but were changed when heated in a bath of melted silver. These limits, although considerably wide apart, are interesting as giving a possible clue to the temperature at which anthracite metamorphism of coals has been effected in different districts. Mr. W. C. Roberts has recently shown that the alloys of silver and copper have very definite melting points; it will be possible, therefore, to determine more nearly the lowest temperature necessary to produce the change.

"In the South Wales anthracite district, it is well known that no great amount of disturbance has taken place in the position of the coal seams, while in North America and Peru the change has been accompanied with much more violent action, as evidenced by the greater disturbance of the rocks; and probably a correspondingly higher degree of heat was developed in the mass. The evidence afforded by the coals that have been actually altered by intruded rocks, and must have been highly heated, appears to bear out this view. On the other hand, long continued exposure to a lower temperature might possibly produce the same effect, and further experiments upon this point would be desirable."—*H. Bauerman, F. G. S.*

Paper Car Wheels.

The American Paper Car Wheel Company, of Hudson, N. Y., has specimens of 30, 33, and 42 inches wheels of its manufacture. These wheels have steel tires made with an inside flange and a cast iron hub. On each side of the hub and tire, wrought iron or steel plates 3-16 inch thick are bolted, and the space between the plates is filled with compressed, or rather condensed, paper. This paper is made of straw boards ¼ inch thick, pasted together with paste made of rye flour., and first made into sections about ¼ inch thick. These are subject to a pressure of about 400 tuns for about five hours, and are then dried with hot air. These sections are then pasted together in the same way, so as to get the requisite thickness, about 3¼ inches, and are again pressed and dried. They thus form a disk, which is turned off and the tire forced on with a pressure of about 150 tuns. The plates are then bolted to the inside and outside of the wheel with ¾ inch bolts. An old wheel is exhibited, "one of the first paper car wheels ever made. It has run under a Pullman car 312,900 miles without the tire being turned." One of the wheels is shown with a portion of the plates and paper disk cut away, so as to show the inside structure. One of the paper disks is also exhibited; and if a separate

tire and hub were shown, the exhibit would be complete. The wheels are painted brilliantly red, which might be described as mono-chrome-engineering.

Guanine.

The perfectly white solution of the scales of the bleak (*leuciscus alburnus*), a fish indigenous to the rivers of France, is now used largely for the manufacture of artificial pearls. The solution or guanine is a mucus which lubricates the scales of the fish. It coagulates by heat to a thick, white deposit, and is obtained by carefully scraping the fish over a shallow tub containing fresh water. Care is taken not to scale the back or dorsal part, as these scales are yellow, while the white scales possess the value. The material is received on a horsehair sieve. The first water, mixed with a little blood, is thrown away. The scales are then washed and pressed, when the mucus or essence (guanine) sinks to the bottom of the tub and appears as a very brilliant blue-white oily mass. It takes 40,000 fish to furnish two pounds of the material. The fishermen seal it in tin boxes with ammonia, and in this condition send it to Paris. If a drop of the essence be taken up by a straw and let fall upon water, it floats, giving forth the most brilliant colors. Mere glass bulbs, in shape of pearls, lined with this substance, imitate the real gems with remarkable closeness.

PRACTICAL MECHANISM.

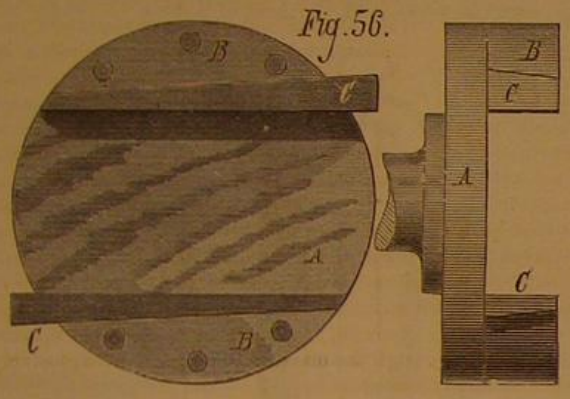
BY JOSHUA ROSE.

SECOND SERIES—Number VIII.

PATTERN MAKING.

Fig. 56 represents a side and face view of a very useful chuck, suitable for holding core boxes while boring them. It is shown attached to one of the metal plates that fit the mandrel of the lathe, and is usually made of hard wood; but for a large sized one, say 15 or more inches in diameter,

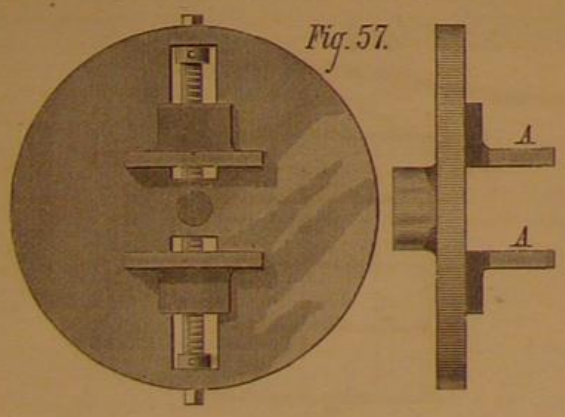
Fig. 56.



the disk portion, A, may be made of pine wood. The two sides, B B, are firmly fixed to the disk, their inner edges being planed at an acute angle to it. The work is held by driving the wedges, C C, and may be truly chucked by them in a comparatively short space of time.

Another very useful chuck is shown in Fig. 57, and it will

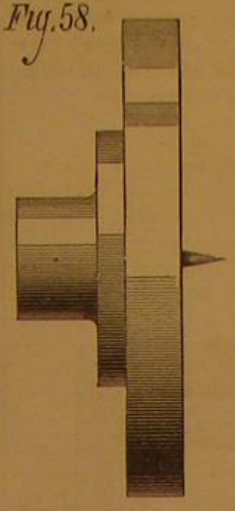
Fig. 57.



answer the same purposes as that shown in Fig. 56. It is, however, made entirely of metal somewhat similar to a machinist's dog chuck, but much lighter. Pieces of wood may be screwed on the jaws at A A, and bored to the curvature of any round piece of wood, an advantage which the chuck shown in Fig. 56 does not possess. Or the jaws may be turned round in their places, so that the faces, A A, will stand outwards, and the wooden pieces screwed thereon may be made to fit a hole. This chuck will be found to save much time over the plan of screwing work to the common face plate. V pieces of wood may be fixed to the jaws, and a piece of work in the rough held by them during the process of facing, boring, and turning the projecting part. The work can then be reversed in the chuck, and similar operations performed on the opposite end; and the work can be taken from the lathe and tried as to either fit or conformation, and, if necessary, restored in a moment to its original position in the chuck, so as to run quite true; but at the same time, for first class work, it is better not to use the Vs on finished surfaces. For holding bits and small work, neat little chucks may be purchased at the hardware stores, and they act similarly to the nipping arrangements applied to boring braces. These chucks can be supplied to either screw on the lathe mandrel; and they will, with a taper shank, fit into the taper hole provided to fit the holes which receive the lathe centers. It is well to have one of each, so as to be able to use one of them in place of the still lathe center, to operate upon work already chucked on the face plate of the lathe.

A simple and very useful chuck still remains to be described, being what is known as the cement chuck, which is made as follows: A disk of hard wood is screwed to a metal plate, where it should remain permanently; but if the face plate cannot be spared, bore a slightly taper hole through the disk, a little smaller than the diameter of the screw of the lathe mandrel, and partly through the disk. Then screw the disk on the mandrel, working the disk backwards and forwards to form a thread in the bore of the disk, and then turn and face it perfectly true. Then bore a small hole in its center, and drive in a piece of soft steel wire, leaving a short length projecting from the face and turn it to a point, as shown in Fig. 58.

Fig. 58.

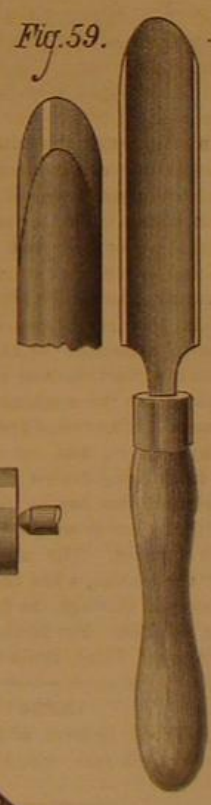


The object of this chuck is to drive thin delicate work, which it would be difficult to screw or clamp by adhesion, and this is accomplished as follows: We first prepare a wax composed of 8 parts of resin to 1 of the best beeswax, melted together, and we stir them well together, and run the mixture into tubes of paper or other suitable molds. To chuck the work, we take a stick of the wax, and press its end against the face of the chuck while the lathe is running, and then place the center of the piece of work on the steel point, applying sufficient pressure to cause the steel point to force its way into the work. Just before the work touches the waxed surface, we throw the lathe belt on to the loose pulley; and the momentum of the lathe, combined with a moderately heavy pressure, will generate, by friction, sufficient heat to melt the wax and cause the work to adhere to the chuck. The work may be detached, when necessary, by inserting behind it a thin wedge or blade.

TURNING TOOLS.

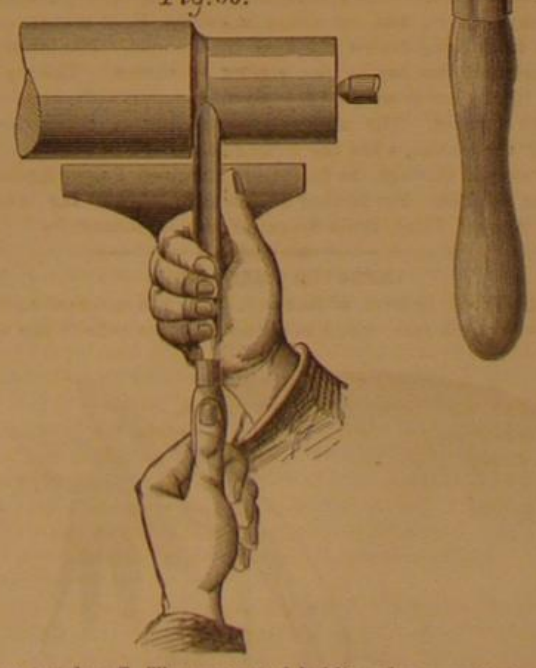
The turning work necessary in making patterns is usually done by hand; although on small and plain work, such as simple boring and facing, slide rest tools may be used to advantage, inasmuch as they will operate quicker than hand tools. Since, however, pattern lathes are not usually provided with slide rests, we shall confine our remarks to hand tools. For roughing out, the turning gouge, shown in Fig. 59, is used. In grinding this gouge, it is necessary to lower the back hand when grinding at and towards the outside corners, so that the cutting edges may be formed, by the junction of two faces, at as acute an angle as those forming the cutting edge in the center of the width of the tool.

Fig. 59.



It is always the custom to reduce the work in the lathe to nearly the required form by this tool, the finishing tools being (with one exception) simply scraping tools, and not, properly speaking, cutting tools; hence it is evidently inadvisable to leave much for

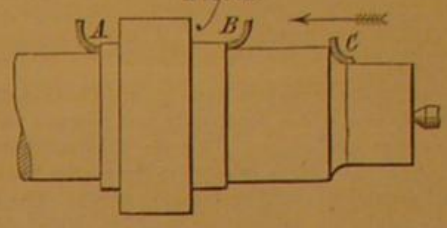
Fig. 60.



them to take off. The manner of holding the gouge is shown in Fig. 60. One hand grasps the handle near the end, while the other grasps the gouge near the cutting point, that is to say, as near as the hand rest will permit. It is sometimes, however, necessary to slightly vary the manner of holding by passing the forefinger of one hand around the hand rest while the gouge is confined between the thumb and forefinger, thus gripping the gouge end to the rest. This is advisable when turning a piece of work that is not completely round, as, for instance, tipping off the teeth of a gear wheel, in which case gripping the gouge to the hand rest will steady it and prevent it from digging into the work. The gouge is shown, in Fig. 60, to be cutting from left to right; it will, however, cut equally well if used from right to left, in which case the position of the hands must be reversed, the left hand gripping the gouge near the cutting edge. In either case, however, the gouge is not held horizontally level, but is tilted to one side, the lower side being the cutting one, otherwise the tool would rip into the work.

Fig. 61 shows the section of the tool and the tilt of the tool when cutting from right to left; while that of the tool, A, shows tilt when cutting from left to right. The reasons for this are as follows: The face of the gouge, on its hollow side and near the cutting edge, receives the strain which is necessary to curl the shaving, that is to say, which is necessary to force it out of the straight line. But if we were to place the gouge in the position shown in Fig. 61, at C, the whole of this strain would be placed upon the gouge, tend-

Fig. 61.



ing to force it forward and into the cut, as denoted by the direction of the arrow; and as a consequence, the gouge would run forward and dig into the work, in spite of all endeavors to prevent it. When, however, the gouge is held in the positions relative to its line of travel to its cut, shown in Fig. 61, at A and B, there is but little tendency for it to run forward, and it can be fed easily to its cut. In addition to its use as a roughing tool, the gouge makes a very efficient finishing tool for hollows, though it is not often employed as such by patternmakers. In this case, however, great care must be taken in controlling its position to the work, as shown in Fig. 61.

Trial of a Weeding Machine.

A trial of a weed eradicator, manufactured by Messrs. Ord and Madison, Darlington, Eng., lately took place under the auspices of the Highland Agricultural Society. The object of the machine is to remove the weeds which grow among corn crops. A drum, about 24 inches in diameter, is placed between two carrying wheels. Three sets of projecting teeth or iron combs run horizontally along the drum. This, when the machine is in operation, revolves by the action of the gearing, the combs at the same time working in and out of the slits, and over and along the top of the crop. Supposing the ground to be soft, the teeth catch the weeds and pull them fairly out of the soil; but should the soil be hard, as was the case at the trial, and thus have a firm grip of the roots of the weeds, the combs tear off the heads, so that they are prevented from seeding, leaving the stem in the soil. As the drum revolves and the teeth are drawn in towards the center, the weeds or their heads come in contact with the circumference of the drum, and, not being pulled in at the slits, are allowed to drop to the ground. The teeth exert little or no action upon the crops, passing between the teeth.

Remedy for Obesity.

According to Dr. Philbert, the waters of Brides in Savoy, which are very similar to those of Carlsbad, are very useful in the treatment of obesity. The purgative salts contained in these waters are sulphate of soda, chloride of sodium, chloride of magnesium, sulphate of magnesia, and sulphate of lime. To increase the effect, from 15 to 80 grains of sulphate of soda are added to each glass of mineral water. The quantity taken daily is ½ quart, divided into three doses, and the purgative effect is produced in two or three days. The course may last from four to six weeks. As an adjuvant to the waters, a vapor bath may be taken every day or every second day. Farinaceous and saccharine articles of food are not allowed, and brandy, liqueurs, and coffee are interdicted; but the quantity of food is not limited, and a moderate amount of wine may be taken without harm. Muscular exercise is considered indispensable, and the mountains in the vicinity of Brides afford every facility for walking, where, in addition, this treatment may be followed by the grape cure.

A College of Cookery.

At last a practical step has been taken towards emancipating the people from the evils of bad cookery. We know of no department in domestic economy which is so sadly in need of reform, especially in the United States. Mr. William Emerson Baker, of the sewing machine firm of Grover & Baker, has given to the Governor of Massachusetts and to four other trustees a farm of 50 acres and $50,000, to form a college of cookery. Cookery is to be taught as an art—which it certainly is—and the pupils are to be instructed in the scientific principles which underlie wholesome cookery. The horrible pies, fried meats, hot bread, and other dyspepsia-generating compounds, together with the inexplicable concoctions produced by the verdant Milesian handmaid, let us hope, are doomed to disappear; and instead, our kitchens are to be tenanted in future by culinary artists able to prepare, palatably and healthfully, the vast variety of food this country affords.

Farming in California.

Some idea to what vast extent farming is carried on in California, and some other Western States, may be formed from the following item in one of our exchanges: "Plowing in unbroken furrows six miles long can be seen in Fargo, California. The teams start in the morning and make one trip across an entire township and back before dinner, and the same in the afternoon, making 24 miles' travel every day." It would seem that the steam plow ought to find a place in such a region.

IMPROVED ADDING PENCIL.

In our issue of October 21, 1875, we published an illustration and description of a then recently patented adding pencil, the device of Messrs. Smith & Potts, of Verdi, Nevada. Our readers may remember that not long afterwards we printed a paragraph containing a request from the above named inventors that the public would withhold further letters, as so great was the interest excited by the very ingenious little device that the proprietors found themselves entirely unable to attend to the innumerable requests for further information and orders which poured in upon them. Nearly 5,000 pencils, we are told, have been sold, and the sale may be traced to that publication—a significant evidence not only of the value of the device but of the advantages of the SCIENTIFIC AMERICAN as a means of placing an invention before the people.

Very recently the inventors have hit upon a plan of simplifying the device, which practically amounts to a remodeling of the entire mechanism. This we illustrate herewith. By referring to the article relative to the earlier invention, the general capabil ties will be found in detail The device in brief is a miniature calculating machine, which does its work with unfailing accuracy and without requiring any thought on the part of the operator other than that involved in turning a disk to make coincidence between a figure and a letter. In shape the apparatus resembles a pencil, and its full size is shown in our engraving. It consists of a cylindrical case, closed above, and to the lower end of which is attached a circular flange, the upper side of which is numbered. Inside the hollow cylinder or case is a solid spirally grooved cylinder, and this carries at its lower end a milled disk which extends outside the flange, and is marked by a series of letters. The lower extremity of the pencil is merely used for pointing. The disposition of flange and disk will be more clearly understood from Fig. 2. In the groove of

Fig. 1

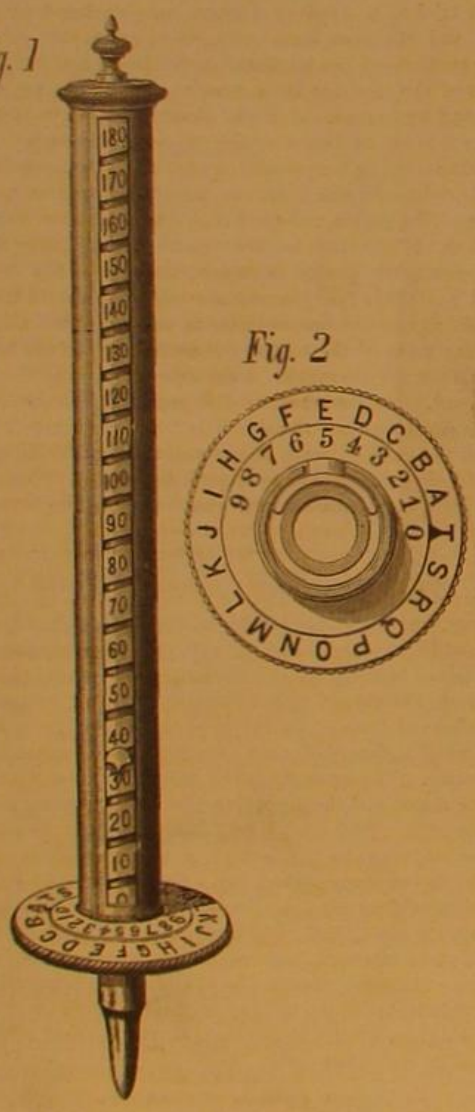


Fig. 2

the solid cylinder, which is numbered, is an index or traveler which projects through the longitudinal slot of the outer case.

Supposing the various parts to be disposed as in Fig. 1, the method of manipulation is as follows: The index, by rotating the inner cylinder, may be caused to travel up or down the slot; as shown, it stands at 30. To add, for example, 5, that number is first sought on the flange, and coinciding with it on the disk appears the letter, F. The disk is then turned by the thumb and finger until said letter F is brought to coincide with the zero mark. This, of course, at the same time rotates the solid inner cylinder so that a distance measured on the groove between the parts marked 30 and 35 travels beneath the index. The latter, therefore, ascends in the slot, and, when the movement is finished, remains pointing at 35.

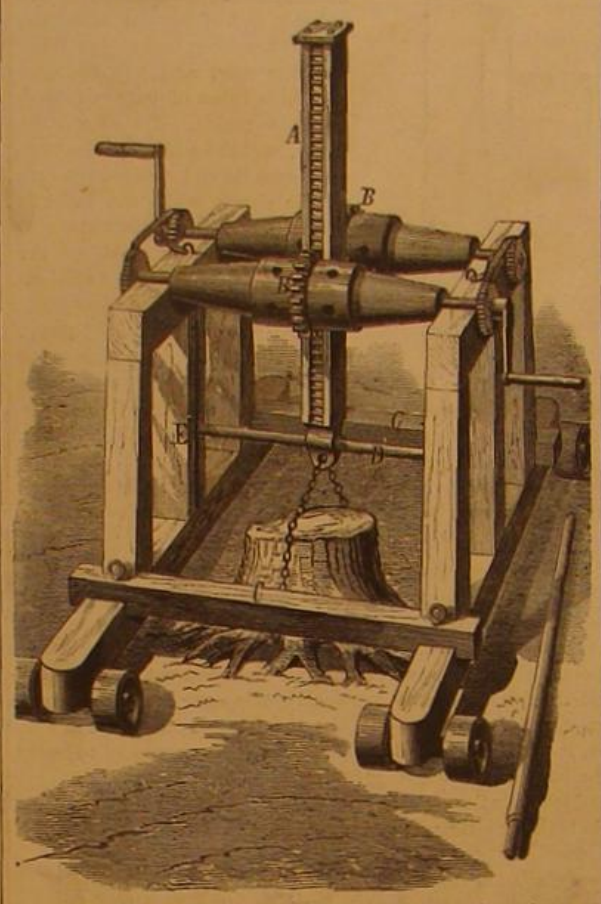
To add another number, the next in a long column, for instance, the letter which happens to corresponds thereto is as before carried around to zero, and this is continued until the column is finished, when the sum is shown by the index.

The advantage of the present over the older device is that the spring, rack, and cog wheel mechanism is abolished, rendering the pencil much cheaper, less complicated, and more reliable. It can be used about as fast as a good accountant can cast up a column of figures mentally; but time is saved from the fact that the first footing is always correct, and hence no second or check process is needed. The pencil can be used after very little practice. Interruption during the computation is no annoyance; and indeed the motion may proceed almost mechanically while the operator is engaged in conversation; or he may stop work in the middle of a column attend to other matters, and resume it after any period of time.

Patented through the Scientific American Patent Agency, April 4, 1876. Patents on improvements pending. The price of the pencil is $5, mailed free. For further information address the Adding Pencil Company, St Louis, Mo.

FICHT'S IMPROVED LIFTING MACHINE.

We illustrate herewith a new lifting apparatus well suited for pulling stumps, raising buildings, or similar heavy work. The power is applied to great advantage, and after the weight is raised it can be moved anywhere by the machine.

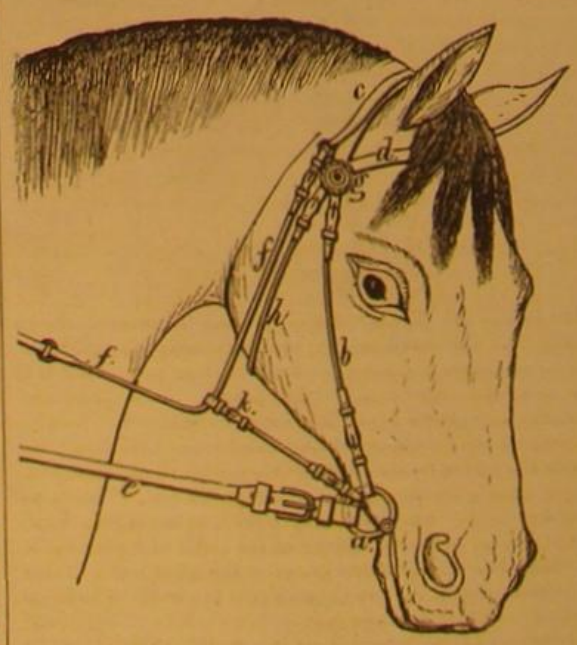


A is the lifting bar which is toothed on opposite sides and disposed between guide ribs, which keep it in gear with a couple of toothed wheels, B. These wheels are arranged on shafts journaled in the top of the supporting frame, which shafts are provided with ratchet and pawl-holding mechanism, and also cranks or levers (one of which is shown at F) for turning them. The frame is composed of two parts made of sills, posts, and beams, each mounted on trucks and detachably connected by cross beams, C, which are fastened by pins, so that the end parts of the frame may be separated to adjust the machine around a stump or other object to be raised. The lower end of the lifting bar has a guide rod, D, through it, and extending to guides, E, to prevent the bar from being drawn sidewise by the load. The latter is attached to the bar by the chains, as shown. The top of the lifting bar is adapted for placing underneath any load to be elevated. The manipulation simply consists in rotating the cranks, when the lifting bar is caused to rise.

Patented through the Scientific American Patent Agency, June 13, 1876. For further information address the inventor, August Ficht, Bella Sylva, Wyoming county, Pa.

IMPROVED CHECK REIN.

Mr. W. U. Selover, of Rahway, N. J., has invented an improved check rein, which is connected at its ends to the up



per part of the headstall, and passes through bit loops that are made of adjustable straps connected with the rings of the bit. By this construction the bit is not drawn forcibly against the upper portions of the horse's mouth. The movement of the head is free and easy, and there is no tendency to protrude the animal's nose, as is often the case when the check rein is drawn too tightly; and the check rein loops, being variable in length, can be adjusted to direct the pull of the check rein in any desired manner, and hence hold the head in the proper position.

The bit, *a*, is of the usual character. The side straps, *b*, head strap, *c*, front strap, *d*, and throat latch, *h*, are of the usual character, and the reins, *e*, are attached to the rings at the end of the bit. The check rein, *f*, is made adjustable in length in the usual manner; but the ends thereof, instead of being attached to the bit rings, are connected at or near the rosette, *g*, of the headstall, and at *k* are loops passing from the bit and around the check rein, so that said check rein may slide through these loops. These loops are, by preference, made as straps that are adjustable in length, and hence the place of intersection of the loops, *k*, with the rein, *f*, may be more or less forward or backward, and at any point the horse's head is free to swing up or down, but it is prevented from moving forward; thereby the animal's head is positioned so as to curve the neck gracefully and prevent him projecting his nose too far forward. The invention was patented February 8, 1876.

GAS WORKS ON THE KITCHEN RANGE.

Here is a device whereby any one may manufacture gas for his house with no more trouble than is taken in setting a clothes boiler on the range or cooking stove. Mr. John S. Thomas, of Maryville, Tenn., has patented the invention (June 13, 1876), through the Scientific American Patent Agency. It consists of a hollow cylindrical retort, A, Fig. 1, made of iron, with an iron cap, C, ground to fit the top. Over this cap there passes a strong iron ball, E, through which there passes a perpendicular screw pressing on the top of the cap, thus holding it firmly to its place. In this retort is to be placed fine or small broken bituminous coal. The retort is made to fit the hole of a stove, or it may be

Fig. 1.

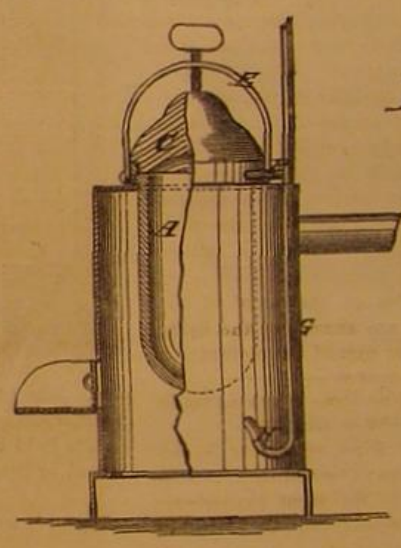
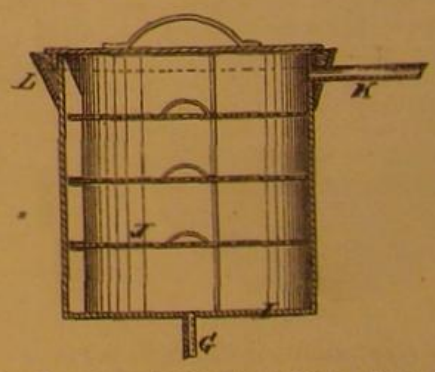


Fig. 2.



used in a furnace made for the purpose. From the retort and near the cap is a pipe, F, extending a short distance intersecting with a perpendicular pipe, G. At the intersection of these two pipes the gas and tar separate, the tar falling below into the tube, which descends below the bottom of the retort, on the outside of the stove, then crooks upward at H, and goes into the stove, fire, or furnace (the accumulation of gas and tar forcing it into the fire, and helping to create the heat necessary to manufacture the gas), or may be conducted elsewhere if desired.

The upper part of the pipe, from the intersection above mentioned, conveys the gas any distance that may be desired to a tin purifier, I, Fig. 2, which is packed alternately between sheets of perforated tin, J, made fast by catches to pieces fastened within, with lime and sawdust, or any material that will purify the gas. At the end from which the gas escapes there is applied a band, L, flaring from the body of the purifier, thus making a channel in which water is to be kept, and a lid, covering the main part of the purifier extending down into the water, prevents the escape of gas. From this purifier extends another pipe running into an ordinary gas reservoir, or it may be direct to a gas burner.

With this apparatus every family can manufacture their own gas, with which they can light their buildings, at the stove on which they cook their meals, in the fire or heater by which they warm themselves, or in the furnace made for the purpose, without any expense except for the apparatus with which it is manufactured, not even losing the heat with which it is made, but rather, on the contrary, utilizing it.

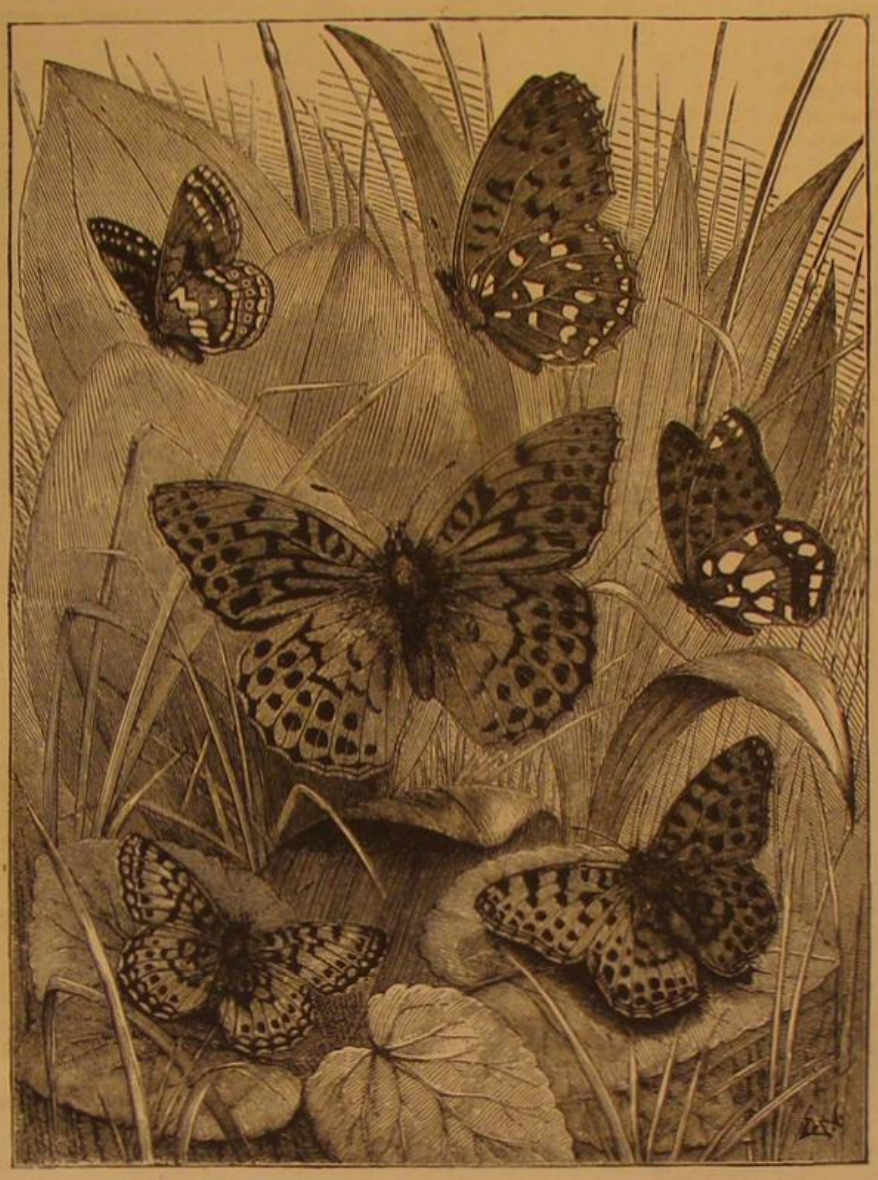
SOME WELL KNOWN BRITISH MOTHS.

Our engraving shows three specimens of moths, which resemble each other somewhat in the marking and color of the wings, but differ in size. The large one in the center is the privet hawk moth (*sphinx Ligustri*) which is nearly as common as the eyed hawk moth; its wings are brown, streaked or rather clouded with darker shades of brown, the hind are of a pinky color, with three black bands across them; the body is marked with brown and black in the center, and the sides marked with pink and black. The caterpillar is green, with seven pink stripes down the sides; the horn is black and green; it feeds on the privet or lilac bushes. The chrysalis is brown, and has a beak in front. The privet hawk moth appears about midsummer, and frequents woods and lanes. Sugaring is a good way to obtain this moth.

At the lower part of the picture on the left hand is seen the bedstraw hawk moth (*deiliphila Galii*), which is only locally known, but in the south of England it is by no means uncommon. The fore wings are brown, with a white line across the middle; the hind wings are pinky white, with a black margin. The thorax and body are of a uni form brown, with the exception of a few white lines on the sides of the thorax and on the end of the body. The caterpillar is green, with a pale line down the back, and a row of pale spots along the sides; the horn is a rusty red; it feeds on the bedstraw. The chrysalis is brown. The perfect insect appears in June or July; it fre quents lanes, and the downs near sea coasts.

The smallest of the three specimens, on the left hand in the engraving, is the small elephant hawk moth (*chærocampa porcellus*). The forewings are of a greenish shade, banded with pink; the hind wings are pink, but black at the base. The caterpillar is brown, with two conspicuous eye-like marks on the fourth segment; the first three segments narrow suddenly; this, together with the eye-like marks, give the caterpillar the appearance of a hog, hence the name *chærocampa*, or hog caterpillar. The caterpillar feeds on the willow herb or bedstraw. The perfect insect appears in June, and frequents lanes and the sides of brooks, especially where the willow herb is plentiful.

The reverse sides of the wings of the three specimens are shown by the flying moths in the upper part of the picture.



BRITISH MOTHS.

A Great Gold Mine that Runs as High as $100,000 to the Tun.

The American mine owned by Hiram Hitchcock, and superintended by Professor J. Alden Smith, is the most extensively worked in Sunshine district, Col. Ter., and for quantity and richness of ore one of the most wonderful mines in the world. The *Courier* says it is turning out large quantities every month, that sell to the smelters at from $100 to $6,000 per tun, and has paid large dividends constantly from the very commencement. The first class ore, by the tun, assays $5,000 to $12,000; the second class, about $800; and the third class, $200. Pieces can be picked from any of the first class sacks that will yield from $1 to $3.50 per ounce, or at the rate of $30,000 to $100,000 per tun. The quantity and quality of the ore has gradually but constantly increased from the surface, and now, at the depth of 220 feet, the vein is fully twice as large as it was at the surface, and the ore is far richer. From what is already known of this remarkable vein few will dispute the assertion that no mine thus far discovered has produced such extraordinary yields as the American at Sunshine. Its character under development proves it to be a true fissure, strong and exceedingly rich in precious metal. Its net returns at this time, and since the first ten feet of opening had been accomplished, have been and are greater than those of any other deposit of gold-bearing mineral in the country. Much of the crevice matter is worth from $10 to $40 per pound, and selected specimens have returned at the rate of $300 per tun. The Chicago *Inter-Ocean*, in speaking of this district, says: "But the latest mining sensation is the recent development in the Sunshine district of Boulder county. Tellurium has heretofore been found in only three localities in the world. It carries the richest deposit of gold. This species of ore is found in this district. Its yield is well nigh fabulous. The entire locality develops telluride ore, but among the discoveries the American mine has been worked to a demonstrable extent. The shaft is only down 220 feet, worked by a hoisting engine. The vein is 2 feet thick, of which a streak of 7 or 8 inches is pay ore. The first class of this is shipped to the Omaha Smelting Works, where the net sales average $5,050 per tun. To bring this price the ore has to assay $6,000 per tun, from which are deducted the freight charges, and $100 per tun for treatment; 90 per cent of the balance is paid to the owner of the ore. The getting out, sorting, and handling of the ore cost, when laid down in Omaha, $100 per month, freight inclusive. The inme employs 30 men, at a cost of $3,000 per month, who produce 20 tuns of milling ore in that length of time. Of this ore there is shipped, as first class, to Omaha, 2 to 4 tuns per month, and the balance to Professor Hill's works, at Black Hawk, as second class. The net profit of the mine is $40,000 per month. The present owners of the mine bought it, when partially developed, for $17,000. It cannot now be purchased at any price within reason.—*Miner's Journal.*

Brussels International Exhibition, 1876.

The Brussels International Exhibition, which was opened on June 26, is exclusively devoted to means or appliances for promoting health and public safety. It will be followed by a Congress, where all questions interesting to these subjects will be discussed, and, so far as possible, decided. A leading feature of this enterprise is that it has been started and sustained solely by private action. It received, however from its commencement the encouragement of King Leopold, who became a patron of this useful undertaking, and of his brother the Count de Flandres, who was elected the honorary President of the Central Committee.

The Exhibition was opened by the King of the Belgians with the usual solemnity. The exhibits are divided into ten classes, as follows: 1. Saving of life from fire; 2. Apparatus and engines of all kinds acting on water and in water, to diminish danger, prevent accidents, and give assistance; 3. Means of preventing accidents resulting from traffic on roads, railways, and tramways; 4. Means of assistance in time of war; 5. Public health; 6. Sanitary measures and means of saving life applied to industry; 7. Domestic and private hygiene; 8. Medicine, surgery, and pharmacy, in relation to the preceding classes; 9. Institutions for improving the condition of the working classes; and 10. Hygiene and protection of life as applied to agriculture. Each of these classes is subdivided into a certain number of sections.

The Russian department contains amongst other things a very complete collection o analyzed foods, such as are seen at South Kensington, showing their various qualities as human food. There are likewise a great number of plans and drawings showing various arrangements for schools, houses, public baths, etc., while the military staff has also sent a number of ambulance wagons, and surgical and medical appliances for use in war time.

Next comes the Belgian department. Here the Minister of Public Works exhibits reduced models of various life and tug boats, and other objects of the same kind, together with railway appliances. Amongst these we must notice an accident wagon, containing all that is necessary or useful in case of an accident occurring on the line, either by collision, fire, or by any other cause. This wagon is very good both in design and construction, and affords credit to M. Docteur, who has designed it and superintended its construction. The Grand Central Railway exhibits also some objects worthy of notice, among which are two carriages fitted with Maquet's *garde de corps*, for preventing guards from falling down when running along the train; this is rather of local interest, owing to the Belgian mode of collecting the tickets. A plan for warming the trains is shown by M. E. Belleroche engineer of the same company.

M. Waroqué, the President of the Exhibition, and one of the richest coal owners in Belgium, exhibits a working model on a large scale of an apparatus called *Waroquiere*, from his own name, intended to raise and lower the workmen in the coal pits. There is also a direct-acting blowing or rather exhausting engine constructed by the *Société Anonyme des Atêliers de la Meuse*, under the direction of M. A. Stévart. This powerful engine, which has two cylinders of 6 feet diameter, is intended for the ventilation of coal mines, principally those troubled with noxious gases.

France comes next; but wonderful to say, this great country offers but few interesting exhibits, the greatest space being occupied by culinary and pharmaceutical articles, and those relating to dentistry. Near the French Department we find Sweden, Norway, and Denmark, and these sections, if they are not the most extensive, are certainly not in the least interesting of Exhibition. They relate principally to school buildings and furniture and houses for workmen.

Germany covers a great surface, and the exhibits are well arranged and useful. They include a good quantity of pumps and other machinery for saving life from fire. Plans and drawings showing the mode in which large public works have been conducted are numerous and very interesting, and the varied specimens in each of all the classes of the catalogue make this section specially worthy of notice.

Messrs. Siemens and Halske, the well known electrician engineers of Berlin, exhibit their numerous appliances for working railways under the block system, also their dynamo-electric machine with accessories. The ambulance wagons and cars, the medi cal and sanitary appliances to help wounded men in time of war, and to help them in all possible ways, are also very numerous and interesting.

In the Austrian department we find also a very complete assortment of ambulance wagons and cars, etc., even a complete train of eight carriages, the property of the Sovereign Order of the Knights of Malta. There is also a pretty good collection of maps showing the general arrangement of light-houses round the Austrian coasts.

Holland has also a good but small exhibition. In this naturally the greater portion is devoted to the means of protection against water. We must mention, however, specially the organization of the fire service of the city of Amsterdam, which is perhaps the most complete on the continent, all the stations being connected by a regular net of electric communication, which can be worked by the public as soon as a fire is perceived.

Italy has some curious exhibits, among which are several furnaces proposed for cre mation purposes. As a specimen of the merits of his *modus operandi*, one enterprising inventor shows a bottle containing a human body reduced to a weight of about 2 lbs.

At a right angle to this gallery is the British department. It covers a surface about equal to that of Belgium, and the exhibits are numerous and well chosen in all the different classses above mentioned. We shall briefly name *en passant* some of the exhibits most remarkable for their utility or their workmanship. Messrs. Saxby and Farmer have a splendid show, containing their various and well known appliances for railway signals, crossings, etc. The Brockelbank Syndicate demonstrate by a working model their system of wagon couplings, which attracts the attention of the public. The exhibit of the London committee for the second class is the most complete of the Exhibition in all respects. The Westinghouse Continuous Brake Company has only a drawing, illustrating the application of their system to an American and English train; but what is still better than a working model, they can show two trains in action on the State Railway lines, one which has now been running for three years on the Belgian railways, and the other fitted on their new automatic principle. —*Engineering.*

Steam Power for Street Cars.

Two separate trials were lately made in Edinburgh of Gran tham's patent tramway car, propelled by Shand, Mason, & Co.'s patent steam engine, with tubular boiler. The trials took place on the tramway rails of the Woodside Ferry and Hoylake Company. The car runs on a bogie with four wheels, the other end of the machine resting on two wheels. The latter being small, an acute curve is taken with facility. On a level part of the line the speed attained was not less than 14 miles per hour. The car can be stopped as suddenly as one drawn by horses. It is claimed for the engine referred to that it gives 12 horse power by a consumption of ¼ cwt. of common gas coke per hour, or the work of 12 horses for 10 hours, at the cost of 5 cwt. of common gas coke, or less than $1.25. Out of fifty or sixty horses met by the car four of them shied on its approach. A small quantity of smoke was emitted from the funnel when the car stopped, and some when the steam passed through the safety valve.

The Excavations at Olympia.

The excavations which have been going on at Olympia, under care of the German government, are to be resumed in September. Many enteresting discoveries have been made in uncovering the ruins of the temple of Zeus, although has been only partially accomplished. It is inferred that

the temple was destroyed by earthquakes, since whole ranges of columns have been overthrown together. These have been preserved from spoliation and decay by being covered with sand and clay; and the sanguine explorers almost think that the materials exist for rebuilding the façades. The bases of most of the columns, and frusta of some, remain *in situ*, as do also a portion of the pedestal of the statue of Zeus, some portions of the walls, and the bases of two altars in the aisles. The mosaic pavement, discovered by the French in 1829, has been re-examined, and covered again with sand to preserve it till work is resumed in the fall, when careful drawings will be made of it. Only the nave (so called) of the temple was paved with marble, the aisles being floored with stucco. A raised platform of about thirty by forty-five feet has been discovered in front of the eastern façade. It is encumbered by fallen columns, and has not been thoroughly examined. The statements of Pausanias concerning the dimensions of the temple agree with the measurement of the explorers, which prove that his were taken at the base of the lowest step on which the building stands. Two sculptured metopes have been found, one very well preserved and the other very ill. The Greek government, which takes great interest in the explorations, has stationed a detachment of troops at Olympia, and put the magazines under seal till the work shall be resumed.—*American Architect & Building News.*

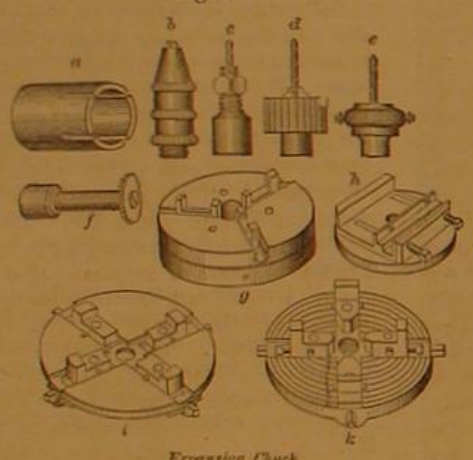
CHUCKS, FORMS OF IRON, AND LUBRICATORS.

Our extract from Knight's "New Mechanical Dictionary,"* for this week, includes an interesting series of illustrations of useful devices and forms of metal. The latter embody a very large number of sections of girders, beams, and other objects of iron, and the engravings will doubtless be found of utility for reference, in determining the selection of any especial shape desired for a particular purpose. Of

CHUCKS,

several improved forms are represented in Figs. 1 and 2. An expansion or elastic chuck, *a*, having a certain range of capacity, may be formed by giving a quadrifid cleft to the end of a cylindrical tube, whose other end screws on to the

Fig. 1.

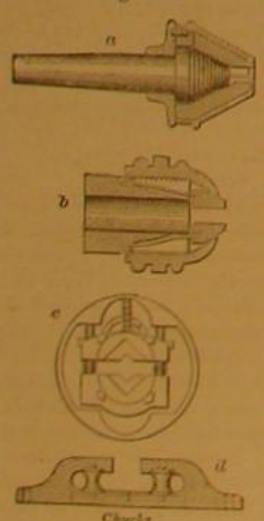


Expansion Chuck.

threaded mandrel of the lathe head. The object to be turned is thrust into the chuck, expanding the quadripartite socket. *b* is Beach's patent drill chuck. *c*, center drill chuck. *d* Warwick chuck. *e*, Morse's adjustable chuck. A circular saw of small diameter may be mounted on a lathe chuck, *f*, which has an axial tenon to fit the hole in the saw, and a central screw or nut to fix the same. *g* is a scroll chuck with three radially adjustable dogs. *h* is a planer chuck. *i* is a screw chuck. *k* is an independent jaw chuck.

Fig. 2 shows three forms of lathe chucks having jaws to grasp the tool or the work, as the case may be. In *a* the stock of the chuck terminates in a conical, threaded head, which opens or closes the jaws, which are threaded, and slide in grooves in the conical shell. The nut in *b* has a conical opening in the end which operates against the inclined backs of the jaws, to clamp them upon the drill; when relieved they are expanded by springs. The chuck, *c*, belongs to that class which is constructed with screws for the purpose of operating the jaws. It is provided with a double screw, the pitch of one being just half that of the other, to operate the jaws simultaneously in opposite directions, so that they will approach or recede from the center at equal speed, thereby forming a self-centering mechanism. *d* is an entirely different device though having a similar name. It is a warping chuck, in which hawsers or ropes run. Friction rollers prevent the wearing of the rope. It is used on the rail or other portion of a ship's side.

Fig. 2.

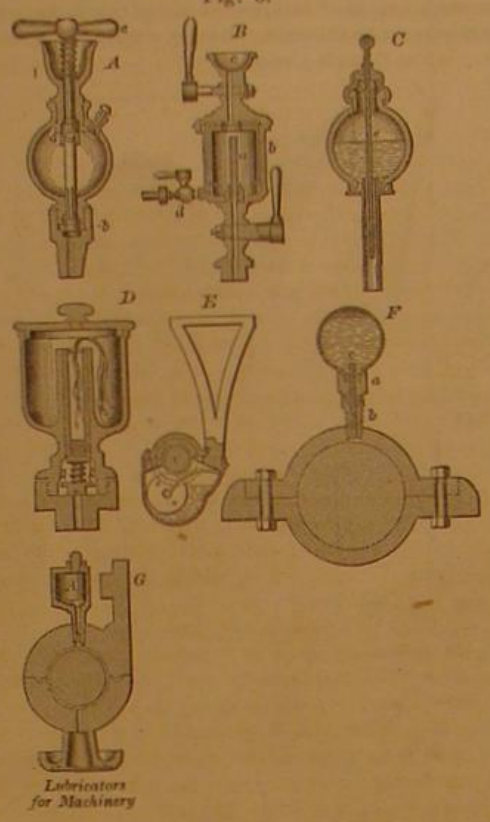


Chucks.

LUBRICATORS,

designed for supplying oil or grease to rubbing surfaces in order to diminish friction, are represented in Figs. 3 and 4. In A, Fig. 3, the two valves, *a b*, are connected by a rod. By turning the handle, *e*, in one direction, the valve, *a*, is depressed by means of a pin working on an inclined plane, and admits oil to the reservoir. A reverse motion opens the valve, *b*, furnished with a similar contrivance, permitting the oil to flow from the reservoir. The valve, *a*, is kept to its seat by a spiral spring on the rod. In B, steam is admitted through the pipe, *a*, to the oil chamber, *b*, forcing out the lubricating material through an opening to the desired point. The supply of oil from the cup, *c*, is regulated by a cock, and a cock, *d*, at the side of the oil chamber permits accumulating water of condensation to be drawn off. In C, the central tube, *c*, is open, and, when the oil sinks below its lower end, air is admitted through it and the annular passage

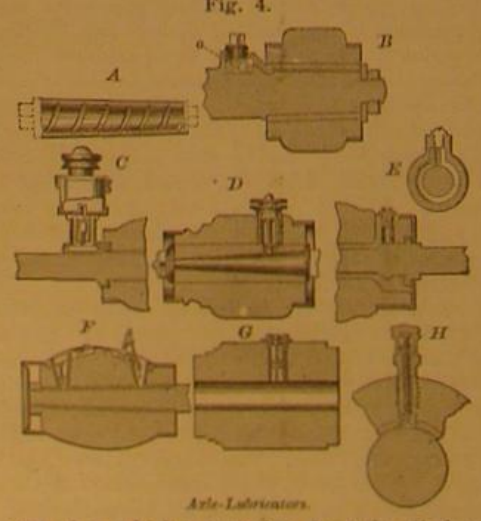
Fig. 3.



Lubricators for Machinery

to the reservoir above, and allows an equivalent amount of oil to descend. The vertical adjustment of the tube regulates the flow by determining the hight of the column of oil resting upon the journal. In D the oil is conducted from the annular reservoir by a wick of fibrous material into the tubular valve stem. This stem has radial holes at its lower end for the discharge of oil, and wire gauze to arrest impurities. Between the upper and lower valve is a spiral spring. When the engine is running, the valves are closed by steam and spring pressure; when stopped, the upper valve is closed by the spring, and when running without steam both valves are sucked open and the oil flows. E is designed for shafting. A pivoted disk in a cup below the lower journal box is revolved by contact with the under side of the shaft, *c*, and carries up oil to lubricate the latter. F has a transparent reservoir with metallic socket, *a*, screwing into the seat, *b*, fitted to the cap of the journal box. Between this and the journal is a slight vacuity, from which air is admitted through the tube, *c*, allowing a greater or less quantity of oil to flow in proportion as the journal turns more or less rapidly. When at rest the flow ceases. The flow of oil from the cup, A, in G, is regulated by an adjustable screw plug. The bearing has ducts for conveying surplus oil from the upper part of the shaft toward the center, and at its lower part is a closed chamber forming a drip cup. In Diller's (A, Fig. 4), a spiral groove is formed around the inner surface of the box, and leads the grease to all parts of the spindle, while the integrity of the bearing surface of the box is not materially interfered with. The reservoir, *a*, in B, is closed

Fig. 4.



Axle-Lubricators.

by a screw plug, which is turned to force the oil through a duct leading to a groove in the upper part of the spindle. The groove tapers toward the outer end, so as to distribute the oil equally. In C a lantern is attached to the axle of the carriage just inside of the butting ring. The oil reservoir, besides furnishing supply to the wick of the lantern, also supplies oil through a duct to the bearing surfaces. In D a tube passes radially through the hub, its lower end opening into the interior space of the box. The oil reservoir is covered by a screw cap. The inner end of the tube is closed by a valve whose stem is attached to the cap. By turning the screw cap the valve is opened or closed, and the oil is allowed to flow, or is cut off. E has an oil chamber made in the box, which communicates with the bearing surfaces. The reservoir is closed by a screw plug, and the oil passes gradually to the spindle without special attention. In F there are one or more conical openings in the hub, each closed by a spring lid to which a rod and sponge are attached, extending to the axle. The sponge is charged with oil on opening the lid. This is kept shut by the spring when the wheel is in motion. G has an oil cylinder, having a piston on a screw rod which works through the cylinder cap, inserted in the hub. Turning the head of the rod pushes the piston down, forcing the lubricant upon the axle spindle. The piston is kept from rotating with the screw cap by a groove in its edge, into which a feather on the inside of the chamber fits. *In H* the depression of the spring valve allows oil to flow from the chamber to the spindle of the axle.

THE FORMS OF IRON

are simply sections, as already stated, and are illustrated in

Fig. 5.

Angle, Bar, Girder, and Rail Irons

Fig. 6.

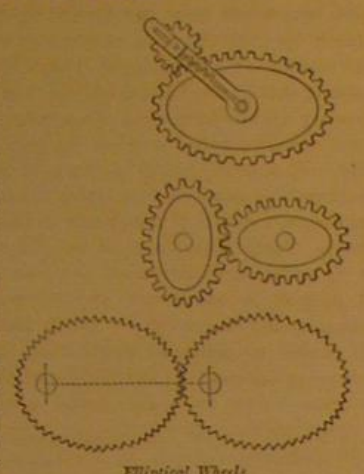
Angle, Bar, Girder, and Rail Irons.

Figs. 5 and 6. The shapes are already shown and need no explanation.

*Published in numbers by Messrs. Hurd & Houghton, New York city.

In Fig. 7

ELLIPTICAL WHEELS



Elliptical Wheels.

are represented. These are used where motion of varying speed is required, and the variation is determined by the relation between the lengths of the major and minor axles of the ellipses. In the upper figure variable rotary motion is produced by uniform rotary motion. The small spur pinion works in a slot cut in the bar, which turns loosely upon the shaft of the elliptical gear. The pinion is kept to its engagement by a spring on the shaft. The slot in the bar allows for the variation of length of radius of the gear.

THE INDUSTRIES AND RESOURCES OF JAPAN.

Japanese manufactures are of great interest to foreigners, primarily in consequence of the raw materials (often unknown in other countries) of which they are made, and secondly on account of the various processes used in their production, processes invented in the long course of patient manual labor, which left to each artisan a free field for his exertions to simplify his work or to produce some new and original object.

With reference to the social condition of industry, it should be stated that there are but very few workshops, of any size or importance, giving employment to more than 30 or 40 persons, and that in most places the manufacturing is done on a small scale. Heavy machinery, with the exception of water wheels, is not used; but the hand tools are in general very well adapted for their purposes; and in several branches of industry, such as, for instance, in fan making, in the manufacture of porcelain, etc., the division of labor is carried on to a great extent. Of later years not only the government, but also the private people, have made great efforts to create larger industrial establishments. Several paper mills have been erected in Tokio, Kiyoto, and Osaka; cotton mills, silk-reeling establishments, with steam or water power, are to be found in different places; a glass furnace has been built in Tokio; sulphuric acid works in Osaka; soap manufactories are at work in Tokio and other places. The streets of Yokohama and of a great part of Tokio are lighted by gas made of the coal mined in Milike, province of Chikuzen; several machine shops and gun manufactories have been established by the government in Tokio, Osaka, Nagasaki, and the arsenal of Yokoska is very completely organized for the purpose of shipbuilding. At the same time, more liberty has been conceded to trade in general, and the old restrictions have been abolished without producing any of those perturbations which have so frequently taken place in Europe in consequence of reforms effected in connection with the social condition of industry.

To these remarks of general character we now extract some special notes concerning the various industries of the country, from the official Japanese Centennial catalogue, limiting our observations either to some characteristic features of a technical kind, or else only pointing out the peculiar nature of the raw materials used in the manufacture of the articles exhibited.

CHEMICALS.

Salt is used in large quantities for the ordinary food, and the preservation of fish and vegetables. It is exclusively produced from sea water by solar evaporation in large salt gardens, composed of a series of fields, the soil of which has been hardened and afterwards covered with a layer of sand. The clean sea water, flowing in through a perfect network of small ditches, is sprinkled over the fields by the workmen, the operation being repeated three times at intervals of a few hours. The sand is then raked together and carried for lixiviation to the filters, which consist of small square wood tanks, 4 by 4 inches, having a bottom of bamboo, covered with straw and mattings. The concentrated lye running out from these filters is first stored in covered wells, and then brought to the evaporating pans through wooden pipes. These pans are not always of the same construction. In some places they consist of low vaults, built of large pieces of slate, covered with gravel and mud, so as to fill up the interstices, and to form the bottom of the pan, which is surrounded by a low mud wall. This vault has an opening on one side for the insertion of fuel, and another on the other side leading into the flue

In other places, a very curious kind of a pan is used, which is constructed in the following manner: A low wall is built, enclosing a space of 13 by 9 inches, the bottom forming a kind of prismatical depression, 3 inches deep in the center. An ash pit, 3 feet deep, is then excavated, starting from the front wall, and extending about 4 inches into this depression at its deepest place; it communicates with the outside by means of a channel, sloping upwards, and passing underneath the front wall. The ash pit is covered by a clay vault, with holes in its sides, so as to establish a communication between the ash pit and the hollow space under the pan. This vault is used as a grate, the fuel (brown coal and small wood) being inserted through a door in the front wall. The air draft necessary for burning the fuel enters partly by the fire door, partly through the ash pit, and the openings left in the vaulted grate. Through these same openings the ashes and cinders are from time to time pushed down into ash pit, for which purpose small openings are left in the side wall of the furnace, through which the rakes may be introduced. A passage in the back wall, supporting the pan, leads off the results of combustion and the hot air into a flue gradually sloping upwards, and ending in a short vertical chimney. At the lower part, some iron kettles are placed in the flue for the purpose of heating lye before it is ladled into the evaporating pans. With reference to the pan, it is made in a way which requires a great deal of skill and practice. In the first place beams, reaching from one side to the other, are laid upon the top of the furnace walls, and are covered with wooden boards, forming a temporary floor. Two or three feet above this floor a strong horizontal network of wooden poles sustain a number of straw ropes, with iron hooks hanging down, and of such length that the hooks nearly touch the wooden floor. The floor is thereupon covered with a mixture of clay and small stones, 4 to 5 inches thick, the workmen being careful to incrustate the iron hooks into this material. It is allowed to dry gradually; and when considered sufficiently hardened, the wooden beams and flooring are removed with the necessary precautions. The bottom of the pan remains suspended by the ropes. The open spaces left all around, between the bottom and the top of the furnace walls, are then filled up, and the border of the pan, 9 or 10 inches high, is made of a similar mixture. It is said that this extraordinary construction lasts 40 to 56 days when well made, and that it can be filled 16 times in 24 hours, with an average of 500 quarts of concentrated lye at each filling. The salt, when removed from the pan, is placed in baskets, so as to allow the adhering lye and part of the deliquescent impurities to drip off; afterwards it is spread out with a layer of sand underneath, in order to dry. The purity of the salt, which differs in quality, depends upon this last treatment.

OILS, SOAPS, ETC.

The oil ordinarily used in Japanese households is the rapeseed oil, produced from the seeds by heating, crushing, and finally pressing them with a kind of roughly made wedge press; in short, it is prepared by a series of operations similar in principle to the European processes. The lamps are merely flat saucers, and the wicks consist of two or three pieces of the white and soft pith of the *juncus effusus*, which are laid into the saucer, and lighted by the end projecting above the edge of the vessel.

But the most important article for illuminating purposes is the candle made of vegetable wax, which is mostly composed of palmitine. It is produced from the fruit of several trees belonging to the genus *rhus*, among which the *rhus succedanea* is the most important, and is grown among vegetables, more or less extensively, almost everywhere in Japan, especially in the western provinces, from the south northwards to the 35th degree. The lacquer tree-*rhus vernicifera*, also yields wax, and differs in appearance but little from the wax tree; its geographical limit extends further northwards, being at the 38th degree. Finally, the *rhus sylvestris*, or wild wax tree, should be mentioned. The cultivated wax tree was originally imported from the Loo-choo islands; but the growers of the tree now distinguish seven different varieties. The berries, of the size of a small pea, and united in bunches, contain the wax between the kernel and the outer skin; they are crushed, winnowed, steamed, placed in hemp cloth bags, steamed again, and afterwards pressed in a wooden wedge press, all by hand. In order to facilitate the flow of the wax, a small percentage of *pe no abura* (oil from *perilla ocimoides*) is added. The raw product, of a greenish color, is made into square cakes, and reduced to small scraps by means of a kind of planing tool, then washed and bleached by the sun and air, whereupon it assumes a pure white color. In ordinary candlemaking the unbleached wax is used, and the manufacturing is done by repeated dipping and rolling on the flat of the hand, in order to smooth and harden the successive coatings. The wicks are made by rolling a narrow strip of Japanese paper in a spiral line around the upper part of a pointed stick, and twisting it at the upper end, so as to prevent its getting loose. Two or three strings of the pith of *juncus effusus* are then rolled around this paper, in close spiral lines, and fastened with a few fibers of silk waste, so that the wicks can be taken off from the stick, and sold in bundles to the candle maker. The latter places the wicks again on sticks, takes half a dozen of them in his right hand, dips the wicks into the melted wax, and rolls them upon the palm of the left hand, repeating these operations till the candles have grown to the proper size For the outside coating, occasionally white wax is used. These candles are made of all dimensions; for ceremonies and similar occasions candles of bleached wax are used, of a fanciful shape and painted with bright colors. The art of candle making is said to have been introduced from Loo Choo, towards the end of the 16th century. Before this time pieces of resinous wood or paper dipped in oil were used.

Another tree yielding a kind of vegetable tallow is the *cinnamomum pecundulatum*. This, however, is seldom cultivated, as, in consequence of its being an evergreen plant, it would cast too much shadow on the other plants cultivated underneath.

An insect, producing a kind of wax very much like or perhaps identical with the Chinese *pela*, lives upon the *ligustrum Ibota*. The insects, in clustering round the thin branches, form by their secretions lumps of a slightly transparent white wax, of a crystalline construction and a very high melting point

A very fine oil is extracted from the seeds of a certain species of camelia, and, either flavored or unflavored, is used for the hair or for pomades, which consist of a mixture of camelia oil and vegetable wax.

PAINTS, PIGMENTS, VARNISHES, ETC.

The most interesting product appertaining to this class is undoubtedly the Japanese lacquer (*urushi*), celebrated all over the world for its excellent quality and great beauty This valuable article is almost entirely a product of Nature and requires but a few mechanical operations to be ready for use. It consists merely of the sap of the *rhus vernicifera*, which is cultivated especially for the production of lacquer, chiefly between the 33° and 37° of N. latitude. The trees when 5 years old are regularly tapped from the end of May until the end of October, incisions being made in the bark, extending about one quarter of the trunk's circumference, and just deep enough to reach the wood. On the incision being made, clear sap flows out, mingled with a very white milky substance, which darkens very soon when exposed to the air, and gradually assumes a dark brown and almost black color. At first these incisions are made at about 14·04 inches distance one from another, on alternate sides of the trunk, and the lacquer is taken off with an iron spatula as soon as it has filled the incisions. After an interval of three or four days new incisions are made, close above and below the former cuttings. Proceeding in this manner until the end of the season, the whole tree becomes covered with incisions, and has to be cut down. The branches are lopped off, soaked in water, and also tapped, by means of incisions made in a spiral line. The lacquer taken from the branches becomes very hard, and is therefore mostly used for priming; its name is *seshime urushi*. In the more northerly part of Japan, where the lacquer tree is cultivated with the additional view of producing wax, the tapping is done on a small scale only, so that the tree need not be cut down, but may yield lacquer and wax for a number of years.

The quality of the crude lacquer (*ki-no-urushi*) depends upon the season in which it has been tapped, and also upon the circumstances of climate and soil, as well as on the care bestowed on the cultivation of the tree. The raw produce is a viscous liquid of a dirty gray color, always covered with a dark brown skin where it comes into contact with the air, and mixed with particles of the bark of the tree and other accidental impurities. Having been placed in small wooden tubs lined with paper, it is allowed to settle gradually; the produce separates into a thinner and finer quality in the upper half, and a thicker and less good quality which settles in the lower half, of the tub. Both are separated by decanting, and are strained through cotton cloth. The superior quality of lacquer is stirred in the open air in order to allow a certain excess of water to evaporate, after which process it assumes a brilliant dark brown or nearly black color; in thin layers it appears transparent, with a brown color similar to that of shellac. The further operations which the lacquer undergoes before being ready for use are generally effected by the workman himself before using it; they consist of mixing it with powdered snbstances, with a view of either hardening or coloring it, and of straining the pure lacquer, or the mixture, through a peculiar long-fibered paper called *yashino-gami*, made for this purpose. The *shunkei urushi*, a kind of lacquer which has to undergo no grinding or polishing, and which is supposed to acquire sufficient brilliancy by mere hardening, is made by mixing the pure lacquer with a small quantity of the *ye-no abura* mentioned above. This lacquer is used in a manner similar to the foreign shellac or copal varnishes for furniture, upon which it forms a brilliant transparent coating of a yellowish tint, through which the veins of the wood remain visible.

A most interesting operation is that by which the celebrated black laquer (*roiro-urushi*) is produced. This is effected without the addition of any solid particles, such as lampblack or similar substances, but merely by stirring the crude lacquer for one or two days in the open air, whereupon it assumes a very dark brown color. Towards the end of the operation a small quantity of water, which has been allowed to stand for a few days mingled with iron filings, or a gall nut infusion darkened by the addition of iron is added, and the whole stirred again until part of the water has evaporated, whereupon the lacquer acquires a proper consistence and color. The addition of this water is said to be absolutely necessary for producing the highest brilliancy and darkness of the lacquer. The operation as described above is indispensable; but there are a few unimportant modifications, since the manufacturers sometimes add a solution of gamboge or a decoction of the yellow fruits of *gardenia florida*, or other liquid dyestuffs, for the purpose of improving or modifying the color of the varnish.

Among the peculiar properties of lacquer it may be mentioned that it is rather poisonous, and often produces eruptions on the skin, or swollen faces, or headaches, etc.; however, the effects are not the same upon all persons; most people get accustomed to it, others are not affected at all by it. The manipulations of coating and painting with lacquer will be described in another article.

Japanese writing inks are very much like Chinese, and manufactured in a similar, though perhaps not quite identical, way. The body of the ink is soot, obtained from pine-wood or rosin, and lampblack from sesasum oil for the finest sort. This is mixed with liquid glue made of oxskin. This operation is effected in a large round copper bowl, formed by two spherical calottes placed one inch apart, so that the space between can be filled up with hot water to prevent the glue from hardening during the time it is mixed by hand

with the lampblack. The cakes are formed in wooden molds and dried between paper and ashes. Camphor, or a peculiar mixture of scents which comes from China, and a small quantity of carthamine (the red coloring substance of safflower) are added to the best kinds for improving the color as well as for scenting the ink. There is a great difference both in price as well as in quality of the various kinds of ink, the finest article being rather costly. The most renowned manufactory is in Nara, the old capital of Japan, in the province of Yamato.

[For the Scientific American.]

THE OCEANIC CIRCULATION CONTROVERSY.

The question as to whether the circulation of the ocean is due to winds or to gravitation is one that is now widely and warmly discussed. Most of this contention seems to collect around two men as nuclei: one is Mr. James Croll, who holds to the wind theory, and the other Dr. W. B. Carpenter, who attributes circulation to the opposite effects of tropical heat and arctic cold. The effect of winds upon the surface of water is far from inconsiderable. We can see this from the results observed on our eastern coast. "It is well known," says Professor Newcomb, "that the tides are there materially modified by the winds, so that the time of high water may be delayed or accelerated by an entire hour or more, and the hight changed by one or more feet in consequence of a heavy wind. The effects of a wind thus determined must be the same as that of a difference of level equal to that which the wind is found to produce, and this again must be sufficient to produce a very strong surface current. Moreover, a continuous surface current must, in time, extend itself to a great depth, through friction." On a long sloping beach, the wind is often known to blow the water seaward to such an extent that ships at anchor near the shore in high tide, instead of being able to set sail in a succeeding high tide, have been left on a dry beach. In the passage of the Israelites through the Red Sea, we are told that "the Lord caused the sea to go back by a strong east wind all that night, and made the sea dry land." Observations in connection with the survey of the Suez Canal route have revealed the fact that at the probable place of crossing was a sand bar, but a little beneath the surface, which is now visible above the surface. The strong east wind was sufficient to force back the water from this sand bar and make a dry passage way. So this statement of Scripture is in strict accord with the discoveries of science.

On the other hand, adherents to the gravitation theory hold that, as water is heated by the sun at the equator, and cooled by want of it at the poles, the cold and hence heavier water of the north must sink and crowd under the warmer and lighter water at the equator, thus causing circulation. The movement-forming currents in the air are explained on the theory that the heavy air descends, crowding up the air made lighter by the expansive power of heat. The result of this is seen in the northeast and southwest winds from the poles to the equator, and the probable upper currents in the opposite direction. This is the accepted explanation of atmospheric circulation; and since the water—though less mobile—is nearly a perfect fluid, the same cause would reasonably be expected to produce a similar effect in the ocean. While these two theories, when simply stated, seem almost equally plausible, the friends of each find many objections to an acceptance of the other.

Much has been said about the Challenger's "crucial test" of these opposing theories. This has been advanced by Mr. Croll in opposition to the gravitation theory. Mr. Croll rightly remarks that, for gravitation to act, the surface at the equator must be elevated above that at the poles and all intermediate points. By referring to Dr. Carpenter's oceanic section which is most favorable to the latter's theory—which section is remarkable for the thinness of the warm strata at the equator compared with the greater thickness of the heated water in the North Atlantic—he concluded that the ocean, to be in equilibrium, must stand at a higher level in the North Atlantic than at the equator. To verify this conclusion, Mr. Croll examined the temperature soundings of the Challenger expedition taken near the equator, in 23° and 38° of north latitude; and he computed the variation in the hight of these three columns of water due to the temperature indicated, by the use of Muncke's table, showing the expansion of sea water for different degrees of temperature. He afterwards corrected his computations by comparing them with results obtained from the use of Hubbard's table, and found that the column of water at 23° north latitude must stand 2 feet and 3 inches, and at 38°, 3 feet and 3 inches, higher than at the equator, in order to produce equilibrium. This shows that the north latitude waters must stand higher than the equatorial, and that in fact the surface does slope up from the equator to nearly the latitude of England. Hence, if the circulation from the equator to the pole is due to gravitation, the water must literally run up hill. And Mr. Croll says we might as soon expect the waters of the Gulf of Mexico to flow back into the Mississippi and Missouri rivers by force of gravitation.

From the data Mr. Croll has given from the records of the Challenger, it is somewhat difficult to see how he reaches his conclusions. For, taking the temperature soundings as he has given them, and finding the mean of temperature for the three latitudes above mentioned, we find the mean temperature of the water columns for the soundings to be a little over 51° at the equator, nearly 45½° in latitude 23° north, and about 46° in latitude 38° north. According to this, to produce equilibrium, the column would necessarily be highest at the equator, because expanded by greatest amount of heat, next highest at latitude 38°, and lowest at 23°. Hence there would be a depression in the surface, and then an elevation as we go from the equator to the pole; but as the equatorial surface is higher than the elevation north of it, the force of gravitation could doubtless cause a northerly flow to the surface water. This result, however, does not suit Mr. Croll's purpose, and is evidently not the one which he obtained, though, as far as we can see, legitimately and naturally reached by use of his own data. But if we take in each of the three columns (representing the three latitudes) the mean temperature of only those soundings which correspond in depth in all columns, we obtain results just suited to Mr. Croll's purpose, which represent conditions essentially alike those which he presents as necessarily existing from Dr. Carpenter's section and the Challenger's soundings, namely, 42° at equator, 45° at latitude 23°, and 46° at 38°, or a gradual elevation of surface from the equator to the North Atlantic. This is presumably the method of calculation by which he reached his conclusion.

Mr. Croll further notices that Dr. Carpenter's section south of the equator furnishes an argument for the wind rather than for the heat theory. This section reveals the fact that the amount of warm water north of the equator is much greater than south of it, while, according to the heat theory, the reverse should be the case, because of less obstruction to circulation south than north of the equator. Dr. Carpenter anticipates this objection by explaining that the warm water is in excess north of the equator because "the upper stratum of the North Atlantic is nearly as much cooled by its limited polar outflow as that of the South Atlantic is by the vast movement of antarctic water which is constantly taking place toward the equator." "But," answers Mr. Croll, "this 'vast movement of antarctic waters' necessarily implies a vast counter movement of warm surface water. So that if there is more polar water in the South Atlantic to produce the cooling effect, there should likewise be more warm water to be cooled." Mr. Croll declares this fact is easily explained on the wind theory, by noting the fact that the southeast trade is stronger than the northeast, and hence, by overpowering the northeast trade and blowing across the equator, would sweep the preponderance of warm water into the Gulf of Mexico, where it has time to be heated, and then to the north, where it accumulates.

Mr. Croll is apparently a little inconsistent in the following: "There is an additional reason to the one already stated why the surface temperature of the South Atlantic should be so much below that of the North. It is perfectly true that whatever amount of water is transferred from the southern hemisphere to the northern must be compensated by an equal amount from the northern to the southern hemisphere; nevertheless, the warm water which is carried off the South Atlantic by the winds is not directly compensated by water from the North, but by the cold antarctic current, whose existence is so well known to mariners from the immense masses of ice which it brings from the Southern Ocean." So it is not directly compensated from the north at all, but from the south. And, from all he says, we might expect a constant accumulation around the north pole at the expense of the south. If it is not directly compensated from the north, how is it indirectly? While Mr. Croll leaves us in the dark respecting this important question, we find an explanation in Professor Wyville Thomson's Challenger "Report to the Hydrographer of the Admiralty.' He says: "The more the question is investigated, the less evidence there seems to me to be of any general ocean circulation depending upon differences of specific gravity. It seems certain that both in the Atlantic and Pacific the bottom water is constantly moving northwards; and I am now very much inclined to refer this movement to an excess of precipitation over the water hemisphere, a portion of the vapor formed in the northern hemisphere being carried southwards and precipitated in the vast southern area of low barometric pressure." Want of space forbids remark on this explanation.

Mr. Croll again notices, from Captain Nares's report of Challenger Expedition, that, from 50° to 65° of south latitude, water to the depth of 600 fathoms—excepting a thin stratum at the surface heated by the sun's rays—was several degrees colder than the water below it; and declares this entirely inconsistent with the gravitation theory, according to which the colder should sink beneath and displace the warmer. Carpenter answers this quite satisfactorily by saying the cold water, according to Captain Nares's distinct statement, comes from the melting of field ice, and would have less salinity, hence less specific gravity, than the salt though warmer water beneath. The truth of this, however, depends upon mathematical computations from well ascertained data, and not upon theory.

To Mr. Croll's first crucial test argument, Dr. Carpenter at first replied that the doctrine to which Mr. Croll applied his test was a creation of his (Croll's) own, since his whole argument was based on the assumption that the ocean was in a state of static equilibrium, whereas Carpenter claims that it never can be in equilibrium so long as part of it is cold and the other part warm. And he illustrates it by a boiler and water pipes for heating, and claims that equilibrium exists till heat is applied, and then can exist no longer, and circulation necessarily commences. In one of his communications later in the series, Dr. Carpenter replies, as if it were an afterthought, that Mr. Croll "has entirely omitted the consideration of the inferior salinity of the equatorial column." This, he says, would make a difference in the opposite direction sufficient to neutralize the three feet and over of excess in the elevation of the North Atlantic column of water. To Dr. Carpenter's former point, Mr. Croll replies that considering the ocean in equilibrium was an advantage in his opponent's favor: the former granting that it never attains such a condition, and that, on the latter's supposition, a disturbance of equilibrium would necessitate that the North Atlantic elevation above the equatorial surface be greater than Mr. Croll has computed, and hence so much less liability for the water to move to the north by its weight. "It is singular," says Mr. Croll, "that Dr. Carpenter should not have observed that his objection strengthens my argument instead of weakening it. For if it be true that the equatorial column, though in a state of constant upward motion, never attains to the hight required to balance the polar column, then it must follow, as a necessary consequence, that the rise from the equator to latitude 38° in the North Atlantic must be greater than I have estimated it to be; and therefore, so much the more impossible is it that there can be any surface flow from the equator to the pole due to gravity." There seems to be a little want of candor or some misunderstanding in this reply; for it supposes the lack of equilibrium to result in a movement of surface water from the north toward the equator; and neither partly believes this the true direction. Mr. Croll's strong point seems to be that water will not run up hill by the force of gravity. But if the North Atlantic is over three feet higher than the equator, why does it not run down hill by force of gravity? Or, since it is in equilibrium as it stands, is it not as likely to run one way as the other?

Respecting Dr. Carpenter's latter objection, Mr. Croll expresses doubts as to the inferior salinity of the equatorial column to any great depth, though granting it to be a fact as far as the surface is concerned, and claims this as additional evidence in favor of his theory; but in what way, he fails to make clear, especially when he afterwards admits that he has made allowance for differences in salinity, to the advantage of the other theory.

There has been considerable sparring between the opposing parties concerning the viscosity of water in its effects upon this question; but while one concludes that it has nothing whatever to do with the question at issue, the other says that it is so slight that it may well be entirely ignored. Hence the *pro* and *con* on this point need not be noticed.

After the long and determined controversy, which is here but briefly epitomized, it seems a little strange that each has virtually admitted the correctness of his antagonist's position. Mr. Croll remarks: "Everyone will admit that, were there no other agencies at work but equatorial heat and polar cold, a difference of temperature would soon arise which would induce and sustain a system of circulation, but this condition of things is prevented by the equatorial waters being swept away by the winds as rapidly as they are heated." To this, we would simply remark: There appears no good reason why "this condition of things" should be "prevented" by the winds, and might not exist in its degree at the same time. On the other hand, Dr. Carpenter asserts: "I have never denied the existence of a horizontal wind circulation." And in another place: "It is scarcely fair in Mr. Croll to continue speaking of the wind theory and the gravitation theory of ocean circulation as if they were antagonistic, instead of being not only compatible but mutually complementary—the wind circulation being horizontal, and the thermal vertical." In view of these concessions, it may not be unreasonable to conclude that ocean circulation is due to both causes working together, and that we have not yet sufficient data for finally deciding which produces the greater effect, though, perhaps, the probabilities are in favor of the wind.

S. H. T.

The American Chemical Society.

This is a new organization, lately formed in New York city. The objects of the society are the encouragement and advancement of chemistry in all its branches.

The society consists of members, associates, and honorary members.

Only chemists are eligible as members or honorary members The following are the managers:

President.—John W. Draper.

Vice-Presidents.—J. Lawrence Smith, Frederick A. Genth E. Hilgard, J. W. Mallet, Charles F. Chandler, Henry Morton.

Corresponding Secretary.—George F. Barker.

Recording Secretary.—Isidor Walz.

Treasurer.—W. M. Habirshaw.

Librarian.—P. Casamajor.

Curators.—Edward Sherer, W. H. Nichols, Frederick Hoffmann

Committee on Papers and Publications.—Albert R. Leeds, Herrmann Endemann, Elwyn Waller.

Committee on Nominations.—E. P. Eastwick, M. Alsberg, S. St. John, Charles Frobel, Charles M. Stillwell.

Capsizing of a Yacht.

The magnificent yacht Mohawk, probably the largest pleasure sailing vessel in the world, was recently capsized in New York Harbor, by a sudden squall. The vessel was getting under way under all plain sail, when a heavy gust struck her, throwing her almost on her beam ends. As she righted, another squall threw her back, and her heavy wet canvas pulled her over so that in a short time she filled and sank. Mr. William T. Garner, Vice Commodore of the New York Yacht Club and owner of the vessel, his wife, and three others were drowned. The Mohawk was 150 feet long and of 30 feet beam. Her construction was of the strongest description, and her interior fittings were palatial.

Mr. Garner was one of the largest print cloth manufacturers in the country, owning five large cotton mills at Cohoes, besides many others in various parts of New York State. He employed from 7,000 to 8,000 workmen, and in his cloth-printing factories ran 42 machines, this being dou-

ble the number used by any other manufacturer in the United States. He was a man of great wealth, a prominent citizen, and one whose loss will be widely and deeply regretted.

Potato Bug Sailors.

The sea coasts in the vicinity of this city and the shores of Long Island Sound are, at the present time, undergoing invasion by countless myriads of potato bugs. Where the insects come from is a mystery. They seem to cling to the floating sea weed and are left therewith on shore by the tide. At Coney Island and other points directly on the ocean the bugs are most numerous, showing that they have been brought hither by sea currents, and by similar means have been swept into Long Island Sound. It seems hardly possible that the insects will now fail to reach the other side of the Atlantic, as they may find transportation on vessels or be carried over in the drifting weed of the Gulf Stream.

Progress of the French Exposition of 1878.

Ninety-four Parisian architects have recently submitted plans for the buildings in which the great French World's Fair of 1878 will be held. For six of these, a prize of $600 each has been awarded, and for an additional six, next in order of merit, the designers have received premiums of $200 each. The project definitely adopted includes a principal palace which will be built on the Champs de Mars, and in the center of which will be the fine art gallery. The latter will be surrounded by the industrial department. France reserves to herself half the space; the remainder will be distributed among foreign nations. The buildings will cover an aggregate of sixty-eight acres, and the total expense of construction is estimated at $7,000,000.

The Spirophorus.

The above is the name of a new device proposed by Mr. Woillez for restoring partially suffocated people. The patient is enclosed in a metal cylinder, so that only his head protrudes; connected with the cylinder is a large bellows holding five or six gallons of air. When this is operated, the air is alternately drawn out and forced into the cylinder, thus causing artificial respiration in the patient. The movements of the chest of the latter can be seen through a pane of glass in the cylinder.

Killing Entomological Specimens.

The Bulletin of the Amiens Linnæan Society describes the following simple device for killing butterflies and other insects, without injuring them, as is often the case when they are held in the hand. A glass tube of sufficient diameter to accommodate the insect is provided, with corks at each end. As soon as a butterfly is captured, one cork being removed, it is gently inserted in the tube, then a wad of tow is pushed in, saturated with a couple of drops of ether. The insect dies instantly, and may be at once removed and pinned.

United States Circuit Court--District of Connecticut.

RULE IN REGARD TO FOREIGN PATENTS.—THOMAS A. WESTON *vs.* WILLIAM H. WHITE *et al.*

An American patent will expire at the same time with the foreign patent granted to the same party or parties, but will not exceed the term of seventeen years.

The date of publication of the foreign patent is to be the date from which to determine the life of an American patent.

The fact that a patent has been issued does not of itself prove the introduction into common use without the necessity of other testimony.

[*E. Wetmore*, for plaintiff.
John S. Beach and *S. W. Kellogg*, for defendant.]

NEW BOOKS AND PUBLICATIONS.

A NEW TREATISE ON STEAM ENGINEERING. By John W. Nystrom, C. E. Philadelphia, Pa.: J. B. Lippincott & Co.

Mr. Nystrom is a thoroughly educated engineer and a competent teacher of his profession: but in this, as in some of his previous works, he falls, we think, into the manifest error of using too many new terms and characters. The object is the laudable one of simplifying his meaning; but the result to the average mind will, we fear, be the reverse. The best of workmen, accustomed for years to his present implements, cannot produce skillful work with strange tools, the manipulation of which he has got to learn before he undertakes a task. The less new terminology introduced into science the better; for the student in any branch has enough to do to become well grounded in principle, without burdening his mind with vocabularies of new languages. Besides, the introduction of new characters and names renders the book useless for reference, save to those who have studied it from the beginning. In other respects, Mr. Nystrom's work is clearly written, and may be profitably studied by engineers and others.

A TREATISE ON THE MECHANICAL THEORY OF HEAT AND ITS APPLICATION TO THE STEAM ENGINE, ETC. By R. S. McCulloch, C. E. New York city: D. Van Nostrand, 23 Murray and 27 Warren streets.

This is an elaborate purely mathematical treatise on thermo-dynamics. It requires a thorough knowledge of analytical geometry and the fluxional calculus for its comprehension, and consequently is not a book for the ordinary practical engineer. For advanced students, however, in colleges, it will be found valuable, since it may be used as the continuation of a mathematical course, and in this respect may be advantageously substituted for the works on astronomy and others involving high mathematics, commonly employed for the study of practical application of the abstract reasoning.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED BALL VALVE.

Cortland Carlton and John B. Jones, Kalamazoo, Mich.—This invention is intended to take place of the commonly used hinged leather valve, which frequently gets obstructed and out of order; and it consists of a ball valve with metallic seat entering the wooden tubing, being driven by a sharp circumferential flange into the end of the tubing.

IMPROVED STATION INDICATOR.

J. Robinson Balsley, Connellsville, Pa.—As the train, car, or boat leaves a station, a cord is pullod, which turns rollers and brings into view the name of the next station, which operation causes the hammer to strike the bell to call the attention of the passengers to the indicator. As the train, car, or boat approaches the said station, another cord is pulled, which brings the lever into position to be again operated, and also again strikes the bell to warn the passengers that they are approaching the station.

IMPROVED CAR MOVER.

John W. Raynor, Moberly, Mo.—This is for readily moving cars from the main to the side track, or out of the way; and it consists of a block with curved front jaw that takes hold of the outer concave part of the wheel, a pivot dog and block being on the tread of the wheel, and an adjustable gage piece bearing on the flange of the wheel.

IMPROVED SWITCH AND SIGNAL LOCKING DEVICE.

Smith H. Finch, New York city, and Henry Moore, Orange, N. J.—This attachment for switch and signal levers is so constructed that the movement of the detent to release a lever will lock the other levers, or any previously arranged number of them, before the said lever has begun to move. So that the other levers cannot be moved until the first one has been brought back to its place and secured by its detent.

IMPROVED CAR BRAKE.

Peter Hughes, New York city.—This consists of a yoke spanning a friction wheel on each axle of the car, and having a little motion forward and backward, so as to be driven against the wheel from either end of the car. Said yokes are connected together between the axles, and attached at each end of the car with a brake lever rising up in front of the platform, so that it can be worked to apply the power.

IMPROVED SELF-CLOSING HATCHWAY.

Henry Reese, Baltimore, Md.—As ordinarily constructed, the iron hoisting ropes of elevators prevent the use of hinged doors or hatches.—The object of the first part of the invention is therefore to provide hatches adapted for use in such connection; and to this end, rigid arms are attached to the crossbeam of the frame from which the elevator platform is suspended, and cleats are so attached and arranged in the several floor openings of the hatchway that, when the platform goes up, it shall take each hatch or cover with it, and, when it descends, shall leave each in its proper place supported upon said cleats. The second feature of the invention relates to a sliding gate, guard, or railing for each floor opening, the same being arranged to be raised (by hand) when it is desired to transfer goods to or from the platform upon any of the upper floors, and to be automatically released and thus allowed to resume its place when the platform descends.

IMPROVED CANAL LOCK AND DAM.

George W. Parsons, Ceredo, W. Va.—The object of this invention is to enable boats to be passed from one level to another, either in canals or rivers, more quickly and with less labor than by means of the locks heretofore used. To this end, the invention is twofold: It relates, first, to a lock proper; and secondly, to the bulkhead of the lock or dam. For locking purposes the inventor employs vertically acting gates, operated by the pressure of the water in the canal or river. The water is let on and shut off from the pistons which raise and lower the gates, simply by the adjustment of a valve or wickets. It is hence obvious that the labor and time involved in the operation are reduced almost to a minimum. In respect to the chute, the ridge or column of water which forms at the bottom of every fall is broken up by allowing a portion of the water which would otherwise pass over the fall to pass beneath or around it (in one or more separate streams), and enter, or rejoin, the main body at the bottom of the fall. A body of comparatively smooth water will thus be formed to float the boat safely over the brink of the fall.

IMPROVED METHOD OF CASTING CAR WHEELS.

James McAllister, Virginia City, Nev.—This invention is an improvement in the class of car wheels having a soft cast iron hub and a hardened rim or tread. The feature upon which the claim to novelty is based is the form of the meeting portions of the cast iron hub and hardened tread or body of the wheel, whereby they are more firmly united than in other wheels of the class.

IMPROVED TREADLE.

Henry Reese, Baltimore, Md.—This invention relates to an improvement in that class of treadles in which independent foot rests or secondary treadles are employed, upon opposite sides of the fulcrum, for obviating the tiresome strain upon the ankle joint. The invention consists, first, in a raised support with an arc-shaped face upon which the instep of the footstep rests, and upon which arc-shaped face the sole of the shoe becomes the independent treadle, turning upon the curved face as a pivot. It also consists in a pivoted independent treadle, having pendent weights which hold the secondary treadle or foot rest always in a horizontal position.

IMPROVED ROLL FOR RE-WORKING RAILROAD RAILS.

James McCaffrey, Pittsburgh, Pa.—The object of this invention is to economize worn-out steel or iron railroad rails by reducing them to flat bars, in which form they may be conveniently utilized for various purposes. To this end, the invention relates to rolls provided with a series of graduated grooves, through which the rails are passed in succession, being thus gradually reduced to uniform widths.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED VALVE FOR BRASS MUSICAL INSTRUMENTS.

William A. Tischendorf, Leavenworth, Kan.—This invention relates to the cylinder valves of wind instruments to open and close the air passages; and it consists of said cylinders, pivoted on center points adapted to be adjusted from time to time to take up the slack, and being adjusted to spring pressure. The object is to prevent the wear of the cylinders against the sides of the case.

IMPROVED ARTIFICIAL TEETH.

Thomas Williams, Braytonville, North Adams, Mass.—This is a new mode of securing artificial upper front teeth in place in such a way that they will be held firmly in place, and may be readily put in and taken out. It consists in a plate and teeth having grooves or channels along the sides of the outer teeth, and provided with a spring and pad, which rests against the roof of the mouth.

IMPROVED TWINE CUTTER.

William Haddenhorst, Hoboken, N. J.—This is a device for cutting twine or cord as it is used for tying up packages. When a package is to be tied, a sufficient amount of cord is drawn through the device, the package is tied, and the cord is cut off by drawing it across the edge of a blade in the apparatus, leaving the device suspended from the cord, from which it need not be removed until all the cord upon the reel or ball has been used up.

IMPROVED DRUGGISTS' GRADUATED MEASURE.

Edward L. Witte, White Mills, Pa.—This is a druggist's graduate or measuring vessel, having the scale or graduation burned into the glass in black or other color to be clearly and readily distinguishable.

IMPROVED LUBRICATING COMPOUND.

Horace W. Billington, Jersey City, N. J.—This is a lubricating compound consisting of saponified grease or soap, London oil, and paraffin oil. It will keep its state through all grades of weather, as the saponified matter will not melt except when broken or disturbed. It will not congeal or harden on cold iron when in use, nor will it gum or thicken. It is applicable to all kinds of axles.

IMPROVED GLASS BOTTLE MOLD.

Jacob Pease and Abraham Tester, Brooklyn, N. Y.—This consists of the bottom of a glass bottle mold so arranged that the opening of the sides of the mold lets the bottom fall to relieve the bottle from pressure between the bottom and the breast, which in the common molds cracks and breaks the bottles to some extent. The contrivance is such that, when the mold is closed, the bottom is raised up to the proper position for shaping the bottle.

NEW AGRICULTURAL INVENTIONS.

IMPROVED SHEARING CHAIR.

James A. Boals, Dinsmore, Pa.—This invention consists of a horizontally revolving seat and a vertically swinging rack, together with adjusting devices for the same, fixed on a platform and arranged in such manner that the sheep may be so placed on the seat and rack as to be more conveniently supported and handled for shearing.

IMPROVED HARVESTER.

Richard Emerson, Sycamore, Ill., assignor to himself and Horatio H. Mason, of same place.—This is an improvement in the class of harvesters having a binder's table and tilting platform, and a traveling rake arranged to carry the cut grain up to the binder's table. The construction and arrangement of the parts are simple and embody many new devices, which require drawings for their proper explanation.

DITCH-DIGGING AND TILE-LAYING MACHINE.

David T. Lucas, Stockwell, Ind.—This invention relates to a novel construction of ditch-digging and tile-laying machine, designed to effect in one operation the opening of the earth and laying of sections of pipe or tile adjacent to each other, so as to form a continuous under drain. The invention consists mainly in the construction of the placing devices, having a long beam supported in front by a sled adjustably attached to said beam, so as to vary the elevation of the beam and depth of placing devices. The placing device is provided with a chute dam, which the tiles pass consecutively in contact with each other, and occupy a position in the opened channel below, one after the other, in alignment, a supplemental trough being used with the chute to facilitate the inserting of the tiles, and the chute made adjustable to different sized tiles by a spring.

NEW HOUSEHOLD INVENTIONS.

IMPROVED MATTRESS.

John J. Donahoe, New Orleans, La.—The object of this invention is chiefly to effect an economy in the construction of mattresses, particularly in respect to the material of which the covering is composed, and the mode of making up the same. The invention consists in displacing with the cord or binding at one end of the mattress and continuing the ticking around said end so that the portion which covers the top and bottom of the mattress is of one and the same piece. The portion covering the sides is also in one piece, and likewise the binding cord.

IMPROVED WASHING MACRINE

Thomas Muir, Andes, N. Y.—This invention consists of a couple of conical rollers arranged side by side, and reversed as to their tapers, on a fluted roller, and pressed down upon it by a lever and weight or other suitable means, the said rollers being arranged horrizontally across the middle portion of a tub, so that the clothes can be drawn up from and be delivered back into the tub in working the machine. By the conical form a rubbing action is effected, and by the use of two reversed conical rollers the clothes are made to pass straightly through the rolls.

IMPROVED COFFEE POT.

Willis H. Sherwood, Waco, Tex.—This consists of a receiver for the decoction, fitted in the pot from the top. In the top of the receiver is a dripping cup to hold the coffee or tea, and through which and the receiver a tube extends from the water pot. Up the tube the hot water is forced by the steam, and discharged into the dripper to drip the coffee into the receiver, from which it is drawn for use without passing into the water pot. The receiver is provided with a gage to show the quantity in it, and the water pot has a safety valve to let off the steam when the pressure is too high, the said valve being fitted in the cap of the filling tube.

IMPROVED STOVE PIPE ELBOW.

Alfred Greenleaf, Brooklyn, E. D., N. Y.—This is so constructed that the pipes may be cleaned out, when required, without being taken down, and conveniently examined to see if they need cleaning, and ventilated so that they will not rust if allowed to stay up in summer. It consists in the combination of the collar and the cover with the opening formed in the one part of the elbow, directly opposite the cavity of the other part. The edge of the cover has notches formed in it to receive the screws by which it is secured in place, and which are screwed into the collar, so that by loosening the said screws the cover may be removed.

BATH TUB ATTACHMENT FOR STEAM, HOT AIR, OR VAPOR.

William C. Kidney and Alfred H. Kidney, New York city.—This invention consists in the combination, with an ordinary bath tub, of a casing provided with movable doors or sections, and ventilating doors or openings. By using this attachment, a steam, vapor, or hot air bath may be taken by its owner at his own house and in his own bath tub.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WAGON BODY.

Benjamin Rankin, Jeffersonville, O.—This wagon body is so constructed that it will be held firmly in place, and together, may be readily attached and detached when desired, may be snugly packed for storage, and will allow the rear end boards to be detached without loosening the other parts.

IMPROVED TABLE.

Conrad Schmid, New York city.—This is an improved table for parlors, hotels, and other uses, that may be employed for playing and other purposes, its top being capable of being changed from one side to the other by a simple mechanism. The invention consists in providing the circumferential frame of a table with a swinging end locking leaf and a joint covering molding.

IMPROVED TABLE HINGE.

Frederick H. Cutler, Buffalo, N. Y.—This hinge for table leaves is so constructed as not only to allow the leaf and top to be flush when extended, but mainly to allow the leaf, when down, to hang immediately under the top, and flush with the edge thereof. This allows compactness of form and in packing for shipment, and does away with the usual edge and groove of the leaf and top.

Business and Personal.

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

Notes & Queries

J. P. McD.'s query as to the velocity of thought is too metaphysical for our columns.—D. P. D. will find directions for transferring engravings to wood on p. 138, vol. 30. For transferring them to glass, see p. 123, vol. 30.—P. R. L. will find directions for dissolving mica on p. 241, vol. 32.—J. B. Jr., can preserve fruit by following the directions on p. 169, vol. 33.—L. L. F. should use the recipe given on p. 360, vol. 34, for renovating clothing.—A. P. W. will find a description of malleable glass on p. 402, vol. 32.

(1) E. S. B. asks: Will a projectile thrown upward in the air fall with greater, less, or the same velocity as that with which it ascended? A. The terminal velocity will be less than the initial. 2. What is the use of having the rifles of a gun barrel twisted? A. To give the bullet a rotary motion.

(2) J. B. M. asks: 1. Is it more injurious to track, bridges, and rolling stock to run loaded freight trains at the speed of from 30 to 40 miles per hour, than from 10 to 20 miles per hour? A. Yes. 2. Will it require more fuel to haul a loaded freight train 100 miles at the rate of from 30 to 40 miles per hour than from 10 to 20 miles per hour, all other things being equal? A. It is the general opinion of railroad men that the slower speed is the more economical, but there have been some recent experiments which point to the opposite conclusion.

(3) M. W. asks: What is the weight of a cubic foot of solid ice? A. About 57½ lbs.

(4) T. H. S. asks: Why do the dots on a telescope's joints have to be placed in a straight line? A. Because the tube is the straightest in this position.

How can I make sulpho-cyanide of mercury? A. Take the commercial sulpho-cyanide of potassium in ammonium, dissolve in water, and precipitate with bichloride of mercury; this precipitate is washed in several changes of water to free it from the chloride.

(5) A. S. asks: How can one reduce his weight without injury to health? A. Mr. Banting, an author on this subject, succeeded in reducing his weight some scores of lbs. by leaving off eating plain bread, potatoes, butter, fat meat, pastry, sweets, salmon, pork, and veal; and restricting his diet to fish, lean beef and mutton, and toasted bread or crackers, and fruit. He drank nothing with milk or sugar in it, nor any wine but claret, and no beer.

(6) E. L. G. asks: 1. Can the telephone arrangement, as noticed in SCIENTIFIC AMERICAN of August 1, 1874, be operated without a battery? It is for a distance not exceeding 100 feet. A. No. 2. If not, is there any cheap reliable battery, easily understood by the average mechanic, not needing attention very often? A. The sulphate of copper battery is one of the best.

(7) J. F. A.—To find the diameter of a round opening having the same area as a rectangular one, divide the area by 0·7854, and take the square root of the quotient. Hard cast iron will probably be a good material for a nozzle.

(8) L. C. M. asks: Will a vertical steam boiler 30 inches high by 16 inches diameter, with 12 upright flues, 1¾ inches in diameter, running the length of boiler, set on the lower half of a common coal stove, be of sufficient capacity to warm a house by hot water, the house containing 4 rooms, each 16 feet square by 9 feet high? A. If you have a strong draft, and a good arrangement of heating pipes, we think your boiler may answer.

(9) B. K. asks: Will common coach varnish do to varnish a poplar boat that is not painted? A. The best transparent coach varnish will probably answer very well.

(10) A. O. Y.—If you have written respectful letters to the Secretary of the Navy, as to entering the Naval Academy, and have received no reply, you might very properly address the member of Congress from your district in regard to the matter.

COMMUNICATIONS RECEIVED.

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

On the Medicinal Use of Chalk. By T. C. H.
On a Grease Soap. By B. C.
On Liquid Glue. By D. W. P. A.

Also inquiries and answers from the following:

T. P.—J. H. N.—G. M.—G. S.—W. H.—S. P. F. F.—C. F.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who sells Japanese lacquered ware? Who makes the best locomotive engines? Whose is the best achromatic telescope? Why do not wholesale druggists advertise in the SCIENTIFIC AMERICAN?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

July 4, 1876,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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9,362.—CLOCK CASES.—L. L. Culver *et al.*, St. Louis, Mo.
9,363.—EAVES TROUGH.—D. M. Cummings, Enfield, N. H.
9,364.—FOUNTAINS.—J. W. Fiske, New York city.
9,365.—BRACKETS.—C. H. Haight *et al.*, Quincy, Mich.
9,366.—CARPETS.—J. Hamer, Dutchess county, N. Y.
9,367 to 9,370.—CENTER PIECE.—S. Kellett, San Francisco, Cal.
9,371 to 9,373.—CARPETS.—J. G. C. Libert, Paris, France
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9,382.—FABRICS.—J. Michna, New York city.
9,383.—INKSTANDS.—F. R. Seidensticker, West Meriden, Conn.

[A copy of any one of the above patents may be had by emitting one dollar to MUNN & Co., 37 Park Row, New York city.

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On application for Design (7 years)	$15
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THE VALIDITY OF PATENTS.

The inexperienced purchaser of a patent does not generally appreciate the importance of having its claims examined, and their validity and scope defined by some person experienced in such matters, before parting with his money. It is not unusual for the assignee, just as he is commencing the manufacture of articles under his recently purchased patent, to find that it is an infringement upon some previously issued patent, and that he has not only made a worthless investment, but that he is likely to get muleted in damages if he proceeds with his manufacture. Cases are continually coming to our knowledge wherein parties have made purchases in good faith, and paid considerable sums of money on the assurances of the patentee and a mere glance at the patent, presuming that all that the drawing of the invention showed was protected by the claims, when, in fact, the point covered was almost infinitesimal. Another manner in which purchasers are sometimes deceived is that the claims, although broad enough and worded properly to cover the invention, contain a single element protected by some prior patent, which covers the very part in the new machine which is necessary to insure its efficiency. The Howe sewing machine patent illustrates this. It protected but little that any of the manufacturers cared to use, except the one small part essential to all sewing machines; and all manufacturers had to pay Howe a royalty, and he derived from that apparently trivial item an immense income.

We therefore recommend any person who is about to purchase a patent, or about to commence the manufacture of any article under a license, to have the patent carefully examined by a competent party, and to have a research made in the Patent Office to see what the condition of the art was when the patent was issued. He should also see that the claims are so worded as to cover all the inventor was entitled to when his patent was issued; and it is still more essential that he be informed whether it is an infringement, as above suggested, or not. Parties desiring to have such searches made can have them done through the Scientific American Patent Agency, by giving the date of the patent and stating the nature of the information desired. For further information, address MUNN & CO.,
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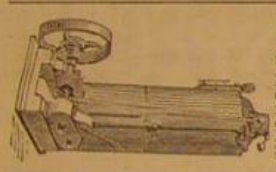

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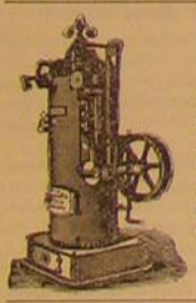

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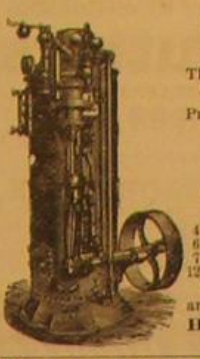

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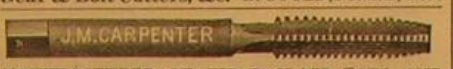

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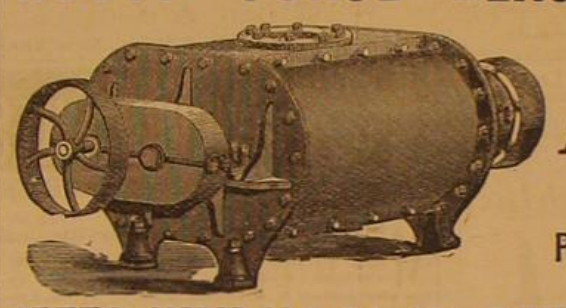

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100 Cash Gifts of	500 each	50,000
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Vol. XXXV.—No. 7. [NEW SERIES.] | NEW YORK, AUGUST 12, 1876. | [$3.20 per Annum. [POSTAGE PREPAID.]

Fig. 1.

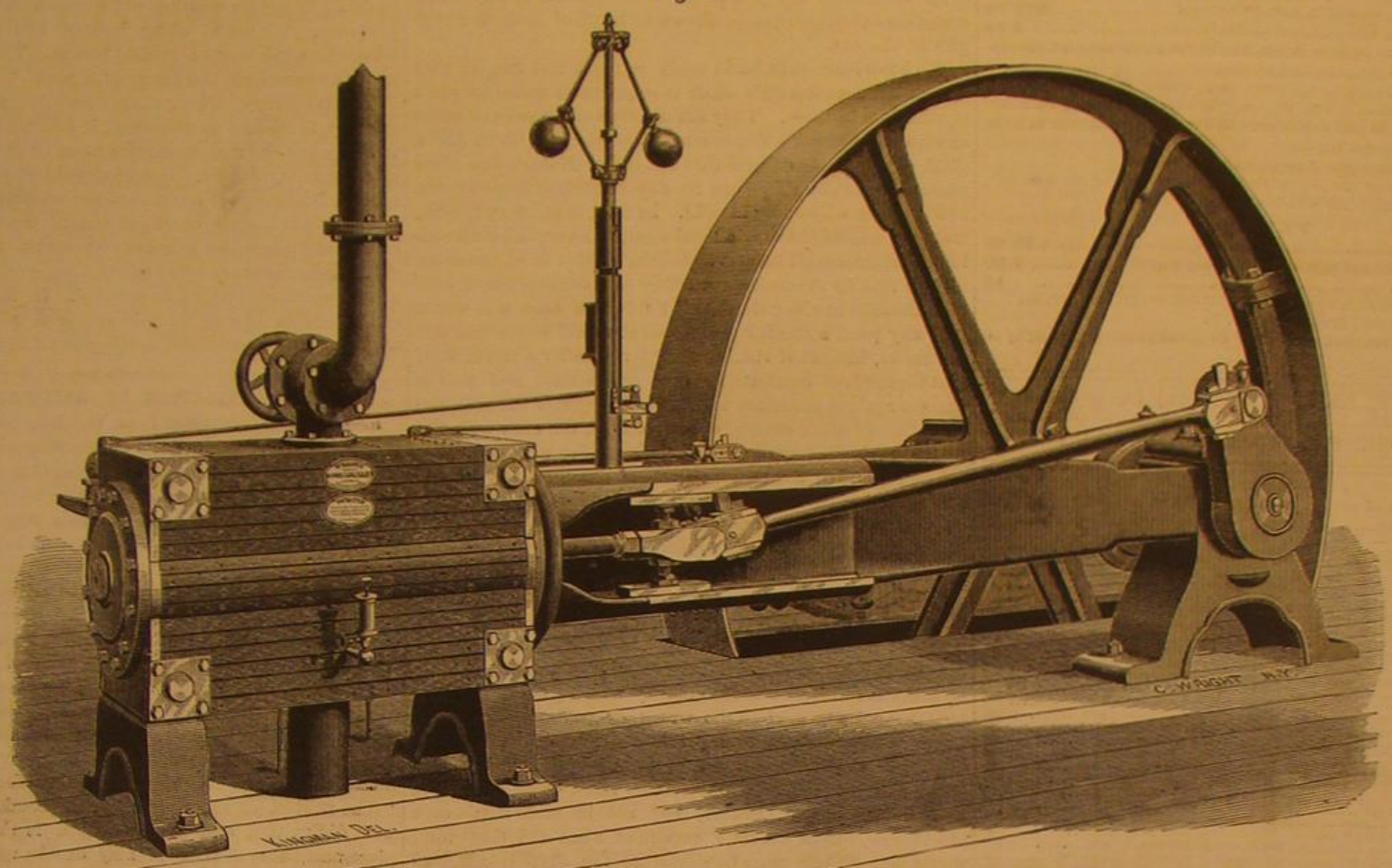
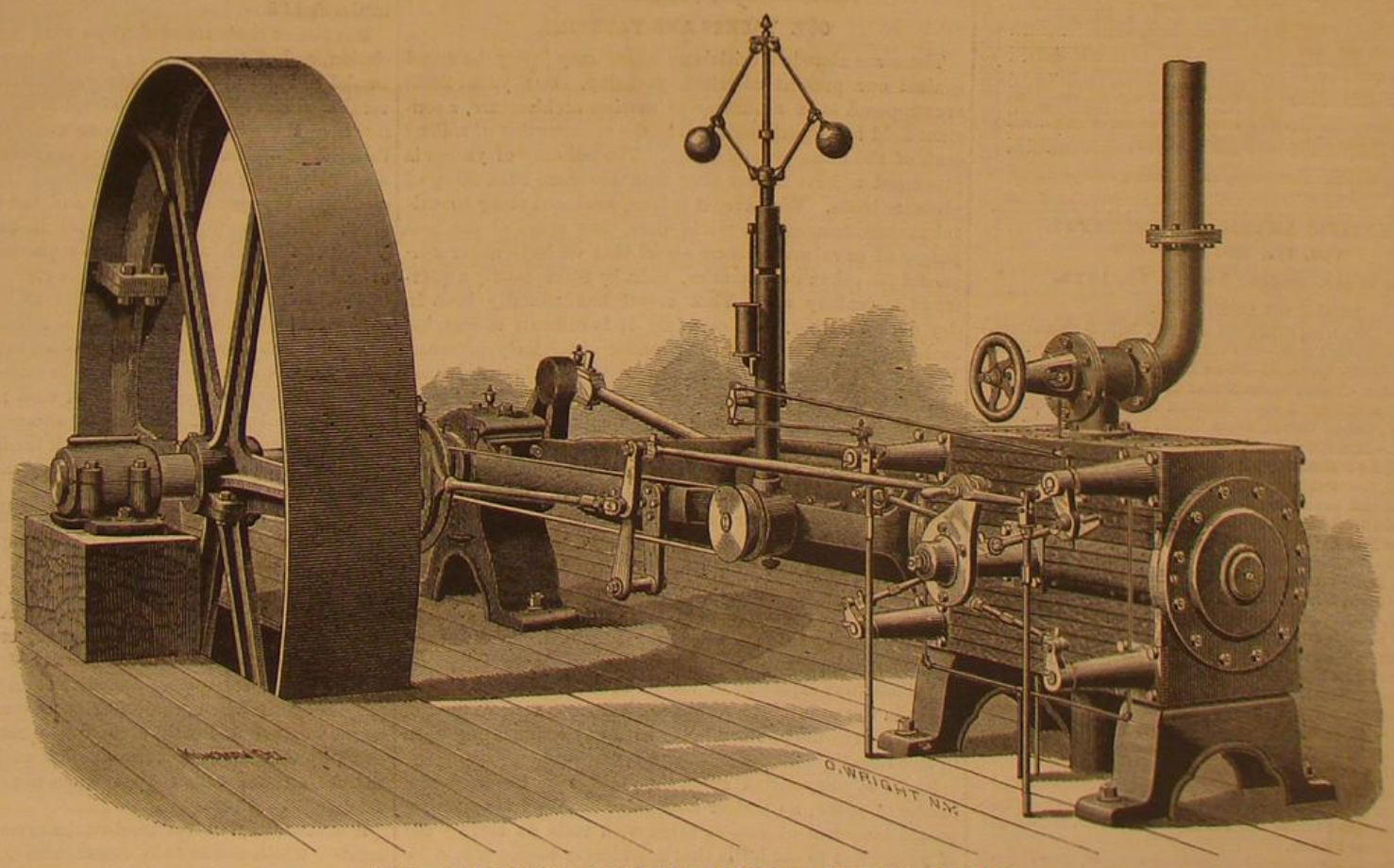


Fig. 2



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The Harris-Corliss steam engine has achieved so wide a celebrity, and has been brought so prominently into public notice of late years, through the trials which it has successfully undergone in several fairs, that we deem it unnecessary, in the present connection, to review in any detail the general construction of the machine. From the engravings, Figs. 1 and 2, herewith, showing both the crank and the valve gear sides, it will be perceived that the mechanism which moves the valves is outside the steam chest, hence susceptible to constant supervision and easy access. The valve gearing is mainly a simple eccentric. The same valve admits and cuts off steam, and its location is such that there are no long passages at each end of the cylinder to become filled with live steam. The exhaust valve is correspondingly located beneath the cylinder, has similar advantages, and through its situation frees the cylinder of water in a thorough manner

The form of the valves will readily be understood from Fig. 3 (see page 98), in which a valve is shown in section at A. The valves are circular slides, motion being imparted to them by levers keyed to valve stems. These stems have a flat blade of the length of the valve in the steam chest, and the valves oscillate on centers or fixed bearings in the front or back bonnets. In their adjustment, an important improvement has been made, to which we shall allude further on

The general arrangement of the governing mechanism is such that the quick opening and closing of the valves at exactly the proper time is secured by positive devices. Of these last, the prominent feature is the combination of eccentric and wrist plate, the latter affording an increasing speed at the end of the throw of the eccentric to compensate for its slow motion, at that period, in opening the steam valve. At the same time, the steam valve at the opposite end of the cylinder commences to lap its port, also by the motion of the eccentric, but by a reverse or subtraction of speed, produced by the same wrist plate, which speed is constantly decreasing till the throw of the eccentric is completed. The rapid opening and slow closing of the exhaust

Continued on page 98.

Scientific American.

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VOLUME XXXV., No. 7. [NEW SERIES.] *Thirty-first Year.*

NEW YORK, SATURDAY, AUGUST 12, 1876.

Contents.

(Illustrated articles are marked with an asterisk.)

THE SCIENTIFIC AMERICAN SUPPLEMENT.

Vol. II., No. 33.

For the Week ending August 12, 1876.

TABLE OF CONTENTS.

MODERN ROWING RACES.

Our aquatic sports seem to be assuming an artificial nature which is rendering them more and more unlike those of an earlier and less "advanced" period. Rowing races certainly have become reduced to competitions in which the conditions imposed by Nature, which give zest to the exercise and, through their very variety, constantly call forth fresh skill, are carefully eliminated. There is no sport more exhilarating, more healthful, or more reliable in results than this, when genuinely followed; but as it is now practised it is scarcely possible to place it on a level with the sports of the turf. It is an undeniable fact that horse racing has resulted in vast improvements in the breed of horses, and thus a genuine good is gained, which at least neutralizes the evils attending the practice. But we doubt if any corresponding advantage can be shown in favor of modern struggles at the oar.

We have learned to build boats so light and fragile that almost the rope dancer's skill is required to maintain one's equilibrium in them. They are utterly useless save in water as smooth as glass. The oarsmen are educated to so fine a pitch of physical culture that exhausted Nature too often passes the dividing line, and the superb athlete breaks down and becomes a life-long invalid. In fine, boat, water, oars, training, conditions of wind and weather, everything attending the sport, are all subservient to the single aim of disposing men so that by muscular work they can accomplish a certain distance in a certain time. So far as boat and water play any part, a result equally useful would be reached did the crews, instead of risking their lives under a torrid sun, seat themselves comfortably in a gymnasium and pull in concert against machines which would register the mechanical effect of their efforts in foot pounds, the crew with the largest registered number to be declared the winners.

The reports of the recent regatta at Saratoga tell us that the Cornell men won by sheer force of strength. They showed no technical excellence in their rowing; their appearance was not especially graceful; they lacked what is technically called form; but they lifted their boat, as it were, by main strength, and pushed it forward with the power and endurance of giants.

We do not think that such work is entitled to the name of skillful boating; and certainly, in point of heroism, it must be considered inferior to that ability which guides the lifeboat through the surf to the wreck, or pulls against varying tides and currents, or urges the sharp bowed whale boat in pursuit of the sea monster, or even handles the oar in a high running sea. To our minds, races occurring, not in hot July but in cool October, and not in mere shells on a placid lake, but in staunch cutters in a sea and tide way, would be infinitely more beneficial to the participants, and at the same time would call for the display of higher qualities, both of physical strength and calm judgment.

OUR YACHTS AND YACHTING.

There are abundant criticisms which may justly be urged against our present so-called yachting. Our yacht fleets are supposed to be a nursery of marine architecture, a constant field for experimentation in the construction of sailing craft of the finest possible form. The building of yachts is presumed to have higher aims than the mere furnishing of pleasure boats. We have, it is true, produced many beautiful models, famous the world over, but some of the best judges of naval architecture assert that we have never surpassed the celebrated America, built by Steers nearly a quarter of a century ago. That vessel has recently been in dry dock refitting, and certainly it is difficult to imagine more exquisite lines than her under-water body presents. We cannot therefore claim any material advance in the hull architecture; nor can we assert that we have built vessels with improved seagoing qualities. The America crossed the ocean years ago to sail for the Queen's cup. A few yachts have done so since, but the pleasure vessels rarely go to sea during a stormy season of the year. Yet pilot boats even smaller in size constantly cruise hundreds of miles from land in midwinter, and in the fiercest gales; and Long Island and New England fishermen unhesitatingly put to sea in storms which would send every yacht close-reefed into the nearest harbor. Nor has our yacht squadron shown itself of value as a school for seamen. The wretched incompetence exhibited in the circumstances attending the disastrous capsizing of the Mohawk, the largest sailing yacht in the country, in New York harbor a few days ago, is too fresh in the public mind to need any commenting upon in this regard.

So far as competition goes, the yacht race has become a matter of speed, no matter how gained. We have seen repeated instances of vessels fitted with sails so largely out of proportion to the hulls that a moderate breeze would be very liable to throw the latter on their beam ends. But to counteract the enormous heeling tendency, racing crews of unusual numbers are brought on board, and each man is provided with a sand bag. He is simply living ballast, and his duty is to transport himself and sandbag as far to windward as he can get. The pressure on the sails is met, not by build, nor by displacement, by breadth of shoulder, but by weight of men and sand bags. Not long ago a catamaran (two parallel hulls covered by a transverse staging and rigged with mast and sails) fairly vanquished a number of crack yachts. The yacht owners loudly protested against being conquered by so outlandish a craft, forgetting the fact that the ingenious builder merely gained stability by a device substantially the same and very much more effective, though of course more obvious, than theirs. Certainly the means he adopted were not a whit more artificial.

The Rev. Dr. Hepworth, of this city, an enthusiastic yachtsman, has, since the above was written, published a work in which our yachting is mercilessly criticized. He says of the yachts: "They have generally very graceful lines, great breadth of beam, which makes them roomy and comfortable under deck, but are often so overloaded with spars and canvas that they are unfit for rough outside work. Our topmasts run up to such an incredible hight that, when the boat begins to roll in a seaway, it seems as though she would never stop until she had jerked out her spars.

"The crowning defect, and one which we are beginning to acknowledge, is the shape of the bows. They are so sharp that they not only cut through the water when it is smooth, but they also cut into it and under it when there is any seaway on. The only thing that holds the head of a yacht up in rough weather is its preposterous bowsprit and jib-boom. We crawl along inshore and run for a harbor when the wind blows a reefing breeze. The play of a coaster or lumberman is the *agony* of a yacht."

In this country, where a large standing navy no less than an army is deemed unnecessary, it follows that not only the military but the marine service must in time of need be derived from the people. Our geographical position moreover renders it likely that a war between ourselves and a foreign power would mainly be waged afloat. An advantage to the community therefore primarily exists in fostering aquatic skill, while there are other advantages, sufficiently indicated above, which also might be secured. In this view the present condition of our aquatic sports is plainly one which might greatly be modified to the general benefit.

THE VENTILATION OF RAILWAY CARS.

Scarcely less important than the long-vexed and almost hopelessly unsolved problem of securing good air in public assembly rooms is the proper ventilation of public conveyances. Under no other conditions are we packed so numerously in limited spaces; and as a rule our journeys are of longer duration than the times we spend in places of public amusement, instruction, or worship.

The problem, so far as it relates to railway cars, was discussed at considerable length at the recent convention of the Master Car Builder's Association. Neither the committee's report nor the subsequent remarks of the members of the association give much cause, however, for expecting any immediate relief from the poisonous atmosphere the traveling public has to put up with as a rule. The important fact that pure air is desirable in public conveyances is recognized in a languid sort of way; but, so the committee say: "The subject (of securing it) is still practically encumbered with difficulties, and our only hope is that, by treating it piecemeal, the difficulties may one by one be overcome." The past year has been "quite barren" of improvement in ventilating devices, still an increasing interest in the matter among car builders shows that "some progress is being made in the right direction."

But two or three recent devices were noticed by the association, and of these nothing positive was determined. Mr Daniel S. Darling, of Brooklyn, submitted the model of a ventilated car, by which he claimed to meet all the requirements of the case. By this plan the fresh air is taken in through an opening at the crown in the ends of the car, immediately under the roof, the opening to be regulated according to the speed of the train and the quantity of air desired. The inflowing air is received in an air chamber and delivered through side openings a quarter of an inch wide, extending the whole length of the car. With an inlet 12 inches by 6, and a speed of 20 miles an hour, a steady supply of 800 cubic feet of fresh air a minute is promised, or enough to effect an entire change of air in the car every three minutes. No attempt appears to be made in this plan to prevent the entrance of smoke and dust; while the current, entering the body of the car in sheets, would seem to be specially favorable to drafts, though the inventor is of opinion that in a car ventilated in this way the fresh air will be diffused very gently.

Mr. H. A. Gouge, of New York, also presented a model illustrating some improvements on his mode of car ventilation. This plan has been tried the past year in a car running on the Boston and Albany road, giving, it was reported, very good satisfaction in warm weather. In cold wethera the warming of the car was defective, especially on an accommodation train; but that difficulty Mr. Gouge was confident he could overcome. Another car on the same road was provided with a fan ventilator, with excellent results in warm weather and with a moderate rate of speed; but it was very difficult to heat the air sufficiently in cold weather, and the air was rather close when the car was not in motion.

Still another plan was tried on the same road, the management of which seems to be commendably in earnest in this matter: a plan devised by Mr. Gates, of Boston. It consists in lowering the head lining a few inches so as to make an air chamber between it and the roof, from which chamber the fresh air enters the body of the car through wire cloth or perforations extending the entire length of the car. The entrance and exit of the air is regulated by swing sashes at each end of the car. So far the plan seems to work well, but a longer trial must be made before a decided opinion can be expressed in regard to its merits. A similar device is on trial on the Pennsylvania Road.

Favorable report was also made of the Winchell ventilator, with which certain western roads have been experimenting. The Canada Southern has had it, without deflectors, on four cars, and the representative of the road pronounced its operation very satisfactory. A little smoke got in, but not enough to be troublesome. The system consists

in an air chamber in the roof, extended into a hood covered with very fine wire gauze, and carrying in the end a wicket opened and closed by a rod. In the bottom of the chamber is a register through which the air is forced down the center aisle of the car. The rear gate acts as an exhaust. So far the plan resembles Mr. Gates'. For summer use, when the windows have to be open, the rear gate is closed, and deflectors are used to prevent any inrush of smoke or dust at the windows, and to serve as an exhaust. The chief objection seems to be that it is costly, and the air is not warmed.

Evidently there is a good field here for our inventors to cultivate, one likely to be profitable to them and very beneficial to the traveling public

TIMELY KEROSENE DANGERS.

While the mercury remains in the nineties and occasionally rises above 100°, it will be a prudential measure to keep a sharp watch on any kerosene oil that is being used. There are large numbers of rascally or ignorant dealers who sell a compound containing gasoline and other light products which will readily flash at 100° and often at 90°. As it is the gas or vapor from the oil that explodes, it is hardly necessary to point out the danger of keeping a material in the house which, during the intense heats of summer, will reach a state when such explosive gas is freely evolved.

Public attention may also here be called to the peril incurred in using kerosene on traveling conveyances. We notice that in several instances it is being used on railway cars in place of the safe candle; and on steamboats where coal gas is not employed, it is the only mode of illumination. It is curious to remark that for marine purposes the thoroughly reliable sperm oil is gradually becoming obsolete; and that even for vessels' side lights, where certainty of continuous illumination is the prime necessity, kerosene is being used. Sperm oil is actually difficult to obtain in this city, even in comparatively small quantities.

Of course, in the confined limits of vessels and railway cars, the perils from kerosene are greatly augmented; and where inspections by government officials, as in the case of steamboats, may carefully be made, we think that such should include a most rigid investigation into the kind and nature of oil employed. There are, of course, certain kinds of kerosene in the market practically as safe as sperm oil; but on the other hand, the poorer and more dangerous grades are cheaper, and hence are used both through ignorance and cupidity. The steamboat law is extremely explicit on the subject of explosive compounds, and it covers all cases, whether the material is barreled for freight, or innocently contained in the cabin chandelier. It distinctly states that "no products of petroleum shall be used on any steam vessel for illuminating purposes that will ignite at a lower temperature than 150° Fah." The penalty for carrying dangerous explosives is $5,000 fine, or three years' imprisonment, or both. The law is certainly stringent enough, and it remains for the authorities to enforce it, otherwise some frightful conflagration aboard a steamboat may be the result of their neglect.

We mention steamboats more especially because at this season of the year they are almost always crowded, and an accident, even through panic alone, may easily assume very serious proportions. Kerosene, we think, has no place on railway cars; it does not give an adequate light for reading at night, nor is it in any respect, save, perhaps, in point of expense, an advantage over the time-honored candle. In case of a collision or overturn of the cars, the breakage of the lamps and spilling of the oil have often produced a fire and a panic, and will so again if the companies persist in allowing its use.

THE THUNDERER BOILER EXPLOSION.

The double-turreted English ironclad Thunderer was recently the scene of a terrible boiler explosion. The vessel was built some three years ago but, had never been fitted for sea nor had her machinery tested. She had eight boilers of the common low pressure type, which supplied steam to twenty-six small engines for performing various work, besides to the main propelling engines, of 800 horse power. An official trial having been ordered, on the measured mile, near Spithead, steam was got up. The safety valves were supposed to be loaded to blow off at 30 lbs., and a large force of experienced firemen were employed under the Chief Inspector of Machinery. Fires had not long been started when a loud, sharp explosion, exactly resembling the report of a 38-tun gun, was heard, and vast clouds of steam poured up from below. The destruction was terrible. The men in proximity to the boiler were torn to pieces, while others, cooped up in the after-hole, were literally boiled to death. Fifteen persons, including the chief engineer, were killed instantly, and fifty-six were wounded. The end of the forward boiler on the starboard side was blown completely out, the uptake and main steam pipe were hurled bodily away, and the after fire room, generally, was a ruin.

It was supposed (and in the detailed accounts of the disaster which have reached us by mail, it is so stated) that a deterioration had taken place in the boilers, rendering them weak, owing to the lapse of time intervening between their reception from the contractors and the special trial. A telegraphic despatch, however, coming before the mail, reported the result of the official investigation, and the accident appears to have been due to the most inexcusable negligence. Previous to the steam trial, the boilers had been tested by hydraulic pressure, and, of course, all the safety and other relief valves were tightly fastened down by steel wedges. The wedges were forgotten. The pressure soon exceeded the strength of the plates, and the explosion was a necessary consequence Those watching the steam gage must have seen its rapid ascent; and certainly it seems impossible that they could have failed to remark that the safety valve was not lifting after the 30 lbs. set pressure had been attained, and to have taken measures promptly to discover the cause; but the most cautious of men, on the other hand, cannot reasonably be expected to foresee and guard against the consequences of such inconceivable blundering as here appears to have been the case. This is the third serious disaster which has occurred to the English ironclads within a year, the previous casualties, the sinking of the Vanguard and the collision of the Iron Duke, being due to negligence but little less culpable

THE CENTENNIAL EXPOSITION.

As the days have grown cooler, the attendance at the Centennial already shows gratifying signs of increase. Excursion parties, wisely postponed until the conclusion of the hot weather, are now arriving in rapid succession. Whole militia regiments from this city, college students by the hundred, miners of the Reading Coal and Iron Company by the thousand, bands of workmen from factories, besides the throngs of individual visitors, fill the buildings to an extent which is suggestive of the crowding which must take place when the September rush begins. The Granger excursions, and the farmers generally, are waiting to gather the harvests, and also for the great agricultural display of live stock, etc., to open later in the season. From present indications we think that those who contemplate a careful study of the Exposition will do well to make their visits now rather than risk later the annoyances which must follow the presence of a great crowd. If the interest which the people are taking in the show on one hand, and the comparatively small attendance during the past few weeks, are any criterions, the estimates made of the throngs which will pack the buildings in September and October are more likely to be exceeded than otherwise. Every department is now in perfect order, and the most elaborate of examinations can be comfortably and leisurely made.

Preparations for the live stock show, to be open from September 21 to October 4, are being rapidly advanced. A new entry is announced, which will be of the greatest interest to our stock raisers, in the shape of a drove of 100 of the choicest English cattle from the flocks and herds of Lords Chesham and Walsingham, the Royal Agricultural School, and others. The show of sporting dogs, to be held on September 4, 5, 6, 7, 8, also will be very attractive, a superb collection being expected from the celebrated English kennels. A large number of valuable prizes have been offered by private parties for the finest animals of various breeds. The American Forestry Association are to meet on the grounds early in September, and probably some useful suggestions will be forthcoming relative to the preservation and protection of forest trees

THE ENGLISH COLONIES.

Four of the five Australian colonies, Victoria, New South Wales, South Australia, and Queensland, are represented at the Exposition. The fifth colony, West Australia, a penal settlement of scanty population, sends nothing. The vast gold production of Australia and New Zealand is represented by a tablet which faces the visitor at the entrance of the Victorian section. This gives statistical figures showing that, since 1851, the colonies have produced $1,220,823,034, a vast sum which affords an idea of the great *rôle* which the precious metal has played in the development of these young and vigorous provinces. An excellent feature of the Victorian exhibit is a collection of photographs grouped in frames of uniform size, illustrating the scenery, towns, and principal buildings in each of the shires into which the colony is divided. The most striking landscapes are presented in large oil paintings. Wheat, barley, oats, and wool, the last in fleeces of remarkable size, are the principal agricultural products exhibited. There are, besides, a fine collection of minerals, cases of stuffed birds and animals, shelves of ales and wine, cordage, stone ware, and food preparations of all kinds.

The adjoining section is that of South Australia, the agricultural resources of which are better than those of any other colony, although the mining interests are very small. The southern portion is claimed to be the finest wheat-growing country in the world. No less than 112 varieties of wine are shown. A series of photographs represents the rural life of the colonists, and the same graphic means is resorted to to show how a telegraph line was constructed across the island. The most curious exhibit in the section consists in the novel and beautiful objects made of the eggs of the emu. These are as large as ostrich eggs, and have a dark green surface resembling granulated morocco leather. They are superbly mounted in silver. One of the most elaborate pieces represents the egg (which opens and forms a casket) as a rock on a hill overshadowed by a peculiar indigenous tree. On the slopes of the hill groups of natives, in oxidized silver, are seen hunting emus and kangaroos. Another shows a group of gold miners at work, in the egg, and a lively encounter between natives armed with spears and clubs is going on outside in the midst of singular vegetable growths.

The New South Wales court is larger than that of either of the other colonies. A mineral trophy contributed by the Government Department of Mining is, after the great yellow column representing the gold production, the most prominent object. It consists of four large buttresses of coal from different mines, and of specimens of iron, lead, tin, copper, and auriferous ores. There is also a fine collection of tin ore specimens. Among the many photographs is one, a view of Sydney Harbor, which measures five feet by three feet four inches. This was printed from a negative of similar size, and one of the largest in the world. A pyramid of wine bottles, it is said, contains over 100 kinds of wine. There is a small collection of peculiar birds, among them being the "settler's clock" (*dacelo gigantica*) that salutes the rising sun with a sound resembling a laugh, and the Herodias crane that carries, attached to the middle of its back, a number of long skeleton feathers which it can erect at pleasure. Kangaroo leather, used for boot tops, is displayed in abundance, besides excellent exhibits of wool, woolen fabrics, and native woods.

Queensland divides her wall space into black panels, in which are descriptions and statistics of the different parts of the country. Near the appropriate tablets are landscapes, and also specimens of products of the various sections. A gold pyramid, and exhibits of wines, wools, oils, etc., fill the center of the court.

New Zealand exhibits bituminous coal from sixteen different seams, a pyramid of gold, a fine collection of ores and samples of crude petroleum too heavy for anything but lubricating purposes. A singular substance is the Kauri gum, a vegetable deposit found about six feet below the surface of the ground, in lumps of all shapes and sizes. It is supposed to have been distilled by Nature from a species of conifer. It is worth $200 a tun in New Zealand for making varnish. There are also some good specimens of the *phormium tenax* or New Zealand flax, worked into ropes and mats, and an interesting collection of garments, weapons, etc., of the Maoris, besides industrial products of all kinds.

Tasmania shows principally wool, wheat, and the dressed furs of a number of singular animals found only in the Australian group, including the platypus, kangaroo, wirubut, bandicoot, and the Tasmanian devil. There is a curious jelly for table use among the food productions, made of sea weed, and a photograph of the last aboriginal Tasmanian, the sole member of a race supposed by Haeckel to be nearest of all to our alleged monkey ancestors.

Ceylon sends coffee, nutmegs, tapioca, pepper, gums, and gamboge, all raw products. Singapore sends a similar display, with the addition of some plumbago, and an elephant carved in that material by a native. Mauritius displays samples of arrowroot, sugar, medicinal plants, and a collection of ethnological types. The Archipelago of Seychelles, a dependency of Mauritius, sends sixty-seven varieties of woods, besides cocoa, cloves, and coffee.

The Cape of Good Hope covers the inside of the allotted section with skins of wild animals and elephants' tusks, and crowds the space inside with ostrich plumes, dried plants, wools, etc. There are some curious necklaces and bracelets of melon seeds and steel beads, ostrich eggs converted into cups and card baskets, and a model of a leviathan incubator, flanked by two ostrich chicks as specimens of its work. The Gold Coast colony exhibits curiously artistic gold ornaments and wood carvings, the work of natives.

Jamaica, West Indies, displays nuts, barks, spices, rum, arrowroot, and yam flour, breadfruit meal, cassava starch, coffee grown at 5,000 feet above the sea level, said to be the finest in the world; beautiful fancy articles made from a lace bark of the lagetta tree, and artificial flowers, looking like wax work, but formed from the cuticle of the leaf of the *Yucca aloifolia*. The Bahama Islands send exquisite wreaths and sprays made from little pearly white shells, baskets made of mimosa beans, and specimens of tortoise shells, sponges, etc. Bermuda contributes corals, palm leaf fans, cups and boxes of cedar, and a model of the great floating dock, besides sending frequent shipments of vegetables to Agricultural Hall. From Trinidad we have fifty-seven samples of native woods, crude gutta percha, Angostura bitters, crude asphalt from the great Pitch Lake, and various vegetable fibers adapted for cordage. Guiana sends samples of sugar and rum.

This completes the list of the productions of the English colonies: a display which for completeness and instructive value is, as a whole, one of the finest in the great Fair.

Progress of the Railway Tunnel under the Hudson River, New York city.

In April, 1875, we gave the details and drawings of the Hudson River Tunnel, projected by Mr. D. C. Haskin, of this city, and designed to establish direct railway communication between New York city and Jersey city. The work was begun by commencing a vertical shaft of brick masonry, 30 feet in diameter and 4 feet thick, at the junction of Jersey avenue and 15th street, on the New Jersey side, between the present depots of the Erie and Delaware and Lackawanna railways. After the shaft had reached a depth of about 20 feet, the Delaware and Lackawanna Company commenced legal proceedings to stop the work, obtained injunctions, etc., and, by resort to various legal quibbles, managed to delay the enterprise until the present time. The Hudson River Tunnel Company has, however, come off finally victorious, the injunctions are removed, and the construction is now to be proceeded with. It is understood that the wealthy Senator Jones, of Nevada, furnishes the capital, the estimated cost being ten to fifteen millions of dollars. The shaft on the Jersey side is to be carried down 65 feet. The horizontal tunnel under the river will then be commenced. The latter is to be 26 feet in diameter.

A NEW TEST COLOR.—The flowers of the violet and iris have recently been found to yield a very fine blue color, which is a more delicate test for acids and alkalies than the solution of litmus commonly employed. The name of the new color is phyllocyanin. It will probably before long find its way into all chemical laboratories

(*Continued from first page*).

ports are also obtained by the same eccentric and wrist plate, but with greater rapidity, as the travel is greater on the opening of the exhaust.

The constant variations of load upon the engine are communicated to the steam valves instantly by the governor. The latter is extremely sensitive, and in reality performs very slight labor, since it puts forth only the force necessary to move a small stop, and indicates merely the change required, to the levers which move the valves. There is an ingenious stop motion provided, which, should the regulator become inoperative through any cause, effectually prevents the engine running away. The mechanism is such that the steam valves are then not allowed to hook on, and therefore they cannot open. Consequently the engine is stopped by this mechanism alone, although the screw valve may be wide open.

The principal improvement to which it is the object of the present article to direct the reader's attentention, as has already been noted, is found in the means of packing the valve stems so as to obviate the stuffing boxes, while at the same time rendering them self-packing. Hitherto, in order to prevent the grinding of the cast iron faces of the valve and bonnet, a collar has been placed out on the valve stem so as to bear against a heavy cast iron bracket or bonnet secured to the side of the cylinder. This counteracted the thrust on the valve stem—if we may use the term—due to the steam pressure within, which otherwise would force the faces mentioned together, cause wear, and speedily render the mechanism untrue. In addition to this collar, the usual gland and stuffing box for the valve stem were required. Apart from there being here a multiplicity of parts, which it would be a great advantage to simplify, the casting, of course, had to be painted, and the paint in time would, by the heat, become cracked and worn; while the lubrication of the stem, with consequent unsightly dripping, aided in rendering the whole contrivance one for which a neater and better arrangement might well be sought.

The new device which has lately been substituted (but which has now been tested by the manufacturer for nearly four years), and a sectional view of which is given in Fig. 3, seems to remove all difficulties. It obviates the stuffing box completely, and shifts the thrust collar from the outside to the inside of the cylinder, and, abolishing the extra cast iron bracket, causes the collar to bear directly against the bonnet, E. D is the valve stem on which is shrunk the steel collar, F, which, as shown, fits in a recess, *a*, of the bonnet. The opposing faces are finely scraped in manner similar to planer slides or lathe ways. Consequently they approximate very closely, and are packed by the steam itself acting outward on an area equal to the section of the valve stem, D. It will be seen at once that the joint is self-packed, while its chances of wear are exceedingly small, certainly very minute in comparison to what might be the case with cast iron surfaces, perhaps 8 inches in diameter, under other arrangements. The bonnet, E, now becomes a finely polished casting, rendered light by the hollow chamber within. Into this space all drip enters, and is carried off by the pipes, G, which, as shown in the large engraving, extend from bonnet to bonnet, so as to keep all clear and empty.

The other improvement which may be noted is not represented in the engravings. It is, however, a novel piston packing, devised by Messrs. Babbitt and Harris, and which has been in practical use by them for some four years and a half. Its efficiency will be understood from the fact that single-acting engines, in the cylinders of which it has been applied, have frequently run for an entire day at a time with the back cylinder head off, and this with no leakage past the piston. The general construction is simply a packing ring, in sections, inserted in a groove in a chunk ring, and held out, not by steam, but by spiral springs made of German silver. When steam is admitted into either end of the cylinder, the packing ring is carried by the steam over to the side of the groove in the chunk ring, making a joint there and allowing the steam to pass down by and under the packing ring. The latter is thus balanced, while a very light spring is able to exceed the action of gravity and hold the ring out. The packing is very easily taken out and put in, as it is all held in its place in the chunk ring by pins for that purpose, which are removed before putting on the follower. It is stated to be free from the defects of steam packing, and, with proper cylinder oil, not to require renewal for years. The engine is comely in all its proportions, as the engravings show, and finished in the best manner possible. It remains now to sum up briefly the advantages which are claimed for the machine, which claims seem, from its construction, to be well founded. They are economy of fuel, wear, oil, and all that relates to the production of power; an increased amount of work, regularity of speed under varying load and pressure, accessibility of all parts; no portion of the regulating medium acts through stuffing boxes nor enters the steam chest, nor is out of sight of the engineer; the cylinders are bored out of hard, strong iron; the shafts are made of hammered wrought iron, with ample bearings; the stop motion, as already explained, prevents running away; and the recessed valve seats prevent the possibility of shoulders wearing on them. Lastly, and we reserve it to the last because it is a point the value of which we have frequently urged upon engineers, the small parts of the engines are interchangeable; and therefore should accident occur, the injured portion can be speedily and accurately replaced from the manufactory. The manufacturer even keeps extra cylinders on hand to meet such emergencies, while, by the aid of special tools, he is enabled to construct the whole engine, from 10 to 1,000 horse power, in a manner both thorough and exact.

The machine is based entirely on the Corliss system, and was constructed under the same patents during their continuance. It therefore embodies the advantages of engines of that type, together with those secured by the improvements invented by its manufacturer.

The Harris-Corliss engine gained gold medals at the Cincinnati fairs of 1873, 1874, and 1875, and in the last-mentioned year an additional premium of $300 in gold. It is not exhibited in the Centennial Exposition, we are requested to state, on account of the inability of the manufacturer and the Centennial authorities to reach an arrangement satisfactory to the former. For further information, address the manufacturer, Mr. William A. Harris, Providence, Rhode Island.

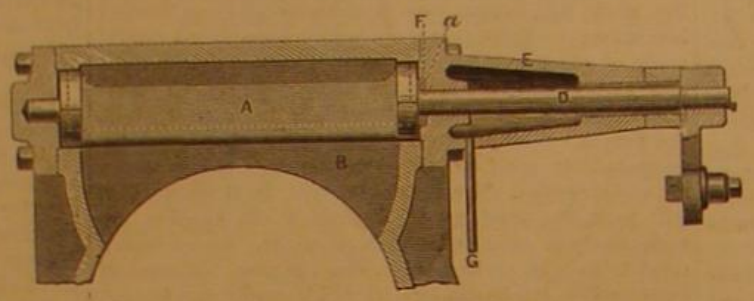


Fig. 3.—THE HARRIS-CORLISS STEAM ENGINE.

Why is the Sea Salt?

Professor Chapman, of University College, Toronto, says that the object of the saltness of sea water is to regulate evaporation. If any temporary cause raises the amount of saline matter in the sea to more than its normal value, evaporation goes on more and more slowly. If the value be depreciated by the addition of fresh water in undue excess, the evaporating power is the more and more increased. He gives the results of various experiments in reference to evaporation on weighed quantities of ordinary rain water and water holding in solution 2·6 per cent of salt. The excess of loss of the rain water compared with the salt solution was, for the first twenty-four hours, 0·54 per cent, at the close of forty-eight hours, 1·46 per cent, and so on in an increasing ratio.

IMPROVED FOUNTAIN PEN.

The annexed engravings represent an ingenious little invention, well calculated to be of service to the large class of persons who constantly use the pen. It is a fountain attachment for pens of all kinds, easily attached and detached, and supplying a large quantity of ink without interfering with the elasticity of the pen. The disadvantage often met with in fountain pens, no one of which, of course, can be constructed to suit the requirements of all hands, is thus avoided, for the writer, after securing a pen that suits him, has only to apply the attachment.

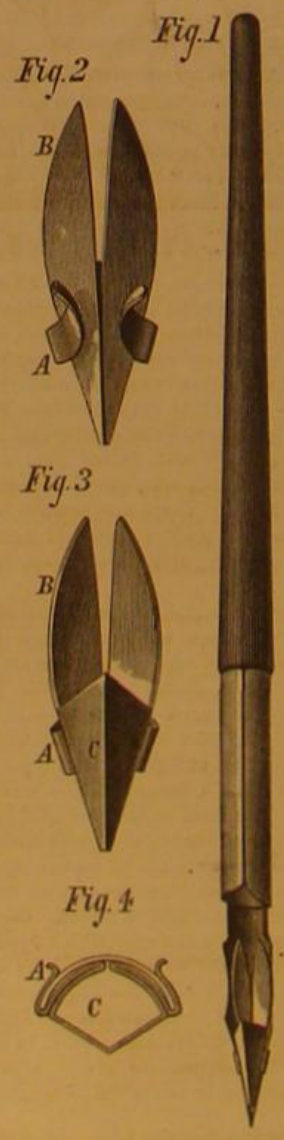


Fig. 1 of the engraving represents the device in full size and in place. Figs. 2 and 3 are, respectively, front and rear views enlarged. Fig. 4 is a transverse section. It is made of one piece of sheet metal having clasps, A, bent up from elongated wings, B, which last are separated by a slit and fitted to the concave inner side of the pen. Below the wing plates is the reservoir, C, whence the ink flows down to the point of the pen The spring clasps firmly secure the device to the pen in the manner indicated in the sectional view.

The inventor states that the large quantity of ink taken up at one dipping is always under control, and that a clear sharp outline is left by the pen. The capillary attraction of the inner sides of the device is so great that the possibility of the ink dropping out, when inverted, is avoided, while the quantity of ink contained will last from 20 to 30 minutes The attachment, being made of gold or silver, or heavily plated, is unaffected by the action of the ink, and will last indefinitely. Patented through the Scientific American Patent Agency, June 13, 1876. For further information, address the inventor, Mr. Henry H. Perkins, P. O. Box 585, Utica, N. Y.

To Preserve Flowers and Plants.

The following instructions are from the pen of Rev. G. Henslow, one of the best practical botanists in England.

The materials required are common cartridge paper, thick white blotting paper, cotton wadding, and millboard, all cut to the same size. The plants should be gathered in dry weather, and soon after the flowers open, when their colors are brightest. Succulent plants such as daffodil, orchis, or stone crop) should be put into scalding water, with the exception of the flowers, for a minute or two, then laid on a cloth to dry

Arrange the specimens and papers in the following order: Millboard, cartridge paper, wadding (split open, and the glazed side placed next to the cartridge paper), blotting paper, the specimens, having small pieces of wadding placed within and around the flowers to draw off all the moisture as quickly as possible, blotting paper, wadding as before, cartridge paper, millboard. When the specimens, etc., are thus arranged heavy weights should be put on them; about 30 lbs. the first day, 60 lbs. afterwards. Remove them, from under pressure, in a day or two; carefully take nway all the papers, etc., except the blotting papers between which the specimens are placed; put these in a warm air to dry, while the removed papers, etc., are dried in the sun, or by the fire. When dry (but not warm) place them in the same order as before; put all under the heavier pressure for a few days, when (if not succulent) they will be dry.

Flowers of different colors require different treatment to preserve their colors. Blue flowers must be dried with heat, either under a case of hot sand before a fire, with a hot iron, or in a cool oven. Red flowers are injured by heat; they require to be washed with muriatic acid, diluted in spirits of wine, to fix the color. One part of acid to three parts of spirit is about the proportion. The best brush with which to apply this mixture is the head of a thistle when in seed, as the acid destroys a hair pencil, and injures whatever it touches (except glass or china); therefore it should be used with great care. Many yellow flowers turn green even after they have remained yellow some weeks; they must therefore be dried repeatedly before the fire, and again after they are mounted on paper, and kept in a dry place. Purple flowers require as much care, or they soon turn a light brown. White flowers turn brown if handled or brushed before they are dried. Daisies, pansies, and some other flowers must not be removed from under pressure for two or three days, or the petals will curl up. As all dried plants (ferns excepted) are liable to be infested by minute insects, a small quantity of the poison corrosive sublimate, dissolved in spirits of wine, should be added to the paste, which it will also preserve from mold. The best cement for fixing the specimens on to the paper or cardboard is gum paste. It is composed of thick gum water and flour mixed in warm water, by adding the two together, warm, and of a consistence that will run off the hair pencil.

Tree Frog Eggs.

Professor Peters has lately described the mode of deposit of its eggs employed by a species of tree frog (*polypedates*) from tropical Western Africa. This species deposits its eggs, as is usual among batrachians, in a mass of albuminous jelly; but instead of placing this in the water, it attaches it to the leaves of trees which border the shore and overhang a water hole or pond. Here the albumen speedily dries, forming a horny or glazed coating of the leaf, enclosing the unimpregnated eggs in a strong envelope. Upon the advent of the rainy season, the albumen is softened, and with the eggs is washed into the pool below, now filled with water. Here the male frog finds the masses, and occupies himself with their impregnation.

Aerolite in Kentucky.

The Louisville *Courier-Journal* states that on July 18, at 4 A.M., Mr. White, watchman of the Weatherford engine house, while on duty, was startled by a loud report like that of a pistol, and instantly following some heavy substance feel into the street a few feet distant. Mr. White searched, and found imbedded in the ground a stone, of the appearance of dark flint, weighing about two pounds. The stone was broken to pieces and examined during the day by several scientific gentlemen, who pronounced it genuine meteoric substance. The probable solution is that the explosion occurred at a greater distance than was supposed, and that this was but a small fragment of a large aerolite.

MEDIÆVAL IRON WORK.

Some of the most interesting relics of the middle ages are to be found in the specimens of metal work which adorn many old mansions in Europe. It is astonishing to see the beauty of proportion and detail, the adaptation of the object to its purpose, and the elaboration of the work, and then to reflect that the whole design was the creation of the smith who performed the labor, who thought out the graceful form at the time he wielded the hammer. Schools of art, so called, there were none in those days; but every workman received, unconsciously, an art education. In Germany, especially, the apprentice traveled from place to place, learning the art, and improving his mind as he went. He saw the church of St. Sebald, in Nuremberg, with its shrine or tomb, on which Peter Vischer and his five sons labored 13 years; he saw the wonderous cathedral of Munich, the Church of the Apostles at Cologne, and the wonderful gothic minster at Antwerp. And in nearly every city he visited, he found articles of every day use fashioned with rare skill and pure taste; and so he acquired the art of construction and ornamentation at the same time, and learnt that use and beauty are, in all true art, inseparable.

We illustrate herewith a wrought iron window grille or lattice, made in the sixteenth century and now to be seen in a house at Ratisbon in Bavaria, a city which can boast numerous works of art industry from the hands of mediæval artists. The design is remarkably graceful, and the elaborate workmanship shows skill in handicraft of the very highest order.

WINDOW GRILL AT RATISBON, BAVARIA.

Rheumatism.

The *Journal des Connaissances Médicales* contains a review of certain curious observations made by Dr. G. Esbach on the conformation of the fingers in various diseases. In persons that perspire easily, or in the case of disorders that induce profuse perspiration, such as rheumatism, typhus fever, etc., the transversal curvature of the nail is increased to exaggeration. This symptom, which scarcely ever fails to present itself in rheumatic subjects, has led Dr. Esbach to establish, by a statistical method, the sudoral etiology of that affection, and in the immense majority of cases he has found the following result: A man who perspires easily, and who inhabits a ground floor, becomes, sooner or later, rheumatic; if, on the contrary, he lives in a dry apartment, he is never troubled with that malady. On the other hand, a man who is not subject to perspiration may live in a damp room with impunity. Rheumatism appears thus to be placed on its real ground; dampness may be the cause of it, but only in such habits as perspire freely.

IMPROVED SPANNER WRENCH.

Mr. A. Frank Skinner, of Plattsmouth, Neb., has patented (March 30, 1876) through the Scientific American Patent Agency, a novel improvement in spanner wrenches, which we illustrate herewith.

It consists in providing a nut wrench with two equal arms, of which the rigid one has a pushing point slightly curved, while the pivoted arm has a drag hook on on its end.

A is the handle of the wrench, the forward part of which is curved outward and forward, and is pointed to form the rigid jaw, B, the said jaw and handle being thus formed in one piece. C is the movable jaw, upon the outer end of which is formed a hook, and its inner end is inserted and pivoted in a socket formed in the angle at the intersection of the jaw, B, and handle, A, as shown in the figure. In forming the wrench the handle, A, and jaw, B, are forged in one solid piece, and an eye or socket is punched in it to receive the loose jaw, C, which is then formed and pivoted in the said eye or socket. In this way a very convenient and effective instrument is produced, having great strength and power, and adapted to fit any spanner nut.

A New Way of Allaying Dust.

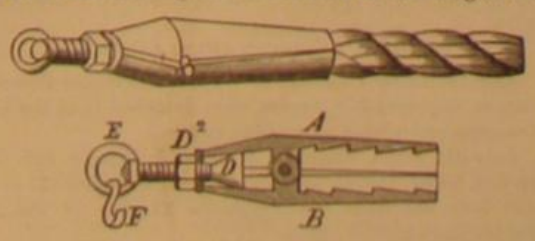
Mr. A. Houzeau has recently suggested to the French Academy of Sciences a mode of preventing dust on roads, etc., which, if experience demonstrates its practicability, will be found both simple and useful. He proposes simply to mix with the water, wherewith the thoroughfares are sprinkled, a small quantity (amount not stated) of chloride of calcium. This, he thinks, will form a patina or crust of considerable resisting power, which will last for several days and which will hinder both the drying of the soil and its disintegration by vehicles, etc. At the same time it will prevent the growth of weeds, and thus, on private roads and walks, prove labor-saving. A similar application of salts in solution was made in London three years ago, with complete success

Vegetable Leather.

A new utilization of sea weed is suggested in the manufacture of a fabric named as above. Sheets of carded wadding are placed on hot polished metal plates, and coated with a concentrated decoction of sea weed, lichen, pearl moss, or other mucilaginous vegetation. The sheet is then dried quickly, thus giving to the surface applied to the metal plate a gloss like that of leather. Rolling and compressing between heated cylinders follows, and then a coating of boiled linseed oil is applied. Afterwards a thin coating of vegetable wax is given, and another rolling to soften the sheet finishes its preparation, when it is ready for bronzing, or any other treatment.

A SIMPLE ROPE CLAMP.

A simple clamp, by which a rope's end may be tightly secured, was patented January 4, 1876, by Mr. Levi H. Page, of Chicago, Ill. The clamping jaws, as shown in the engravings, are formed by two semi-tubes, A and B, made with teeth on their inner faces to hold the rope and prevent its slipping out. A pin, C, passes through lugs on each to form a hinge joint. This pin may be removed to attach the end of the rope by placing it on one jaw, when the other is laid upon it and the pin inserted. An inclined groove is cut in the solid ends of the clamping jaws, above the hinge, to receive a wedge, D, which is formed on the edge of the spirally threaded stem, on which is a nut, resting against a washer. E is a swivel ring on the end of the stem, D, and F a hook on the ring for attachment of the weight to be



lifted, or whatever else the rope is to be fastened to. When the rope is inserted between the serrated jaws, and they are connected by the pin, by turning the nut, D^2, the wedge, D, acting against the inclined faces of the recesses, the jaws will be forced against, and the teeth into, the rope, holding it firmly.

THE weight per yard of cast iron pipe in lbs. is found by subtracting, from the square of the outside diameter in inches, the square of the inside diameter in inches, and multiplying the remainder by 7·35.

The Great Suspension Bridge over the East River between New York and Brooklyn.

The towers and anchorages of the East River bridge are now about completed, and the work of constructing the bridge proper will shortly begin.

The plan of operations, as given by the engineer, is as follows: A steel rope, three fourths of an inch in diameter, will be temporarily fastened to the New York anchorage, thence conveyed over the top of the tower and the coil conveyed to Brooklyn by means of a scow. The rope will then be passed over the Brooklyn tower and to the anchorage, but will be left slack and under water until late at night or early in the morning, when few vessels are passing, when it will be pulled taut. This steel rope will be also temporarily secured to the Brooklyn anchorage and the coil borne back to New York by the scow, and the ends connected, thus forming an endless rope, working on pulleys at each anchorage and on each tower, and worked by machinery on the Brooklyn side. By means of this endless rope other similar ones will be put up as required for the further construction of the bridge. First, two steel wire ropes, 2¾ inches in diameter, will be carried across and made secure to temporary fastenings at each anchorage. These will be 3½ feet apart, and placed a little to the south of the middle of the tower, running over the top. They will be used for the construction of a temporary bridge for the use of the workmen. Oak planks, 1¼ inches in thickness, will be laid upon the ropes, with spaces of about half an inch, both for the purposes of economizing material and to lessen the effect of the wind upon it. They will be fastened by strips running lengthwise across the ends, which will be bolted to the ropes by U-shaped clamps.

The bridge will be completed by stretching small ropes on each side about 3 feet above the flooring and secured to every ten feet. It will be rendered firm by guys.

Three other steel ropes, of the same magnitude as those used in the construction of the foot bridge, will be stretched across the river over the tops of the towers—one 27 feet south of the foot bridge at the edges of the piers, one over the north edges, and one midway between the north rope and the foot bridge, with a space between the north and south ropes of 81 feet. The object of these last-mentioned ropes is to support small cross bridges, technically called cradles, and necessary for the construction of the other portions of the bridge.

There will be five of these cradles, one in each land span between each tower and its anchorage, and three at equal distances in the river span. They will project 10 feet beyond the outside cable, and will support pulleys for the endless ropes. The whole temporary structure will be 200 feet above high water at its center and lowest point, so that no water craft will be interrupted by it. After this work is completed, the construction of the bridge proper will be proceeded with, and the first step will be the stretching of the main cables, which will be put up at the same elevation as the temporary bridge and lowered. These cables will be composed of nineteen strands, each strand being made up of 330 wires, No. 7 gage—that is a little more than ¼ of an inch in diameter. The material used will be the best quality of steel wire. The ropes of the temporary bridge will not be taken down, but finally incorporated into the superstructure of the bridge.

A NEW INSECT POWDER GUN.

This is one of those simple little devices which frequently prove very remunerative to the inventor. It is a substitute for the numerous more costly syringes, bulbs, and spring powder ejectors, now employed for throwing insecticide powder into crevices of furniture, etc.

It is simply an elongated rubber bulb or nipple, the forward part of which is tapered to a point, and is curved to one side, as shown. The other end of the bulb is open, is inclined, and has a collar formed upon it. By this inclination of the collar, when the rubber is applied to the neck of a bottle and is held in a horizontal position, a quantity of the powder will rest in the belly of the bulb, and can be projected upward by compressing the said bulb.

The device may be made with its pointed end closed so that it may be applied to the neck of a bottle containing the powder, and sold with said bottle. In this case the buyer cuts off the point of the bulb with a pair of shears. It was patented through the Scientific American Patent Agency (May 30, 1876) by Mr. C. B. Dickenson, of Brooklyn, N. Y

(For the Scientific American.)

EFFECTS OF TIDE CURRENTS ON HARBORS.

The effects of running water are very strikingly perceptible on the banks of rapidly flowing rivers. The channels of the Missouri and Mississippi rivers are continually changing; and the griefs of shipowners and captains, and the shrewd devices of pilots on this account, have been most attractively depicted by Mark Twain. Many a time has a planter retired, with his home and plantation on one side of the river, and awakened in the morning to find that the river had cut a new channel on the other side of his property. The crescent-shaped bayous so common along the south Mississippi, are results of this change of river bed by washing across from one curve to another in a straight line, instead of following the direction of the bend. The work of Captain Eads, now in progress at the mouth of the Mississippi, shows both the effect of water disposition and the ability of man to counteract it by means of jetties which produce scouring action.

That the waves and tides are materially and constantly modifying the physical geography of the sea coast has been long observed. Places which were once on the very edge of the sea are now removed to the distance of miles from the coast line by the agency of tidal deposit; and others, which were formerly at considerable distance from the water's edge, have since been washed away by tidal erosion. The famous Pass of Thermopylæ, which was, in the time of Herodotus, so narrow that but a small squad of soldiers was necessary to prevent the passage of the whole Persian army, is now separated from the sea by a vast area of marine deposit.

Professor J. E Hilgard, of the United States Coast Survey, has made some interesting observations regarding tidal influence on harbors, and the modifying effects of encroachment to meet the growing necessities of large cities. It is well known that a tidal wave, when uninfluenced by the contour of the coast, is but inconsiderably elevated, and the front slope is about equal in length and similar in form to the rear slope. But as it enters a bay, harbor, or river, the crest of the wave becomes more elevated as the passage for it becomes more constricted, and also the front slope acquires much greater abruptness than the opposite one. Consequently the time occupied by the flood tide is shorter than that occupied by the ebb tide. This phenomenon of tides may be artificially illustrated with a very small amount of water, by dashing a bucketfull horizontally upon some uneven surface, with projecting points and indentations to represent capes and bays. If the water is projected with slow motion, it will be seen to rise but little at the projecting points, and to rise much higher in the indentations or bays, and the slopes of the waves will present the peculiarities already mentioned.

In the Delaware bay and river, the difference between the mean rise and fall at the Delaware Breakwater and at Philadelphia is only 2½ feet, while the difference of luni-tidal interval between the two places is nearly six hours. At the former place, the mean duration of the flood and ebb tides is about the same, showing that the tide wave has here about the same slope on its front and rear sides; while at Philadelphia, the time of ebb exceeds that of flood tide by about 2½ hours. At the head of the Bay of Fundy, the mean hight of the tide is 36 feet, and at spring tides, 50 feet or more. And here the tide rises so rapidly—owing to the very abrupt front slope of the tidal wave—that cattle feeding on the shore, and sometimes people, are often overtaken and engulfed or drowned. In the Severn river, England, above Bristol, the whole rise of 18 feet takes place in 1½ hours, and the fall requires 10 hours. As a result of this variation of slope, when a flood tide enters the mouth of a bay—which is usually a comparatively narrow strait—its rapid flow through the strait carries sand and mud with it; and when the water spreads out in the basin beyond, and thus slackens its velocity, it deposits sediment in extensive flats opposite the entrance. The ebb, being more gradual, only washes little channels which converge from all directions to the outlet, leaving much of the deposit behind. Since the amount of water entering a harbor is about equal to that which leaves it at the next ebb tide, it may seem at first thought that the sediment carried out would just equal that brought in; but when we remember that the rise of water is more rapid than its descent, we clearly see that this cannot be. While, therefore, the accumulation of sediment in well sheltered harbors cannot well be avoided, there is one thing which is very largely under human control, and affects very materially the value of harbors for commercial purposes. Man has it in his power to make deeper or shallower the channels of entrance and exit to a harbor by modifying the water capacity of the enclosed basin.

Professor Hilgard affirms that the depth of the channels "will depend, in a great degree, on the proportion of the area of the basin to the outlet, or, in other terms, on the difference of level which will be reached during the ebb between the basin and the ocean, which determines the greatest velocity and transporting power reached by the ebb stream." And even the flats, which are bare at low water, form an element of importance in fixing the depth of the channel. These flats furnish space for the excess of water at flood tide, and also, by their friction, retard the water in its outward flow. The velocity of water, and hence its scouring effect, is due to the hight of the water column rather than to its area; but while the rapidity of scour is due to its hight, the continuation of its effect must of course depend upon the amount of water. From this we obtain an idea of the risk to harbor navigation which must necessarily attend any encroachment upon the water capacity of a harbor. To emphasize the important lesson he aims to impress, Mr. Hilgard offers as illustrations the two harbors of New York and Charleston.

Of the two entrances to New York harbor, the channel through the Sound is subject to but little natural modification. But it is widely different at the Sandy Hook entrance. In the place where the beacon on the end of Sandy Hook now stands, there was 40 feet of water 15 years before it was built. The cause of this accumulation is attributed to a northward current along both sides of the Hook. This invasion of Sandy Hook upon the best entrance to New York harbor is not a matter to be lightly considered. The depth of this channel, at mean low water, is 22 feet, and is maintained by the water (1) in Raritan Bay and east of Staten Island, (2) in Newark Bay and on Jersey flats, (3) lower waters of the North river, and (4) the Sound tide flowing through Hell Gate. The effect of the last of these is chiefly due to the fact that the Sandy Hook tide wave reaches the docks at New York before that from the Sound, the two meeting at Hell Gate; and the conditions of this tidal circulation are such that, if at the point of meeting a partition were placed, the water on one side would be sometimes 5 feet higher, and at other times 5 feet lower than on the other side. Even in the absence of such a partition, in the most contracted part of the passage the water is often a foot above its level only 100 feet distant. Hilgard estimates that the closing of Hell Gate would cause a loss of not less than 3 feet in the depth of Sandy Hook channel. The effect on this channel of the first three divisions is dependent upon the amount of water and its distance from the bar. The direct and necessary effect of diminishing the area of the tidal basin is to diminish proportionally the depth of the channel. He ventures the assertion that the proposed enterprise of occupying the Jersey flats with docks and wharves "would occasion a loss of not less than 1 foot in the depth of the bar off Sandy Hook, and certainly not more than 2 feet." And he very significantly adds the following remarks, which should not go unheeded: "When we yield to the demands of commerce any portion of the tidal territory, to be used for its wharves and docks, we must do so with full cognizance of the sacrifice we are about to make in the depth of water over the bar; and in order to form any well founded judgment in regard to the effect of such encroachments, it is necessary to be in possession of the fullest knowledge of all the physical facts involved in the problem, and no measure of encroachment should be determined upon except in pursuance of the advice of scientific experts."

Professor Hilgard seems to attribute the cutting-out of harbor channels to the slow ebb scour entirely, and not at all to the more rapid flood tides. The latter would seem to us most likely to produce the greatest scouring effect. And this would be consistent with the two facts stated by him: that sand accumulates at the bar by being thrown up by waves of the sea; and that the inflowing tide carries the sand and mud with which it is charged into the inner basin, and there deposits it, gradually filling up the harbor. In either case, the amount of scour would seem to depend equally upon the capacity of the tidal basin. But it is probable that much of the sediment is washed down the rivers which flow into the harbors, and settles to the bottom, while the river water is backed up in the harbors by the incoming tide.

During the rebellion, a stone fleet was sunk in the channel at the entrance of Charleston harbor, where the channel was 12 feet deep at low water. The submerged fleet caused a shoal to form, so the water here is now only 7 feet deep; but each side of this, a narrow channel has been scoured out, one 12 and the other 14 feet deep. Furthermore, 4 miles south of this point was formerly a much frequented passage for southern traffic; but since the fleet was sunk, this channel, at first 9 feet deep in low water, has become so filled up that it is now only 3 feet deep, very seriously to the disadvantage of easy communication with southern ports. From this, says Professor Hilgard, "we are warned how carefully all the conditions of the hydraulic system of a harbor must be investigated before undertaking to make any change in its natural conditions, lest totally unlooked-for results be produced at points not taken into consideration."

S. H. T.

Naval Items.

The United States Steamer Saco has been in commission ten years, and now returns to Mare Island, Cal., to be put out of service. Though the hull is quite rotten, and the boilers worn out, the engine is reported as being as good as on the day it was finished. She has steamed about 150,000 miles.

NAVAL ENGINEER CORPS GAZETTE.

July 20. Chief Engineer J. W. Whittaker and Passed Assistant Engineer J. S. Ogden were detached from the U.S.S. Congress and placed on waiting orders.

July 21. Chief Engineer William J. Lamdin was placed on sick leave, having been condemned by a medical survey, and detached from the Pensacola flagship of the North Pacific station.

July 21. The leave of absence of Passed Assistant Engineer L. W. Robinson, who is assistant to Chief Engineer John S. Albert, U.S.N., Chief of the Bureau of Machinery at the Centennial Exhibition, has been extended six months from the 1st of August next.

THE longer Portland cement is in setting, the better it will be. At the end of a year, 1 part of cement to 1 part of sand is about ⅔ the strength of neat cement. Strong cement is heavy, blue grey in color, and sets slowly. The less water used in mixing cement, the better

Japanese Paper.

In Japan, paper finds a very wide field of usefulness, outside of the commoner but perhaps more important applications, for writing, printing, wrapping, and wall paper. The peculiar strength and toughness of Japanese paper fit it for many uses which would hardly be anticipated. Japanese paper handkerchiefs, with which we are all familiar, are quite soft, and pleasant to use, and at the same time nearly as tough as cloth; and from twisted strips of paper torn from these, an excellent string may be temporized, really quite strong and serviceable.

In Japanese houses, paper not only covers the walls and ceilings, but is used on light sliding doors which divide one room from another, and on the folding screens which protect from the too abundant drafts. Light wooden frames, on which a single thickness of paper is stretched, form the windows, admitting light but not sunshine, and air in plenty but not wind. These paper *shoji*, however, as might be expected, fail completely against rain, and must be supplemented by sliding-to or outside wooden storm doors.

Made waterproof with oil, paper serves for umbrella covers and rain coats, and in large sheets is used to protect baggage and merchandise.

In the form of an admirable artificial leather, it is used for pocket books, boxes, etc.

An inferior pasteboard is also made from paper, which is sometimes used for boxes. Thin sheets of wood, however, cut by hand with a large plane, being both cheaper and better, usually replace this material.

Articles of *papier maché* are common, but are usually disguised by lacquer, and can hardly be distinguished from ordinary wooden lacquer ware.

Japanese paper is usually made from the inner bark of the paper mulberry (*Broussonetia papyrifera*), which is grown and cultivated for the purpose. The bark of the *passerina Gampi*, and of the *Edgeworthia papyrifera*, are also said to be used.

Japanese paper is always made by hand, and is therefore of necessity made in small sheets; the more common size, known as *kanshi*, being about nine and a half by twelve and a half inches, though both larger and smaller sizes are used to a limited extent.

The paper as generally sold is unsized, the thick india ink used for writing rendering size unnecessary; but there is special paper called *ro-biki*, or *bidoragami*, very thin and translucent, used for blank books, etc., which forms an exception to this rule. The size used in the manufacture of this paper is said to be made from the bark of a species of hydrangea (*h. paniculata*).

Japanese paper is never bleached, and has usually a faint yellowish or greenish tinge. Its texture is rather loose, and very fibrous. Generally the fibers lie parallel to the shorter edge of the sheet, and in this direction the paper tears easily, while in any other line it tears with difficulty. In certain kinds of paper, made for rain coats, wrapping paper, etc., the fibers seem to cross each other, so that it is difficult to tear the sheet in any direction.

The paper mulberry shrubs, which supply the raw material for papermaking, are grown by the farmers in the vicinity of their villages, on the borders of their rice fields, or on the narrow ridges of earth which divide one rice field from another, and very rarely on ground specially devoted to the purpose.

The scraped and dry bark, in quantities of about 33 lbs., is boiled with a strong lye for about two hours, or until the mass becomes sufficiently tender. It is then put into bags or baskets and submitted to the action of running water, in a stream or irrigation ditch, for twenty-four hours, or until the last trace of alkali has been washed out. The lye used for this treatment is made by lixiviating wood ashes, the ash of the common artemisia being employed. According to Zappe, the ash of buckwheat chaff is also used; and in case the fiber does not readily soften, a small quantity of quicklime is added, though the color of the paper is likely to suffer thereby.

To convert the bark thus treated into pulp, it is next beaten, two or three pounds at a time, on a solid slab of oak or cherry, with short heavy sticks, being frequently turned during the operation, so that the fibers may be broken in every direction. This beating is continued vigorously by two persons for about fifteen minutes: at the end of which time, the few pounds operated on have been pretty thoroughly reduced to pulp.

For the manufacture of paper, this pulp must be mixed with a certain quantity of *tororo* or of rice paste.

Four *kan* (33 lbs.) of bark, scraped and dry, yield two *kan* of finished paper: and will make about three thousand to thirty-six hundred sheets of ordinary size and thickness.

Paper of ordinary weight is usually sold by the *jo*, of ten sheets, and the *so*, of two hundred. With some kind of paper the *jo* is twenty sheets, in others forty-eight. Thick paper is always sold by weight.

The Japanese make numerous varieties of fancy paper one of the prettiest being known as devil paper. This is a thin tissue paper on which lace-like patterns are printed in opaque white ink, producing the effect of a most elaborate water marking. This paper is used for fancy lanterns, and sometimes for covering *shoji* or window frames, though it is rather thin for this last purpose. Pasted on glass, it makes a very good imitation of ground or etched glass.

Japanese fans, paper for poems, and wall paper are often very beautifully decorated by painting or printing. The patterns are always artistic, consisting generally of leaves, vines, flowers, shoots of bamboo, etc., very naturally arranged. The wall paper in general use is perfectly white

with a pattern printed in a white opaque ink with a pearly luster. Colored wall papers are rarely used, except for halls and vestibules. This wall paper, like other Japanese papers, is made only in small sheets.

The imitation leather, or leather paper, is made of a special kind of paper, *tozasenka-gami*, of which several layers are employed to give the requisite strength. The inner layers are saturated with oil, *ye-no-abura*, from the fruit of the *Celtis Wildenowiana*, giving the material softness and flexibility. The morocco-like surface is obtained by pressure from an engraved wooden block, and finally the whole is covered with a varnish of lacquer.

"Herr Von Brandt, formerly German Minister to Japan, in a paper* read before the German Asiatic Society, gives a very minute and interesting account of the method of making crape paper, from which I condense the following description: The paper to be craped, ordinary Japanese paper, with some colored design printed upon it, is dampened and spread in a pile on a large slab of wood, in such a way that the edges of no two sheets shall be parallel. Alternating with these sheets are pieces of ordinary white paper, placed between the colored sides of two printed sheets, and sheets of *takanaga* paper. The whole pile is then tightly rolled on a smooth stick, and covered with a long band of dampened linen, rolled diagonally and tightly over the whole. The stick with its roll of paper and cloth is then pressed longitudinally in a rude lever press. The arms of this press are provided with holes through which the ends of the round stick may pass, so that the roll of paper alone receives the pressure. The *takanaga* sheets are made of strong paper, composed of several thicknesses of ordinary paper fastened together with rice paste, which have been previously creased in regular parallel corrugations by a similar process, and which serves to impart the desired regular creasing to the colored sheets when they are together compressed as described. After the first compression, the paper is unrolled from the sticks, and the sheets are separated. The *takanaga* paper is smoothed out, and the pile made up as before, but in such a way that the creasing may come at an angle to the former fold of each sheet. The process is thus repeated seven times, and the sheets finally dried. The paper thus treated resembles crape very closely both in texture and in elasticity.

"The Japanese paper, excellent as it is, does not supply all the wants of the people; and this account would be imperfect did I not allude to the manufacture of paper from rags, after foreign methods, which is now being conducted on a large scale in several parts of Japan. In Tokio alone there are three or more papermills, fitted with the most approved American and English† machinery, and capable of turning out large quantities of paper. The government consumes large amounts of foreign writing paper; the newspapers use foreign printing paper; and the educational institutions require, in addition to these, drawing paper, book paper, etc. All of these are now made in Japan; and it seems likely that the rude and expensive process of making paper by hand, which I have described in these pages, is soon destined to disappear before the power of machinery, which makes a better paper, at less cost, from inferior and less expensive material.—*Henry S. Munroe, E.M., in American Chemist.*

* "Die Aufertigung des Krepp papiers, Tshirimengami," Mitthiellungen des Deutsches Gesellschaft, 5tes Heft, Juli, 1874, s. 5.

† See Engineering, vol. XXI. pp. 400 421.

Correspondence.

The Centennial Excursion by the Pennsylvania Railroad.

To the Editor of the Scientific American:

President Thomas A. Scott recently extended to the Centennial judges and many of the foreign commissioners an invitation for a trip over the Pennsylvania Railroad and some of its branches, so planning the same that it should combine, with a practical examination of the line and its auxiliaries and resources, all the features of a pleasure trip as well. By the courtesy of other roads the train ran into New York State to see Watkins Glen, Genesee Falls, and Niagara.

This excursion, occupying five days, was made by about 175 gentlemen, representing the various nationalities of the world, and was in every respect a most delightful affair. The party was conveyed by special train, ample in its accommodations, and represented the convenience of modern travel, including the luxury of elegant lunches while running at fifty miles per hour. The company had provided accommodations along the route at the best hotels, and each evening brought a banquet to crown a pleasant day. While traversing the superb roadway of the main line, occasional stops were made to allow an inspection of some of the fine iron bridges designed by Mr. Wilson, the engineer in charge of these structures. At Altoona the extensive shops of the company were visited; the various methods in the transforming of raw materials into engines, cars, and the various items pertaining to the outfit of a railway were examined with great interest. There was much careful note-taking by the foreign visitors; and indeed a fair field for observation is presented here, as operations are on the largest scale, and the assemblage of mechanical appliances is something marvelous, from the giant derrick that picks up a whole locomotive as if it were a baby, and moves it tenderly to any desired point, to the delicate scroll saw that cuts dainty designs in birdseye maple. The testing of axles was very interesting, as showing the extreme care exercised by the company; one could hardly witness it without an increased feeling of security

One hundred axles are made from a given melting, and from that number, five are selected promiscuously, as fairly representing the quality of the metal. These are separately laid between heavy blocks which support the extreme ends, and a wedge-shaped iron, weighing 1,640 lbs., is dropped upon the middle, from hights varying from 25 to 40 feet. If they break, the whole one hundred are returned to the furnace; if not, the ninety-five are used; only the five are remelted, these having, of course, been strained by the severe test. Several were thus tried before the visitors, not one breaking. The great steel works of the Cambria and Pennsylvania Companies were also visited, and afforded much valuable information as to the improved method of manipulating iron. On the grounds of the last named, a steam hammer, striking blows of 200 tuns weight, was seen in operation.

At Williamsport, an opportunity was afforded to see one of the largest lumber mills of the country, a huge monster that drags up the helpless logs from the river and, with a roar and a rush, turns them into a million and a quarter of marketable boards per week, feeding itself on the sawdust which is led automatically under the boiler. Rather monotonous food, though it be "fine board," as some one remarked.

The visit to the oil regions was a very interesting feature of the trip, this industry being so peculiarly American. The sight of derricks innumerable, scattered over a strip of country 150 miles long, some working, others silent and abandoned, was suggestive of the singular history of this most singular traffic. It is now conducted upon a methodical and paying system. Thorough investigation was made of the processes by which the petroleum is pumped from depths of 1,400 feet to the tanks of the different owners, whence, after being gaged, it is drawn by union pipe lines, as they are called, and sent through iron veins, nine miles or more, to the railway station, where, loaded into iron cars, it is dispatched on its mission of lighting the world, and reducing the price of gas. During the visit to this strange region, an incident, not in the programme, occurred; a tank containing a million gallons oil was struck by lightning and burnt, causing a scene very impressive, though not without special pleasure to a gas director. The latest decision of Science is that petroleum is not a distillation from coal but from immense masses of coraline deposit. Fossil coral is found overlying the spongy sandstone in which the oil occurs.

The scenery through the diversified valleys of New York and Pennsylvania was greatly admired; while the romance of Watkins Glen and the grandeur of Niagara each contributed their peculiar enjoyment to the party, and the distinguished gentlemen returned to Philadelphia, enthusiastic over the trip. Colonel Scott was unable to accompany them, but was happily represented by his subordinates, who not only illustrate, in the highest sense, the rare abilities necessary to the best type of modern railway management, but are thorough gentlemen, understanding how to exercise republican hospitality with a grace which called forth the admiration of the foreign and the pride of the native born guests. It is not too much to say that their courteous consideration put hunger, thirst, and discomfort out of the question, and rendered the trip, from beginning to end, a continual holiday.

One very delightful fruit of the excursion was the evident fraternal feeling produced among the gentlemen of different nationalities, brought together under circumstances so favorable to the development of pleasant sentiment. Its expression was frequent and earnest; and when, after a superb dinner at the Cataract House, Niagara, they joined voices in singing with the band each others' national airs, it seemed as if one of the noblest results to go out from our Centennial observance was already in part realized, the quickening of the sentiment of universal brotherhood. Honor to Colonel Scott for conceiving and carrying out so delightful and so useful a scheme. G. S. D.

Aerotherapy.

To the Editor of the Scientific American:

In your issue of July 29, it is stated anomously, that aerotherapy in medical treatment by compressed air is new. I saw it in 1857 at Benn Rhydding, in Yorkshire, England, at a great hydropathic establishment, where there was an apartment of iron, very handsomely fitted up, for the purpose. And in 1875 I saw another, which had been in operation for many years at the Townsend House, the spacious and elegant establishment of Dr. Grindrod, at Malvern, Herefordshire, England.

Portland, Me NEAL DOW.

Logwood Inks.

Logwood inks have been much employed for several years on account of their cheapness and the beauty of their tint; the greater part of the so-called copying inks are prepared at the present time from this coloring matter. Both the rasped logwood and the commercial extract are subject to falsifications; it is well, therefore, to make use of the whole logwood, and rasp or grind it as required; it is necessary, also, to consider the presence of an excess of moisture and of foreign substances, which may be used to adulterate it, as insoluble substances, cutch, etc.

The inks prepared from logwood are of four classes: 1. Inks with logwood and chrome; 2, inks with logwood and alum; 3, inks with logwood and copper; 4, inks with logwood and iron

Runge, in 1848, discovered that a dilute solution of the coloring matter of logwood, to which had been added a small quantity of neutral chromate of potassium, produces a deep black liquid, which remains clear, does not deposit, and may be employed as an ink. Perfectly neutral litmus paper is not affected by it: it does not attack pens; it is very cheap, and so easily penetrates writing paper that it cannot be removed by washing even with a sponge—in a word, it has all the properties of an excellent ink. On exposure to the air in the inkstand, it sometimes decomposes very rapidly, its coloring matter being deposited in the form of large black flakes, which leave a colorless liquid above them. This gelatinization is a great defect in this ink, particularly as one does not know the precise conditions which determine it. Different means have been proposed to prevent this action; the best seems to be that of the addition of carbonate of sodium recommended by Böttger.

The author has used an ink prepared in this manner for upwards of two years, and has not observed any decomposition, although this may to a considerable extent be due to the fact that the inkstand employed was one which allowed but little exposure to the air.

To prepare this ink, take extract of logwood, 15 parts; water, 1,000 parts; crystallized carbonate of sodium, 4 parts; neutral chromate of potassium, 1 part.

Dissolve the extract of logwood in 900 parts of water, allow it to deposit, decant, heat to ebullition, and add the carbonate of soda; lastly, add, drop by drop, with constant stirring, a solution of the neutral chromate in 100 parts of water. The ink thus obtained has a fine bluish black color; it flows well from the pen and dries readily. The chrome ink powder of Platzer and the acid ink of Poncelet are imitations of the original ink of Runge.

An ink obtained from a decoction of logwood and chrome alum is not to be recommended; the characters written with it have little depth of color, and are of a somewhat greyish shade.

Decoctions of logwood to which alum has been added give a reddish or violet color, which darkens slowly, particularly with ink prepared from the wood and not the extract. Such inks prepared with alum alone are costly, because to obtain a sufficiently deep tint one is obliged to employ decoctions or solutions of the extract in a very concentrated condition. It is otherwise when a metallic salt is added along with the alum. Alum produces a reddish purple color in decoctions of logwood, while metallic salts produce in the oxidized solution of the coloring matter a precipitate of a black or bluish black color. These inks are analogous to the so-called alizarine inks; the ink is colored by the tint produced by the alum. Under the influence of air there is produced between the metallic salts and the coloring matter a reaction which determines the formation of a bluish black precipitate. To prevent as much as possible this action of the air upon the ink before it is applied to the paper, there is added, as in the case of alizarine inks, a trace of sulphuric acid, designed to dissolve the precipitate which may be produced. This acidity of the ink has several disadvantages; it attacks the pens used for writing with it unless they are either of gold, platinum, or gutta percha. Sulphate of copper or sulphate of iron may be the metallic salt used in such inks—the former is preferable. One of the best formulas for this kind of ink is the following, given in proportions for a manufacturing scale: 20 parts, by weight, of extract of logwood are dissolved in 200 parts of water, and the solution clarified by subsidence and decantation. A yellowish brown liquid is thus obtained. In another vessel, 10 parts of ammonia alum are dissolved in 20 parts of boiling water; the two solutions are mixed, there being also added ½ part of sulphuric acid, and finally 1½ parts of sulphate of copper. The ink should be exposed to the air for a few days to give a good color, after which it should be stored in well corked bottles.

Böttger gives the following formula: 30 parts of extract of logwood are dissolved in 250 parts of water; 8 parts of crystallized carbonate of soda and 30 parts of glycerin of density 1·25 are added; and lastly, 1 part of yellow chromate of potassium and 8 parts of gum arabic, reduced to a powder and dissolved in several parts of water. This ink does not attack pens, does not mold, and is very black.—*E. U. Viedt.*

Facts and Simple Formulæ for Mechanics, Farmers, and Engineers.

Two hundred and seventy cubic feet of new meadow hay and 216 and 243 feet from large or red stacks will weigh a tun; 297 to 324 cubic feet of dry clover will weigh a tun.

Laths are 1½ to 1½ inches by 4 feet in length, are usually set ½ of an inch apart, and a bundle contains 100.

A tarred rope is about one fourth weaker than untarred white rope. Tarred hemp and manilla ropes are of about equal strength. Wire rope of the same strength as new hemp rope will run on the same sized sheaves; but the greater the diameter of the latter, the longer it will wear. One wire rope will usually outlast three hemp ropes. Running wire rope needs no protection; standing rigging should be kept well painted or tarred.

The coefficient of friction of leather belts over wooden drums is 0·47 of the pressure, and over turned cast iron pulleys 0·28 of the pressure.

A mixture of 9 parts phosphate of soda, 6 parts nitrate of ammonia, and 4 parts dilute nitric acid is a freezing compound which will cause a fall in temperature of 71° Fah.

Three fourths of a cubic foot of water evaporated per hour will produce 1 horse power.

Cold blast iron is stronger than hot blast. Annealing cast-iron diminishes its tensile strength.

The safe load in tuns which an iron chain will withstand equals the square of the diameter divided by 9.

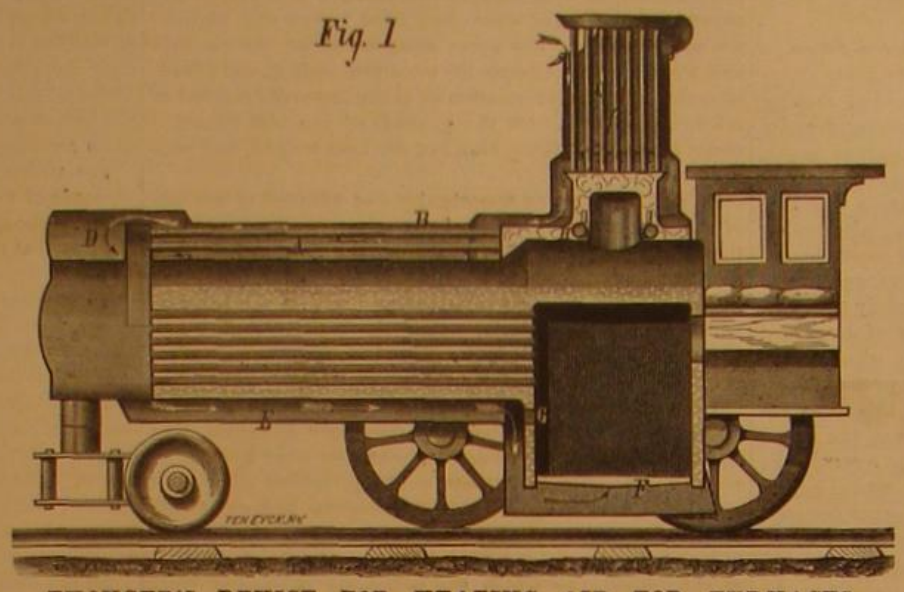
IMPROVED DEVICE FOR HEATING AIR FOR FURNACES.

The invention herewith illustrated is designed to economize fuel through feeding the furnace with hot air for the support of combustion. The waste heat of the furnace is utilized to warm the entering draft, and the devices adopted for effecting this include a hot jacket for the boiler, which is another source of economy. The engraving represents the invention in longitudinal section, Fig. 1, and transverse section, Fig. 2, as applied to a locomotive boiler.

The products of combustion pass as usual through the boiler flues to the smoke box, and thence by tubes, A, extending through casings, B, to the building, whence they escape through the tubes, C, forming the smoke pipe. Surrounding tubes, C, is a casing into which the incoming cold air enters through the hood, as shown by the arrows, passes down into the casings, B, and along to jacket, D. The draft then passes to another casing, E, at the bottom, and finally enters the ash pit at F.

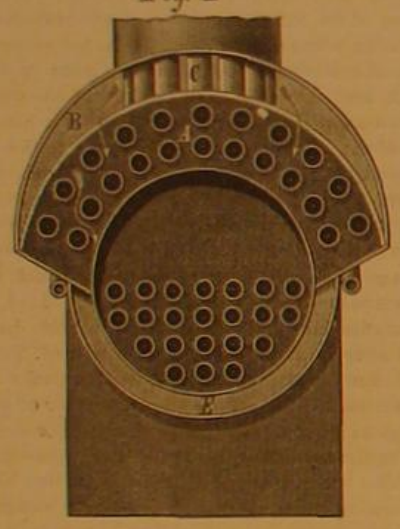
The hood on the smoke stack is made to turn so as to be adjusted to the motion of the engine. The water space at the back of the furnace may be provided with tubes, G, in place of stay bolts. These, leading into the hot air passage will, it is claimed, cause a current of heated air to be thrown in above the fuel to burn the smoke. They may be provided with dampers to regulate the current. The exhaust pipes are led into a coil or ring, at H, surrounding the steam dome. In the ring are numerous jets, so placed as to play into the annular space contained between the dome and casing, thus dividing the fresh air from the smoke. This arrangement, the inventor states, will allow of a much larger area than is usually given to the chimney of a locomotive, insuring a corresponding strength and steadiness of draft. It is also claimed that, in combination with

Fig. 1



THONGER'S DEVICE FOR HEATING AIR FOR FURNACES.

Fig. 2



the hood facing the motion of the engine, the device would probably so accelerate the draft as to allow feed water heaters to be introduced into the exhaust pipe. In addition to encasing the boiler in a hot jacket, a portion of the hot air may be led through the jacketing around the cylinders so as still further to check loss by radiation.

Patented through the Scientific American Patent Agency, in the United States and abroad, June 20, 1876. The inventor, Mr. Charles Thonger, of Courtright, Ontario, Canada (who may be addressed for further information), desires correspondence, relative to the device, with locomotive engine builders and railway managers.

IMPROVED STEP AND EXTENSION LADDER.

We illustrate herewith a new ladder, which will doubtless prove convenient and useful for house and store use, for painters, for fruit gathering, etc. As represented in the engravings, it is constructed somewhat similarly to an ordinary step ladder, being really two ladders (one with steps and one with rounds) hinged together. We are informed that it is as simple and light as an ordinary step-ladder, and can be lengthened to double its length by simply swinging the ladder with the rounds upward, which can be done by anyone in a moment. When arranged as a step ladder, it can be used by two persons at the same time, one going up either side. One size of hinge will answer for any size or length of ladder, as the hinges are adjustable to various widths and thicknesses of wood. The locking bar is self-acting, and will lock the ladder together when not in use, as shown in Fig. 1. Fig. 2 represents the ladder in position as a stepladder, the same locking bar holding it, and Fig. 3 shows the ladder extended, the same locking bar again securing it. The inventor claims that the device can be manufactured as cheaply as any ordinary step ladder, and will find a ready market. Patented January 11 and April 11, 1876, by E. J. Schneider. For further information address M. Schneider & Sons, 35 South Main street, Dayton, Ohio.

Fig. 4

Fig. 3

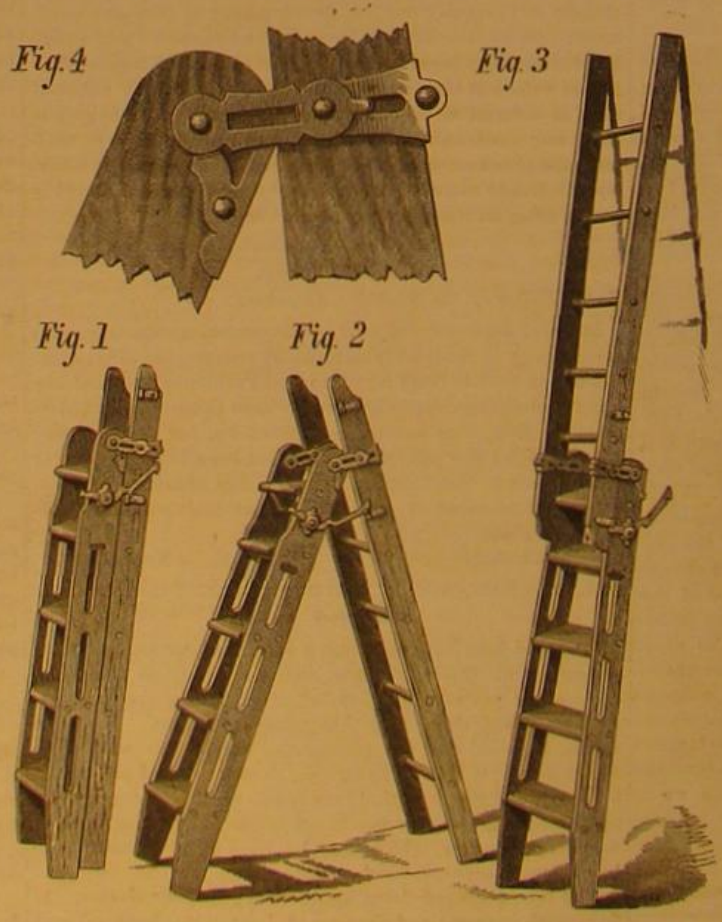


Fig. 1 *Fig. 2*

SCHNEIDER'S STEP AND EXTENSION LADDER.

A Gigantic Bird from New Mexico.

Professor Cope exhibited, recently, to the Philadelphia Academy of Science a tarso-metatarsus of a bird, discovered by himself during the explorations in New Mexico, conducted by Lieutenant G. M. Wheeler, U. S. A. The character of its proximal extremity resembles in many points those of the order *cursores* (represented by the *struthionidæ* and *dinornis*); while those of the distal end are, in the middle and inner trochleæ, like those of the *gastornis* of the Paris basin. Its size indicates a species with feet twice the bulk of those of the ostrich. The discovery introduces this group of birds to the known *faunæ* of North America, recent and extinct, and demonstrates that this continent has not been destitute of the gigantic form of birds, heretofore chiefly found in the Southern Hemisphere *faunæ*.

Birds with Teeth.

The same author has also recently given an interesting account of a remarkable group of birds with teeth, obtained from the cretaceous beds of Kansas, where the associated vertebrate fossils are mainly mososauroid reptiles and pterodactyls. They constitute a sub-class, odontornithes, comprising two orders: The *ichthyornithes*, having teeth in sockets, biconcave vertebræ, a keeled sternum, and wings well developed, represented by ichthyornis and probably apatornis, and the *odontolcæ*, with the teeth in grooves, the vertebræ as in recent birds, a sternum without keel, and rudimentary wings, represented by hespeornis. The occurrence of toothed birds in England has been described by Professor Owen from the London clay of Sheppy.

The Hoosac Tunnel.

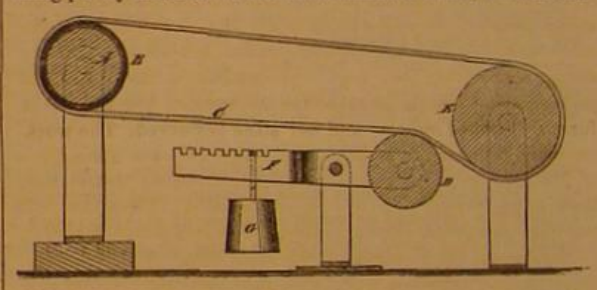
The North Adams *Transcript* says the temperature of the Hoosac Tunnel, at North Adams, Mass., is about the same all the year round, the thermometer standing generally at 60°. The air is pure except when there are a great many trains going through, filling the tunnel with smoke, the tunnel being able to thoroughly ventilate itself under ordinary circumstances.

The brick arching is not all in any one place, but in sections, wherever there was a possibility of danger from loose and crumbling rock. In all, about four thousand five hundred feet have been arched, the longest section being five hundred and the shortest ten feet. Thus the workmen were not all together, but were scattered along the line. After a section of the tunnel had been selected as needing arching, the miners began to remove the rock from the sides and roof for a depth of about three feet, that being the average thickness of the arching. In performing this work constant care was used; and when the extreme liability to danger from falling rock is considered, it is a wonder that so few accidents have occurred. The rock taken down was removed daily and dumped at different points along the road from the tunnel, that from the roof being received and carried out by platform cars that reached within a few feet of it. When the section to be arched had been properly prepared, the masons began their work, laying the brick on wooden centers, which were put up every five or six feet. The brick work was not laid close to the wall in all parts, a space being left for the water to run down. Sheet iron was placed between the brick and the wall for protection against water, and the brick was laid with waterproof cement. No part of the arching has been slighted, the whole work being carefully and thoroughly done.

A telegraph wire has been put through the tunnel, and offices stationed at both ends, and warning will be given every time a train enters and leaves the tunnel. Manager Prescott has appointed R. B. Campbell superintendent of the tunnel, for the present at least, and Mr. Campbell keeps ten men examining the sides and roof and taking down loose rock wherever found. Before each train goes through, the entire length of the tunnel is walked over by four men, stationed at different points, to see that the track is unobstructed The length of the tunnel is a little under five miles.

IMPROVED SPEED GOVERNOR.

Mr. James M. King, Walnut Station, Minn., has recently invented a simple and practical regulator for the clearing apparatus of thrashing machines, to compensate for the irregular motion of the horse power. It consists of a belt-tightening pulley mounted on a counterbalanced beam, with means



for regulating the tension of the belt, and a slipping pulley or cover on the driving pulley. A is the driving pulley; B, the slipping pulley or slipping cover of the driving pulley; C the transmitting band; D the counterbalance tension pulley, and E the pulley to be driven. The tension pulley, D, is, in this example, controlled by an adjusting weight, G, on lever, F; but it may be actuated by other means, if preferred.

The invention was patented on May 30, 1876

The New U. S. Steamer Trenton.

The Trenton is said to be one of the finest and probably fastest vessels in the naval service, being fitted with compound engines, two low pressure and one high pressure cylinders, the former 78 inches in diameter, and the latter 58½ inches in diameter, and all of 4 feet stroke, with an indicated 3,500 horse power. She has eight cylindrical boilers, 12 feet in diameter, and 10·25 feet long, with 510 feet of grate surface, and 12,000 feet of heating surface. The propeller is the Hirsch four-bladed screw, 19·5 feet diameter, and 28 feet mean pitch The length of the vessel is 253 feet between perpendiculars, 48 feet beam, and 23 feet depth of hold from main deck. She is to be full ship rigged, and will be armed with eleven 8-inch rifled guns. She is also to be a ram, being provided with a prow extending eight feet beyond the bow. The vessel, of 2,300 tuns burden, was designed by Naval Constructor Isaiah Hanscom. Heretofore it has been difficult to make the sailors comfortable in cold weather, owing to the danger of the heating apparatus, from bursting tubes, and the necessity of shutting off the steam at night in order to sleep. This annoyance has been overcome by adopting a new open-base radiator, which is so arranged that water can never accumulate in the pipes from condensation, causing unequal expansion and frequent bursting of the tubes. Another improvement for the comfort of the sailors is a new kind of galley, capable of cooking for a force of 800 men at once, and in less time than has been consumed heretofore.

The Trenton will be capable of going at a mean speed of 13 knots, is very strongly built and braced, and will be, it is expected, one of the most formidable cruisers of the navy.

BEES AND THEIR INSTITUTIONS.

[We extract from a contemporary magazine, entitled *Home and School*, a most excellent educational monthly, published by J. P. Morton & Co., Louisville, Ky., the following article on the instinct and habits of the bee. It is from the pen of a lady, Sophie B. Herrick, who evidently understands her subject; and it is so well written that we forbear to alter or curtail it.—EDS.]

It is both curious and interesting to study the government, the laws, the political economy of a kingdom which is precisely the same today that it was six thousand years ago; whose antiquity is so great that it enjoyed an ancient rule when China, Assyria, and Persia were still in their infancy. The bees have not only possessed a stable and orderly government through all these centuries, but they have managed to retain their character as models of wisdom, industry, and thrift, while nation after nation has sprung into being, lived its day, and then dwindled away into insignificance.

Fig. 1.—DOMESTIC BEES.

Many of the lessons which man learns only by bitter experience a thousand times repeated seem to have been stamped by the divine power upon the very entity of the lower creation; and this, if nothing else, would make their habits, instincts, and life history well worth our study.

In every swarm there are three kinds of bees, which not only differ from each other in form and structure, but whose functions are entirely distinct. These are the queen bee, the workers, and the drones (Fig. 1). The queen, who is the only perfect female in the hive, is the mother of the whole swarm. In shape she is easily distinguished from the other bees: her body is long and slender, her wings small but strong and sinewy, her legs are wanting in the brush and pollen basket which characterize the worker, her head is in form a flattened sphere, and her sting is curved. The workers were supposed to be sexless till the delicate dissections of Mdlle. Jurnie, at the suggestion of Huber, determined them to be imperfectly developed females. These are the smallest bees in the hive; their bodies are shorter than that of the queen, their wings of the same size. The four hinder legs are furnished with brushes of stiff hair, with which to collect pollen; the two hindmost with spoon-shaped cavities, in which it is packed away for transportation to the hive (Fig. 2). The head of the worker is triangular, and its sting straight. The drones are the males; in size they are about one third larger than the workers; in form they are thicker, and in color darker. Their jaws and probosces are shorter than those of the common bee; they are destitute of brushes, pollen baskets, and stings, and have heads somewhat similar to the queen.

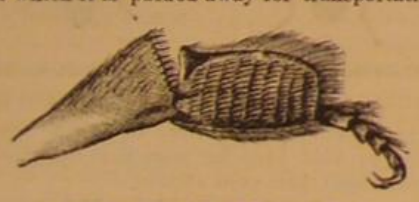


Fig. 2.—LEG OF BEE (magnified).


Fig. 3.—INTERIOR OF AN OLD-FASHIONED HIVE.

There is, unless in exceptional cases, only one queen in a swarm; her function is simply to supply her realm with subjects. The workers number from ten thousand to sixty thousand; they perform the whole labor of the hive; they rear the young, defend the common home, stand sentinels at its entrances, collect and store the provisions, elaborate the wax, build the comb, guard, attend, and provide for the queen, and take charge of the sanitary department. The drones perform no work of any kind, and seldom exceed fifteen hundred in an ordinary swarm.

There are two other kinds of bees noticed by apiarians which are frequently found in swarms; these they call the black bee and the captain bee. They both, upon microscopic examination and careful dissection, show an internal structure identical with that of the worker. It seems to be very well established now that the black bee is only a demoralized worker, who, having once tasted the sweets of stolen fruits, has abandoned honest labor, and given himself up to pilfering as a profession. Squeezing through small holes in the pursuit of his nefarious business, he has bedaubed himself with honey, and so plastered down and darkened the delicate plumage of his body. The captain bee has probably unintentionally adorned himself with the pollinia of some orchidous plant, and in this way gained the top knot which distinguishes him from his comrades.

The old-fashioned beehives (Fig. 3) were so constructed that the whole internal economy of the colony was a mystery. Nothing of it could be ascertained except in the examination of results after the destruction of the colony. Though some of the ancients devoted years to the study of the habits of these insects, a large proportion of the results given to the world was almost valueless. Fact was so mixed up with fancy, observation with conjecture, that the value of the whole was greatly impaired. Some of these difficulties have been removed by the introduction of glass observing hives, though many still beset every observer, from the fact that bees love the darkness, and in every way endeavor to obscure their movements within the hive from observation.

We will suppose that we are observing a new hive into which a swarm of bees has been introduced in order that every peculiarity of bee life and work may be considered in their natural order Before the swarm left the old hive, each bee had gorged itself with honey; beside this provision, a quantity of filled comb is generally supplied to them, so that they may not suffer in their new home.


Fig. 4.—CLUSTER OF BEES.

Before anything else can be done, comb must be built. A number of the workers, therefore, fill themselves with honey and suspend themselves in festoons or curtains (Fig. 4), and there they remain motionless for about twenty-four hours. At the end of that time, in the little depressions on the under side of the abdomen, between the overlapping rings of the body (Fig. 5), will be seen thin scales of pure white wax. It is a kind of external fat secreted by the bee from the honey it has assimilated, much as the fat of animals is secreted, especially from saccharine food. Some of these scales are solid wax, others thin films, and others again only delicate spiculæ. Bees, like the higher animals, do not all secrete the same amount of fatty matter from a given quantity of food.

The bees loosen themselves, and one of their number, using the pincers at the joint of one of its third pair of limbs, seizes a wax scale from its own body and brings it to its mouth. The scale is turned about in every direction by the claws, and its edge is broken down and off by the mouth of the bee. These particles are then accumulated in the hollows of the mandibles, from which it issues in the form of a very narrow ribbon. The tongue, during this operation, assumes a great variety of shapes, being sometimes flattened like a trowel and again pointed like a pencil. After the tongue has imbued the whole ribbon with a frothy saliva, which gives to the wax opacity and adhesiveness, it is again accumulated in the mandibles, and again issues forth in the ribbon-like form. The wax thus prepared is applied to the vault of the hive by a single bee (Fig. 6). After the store of wax of this founder bee is exhausted, others follow. Though there is perfect harmony among the builders, there is no coöperation in the true sense of the word, unless the fact that the many wait, while the one assumes the part of architect and lays the foundation, can be called coöperation. A solid arch of wax is built in an inverted position in the upper part of the hive. These little insects always prefer to begin at the top and build downward, though their instinct is wonderfully flexible in its power of conforming itself to circumstances; and if they are prevented from building in one direction, they build in another. Cells are then excavated from this arch, and after the foundation is dug the remainder of the comb is built upon it (Fig. 7). Ordinary cells are six-sided, but the upper rows in the comb are necessarily only five-sided. The six-sided cells are of two sizes: those built for worker broods number twenty-five, and those for drone broods sixteen, to the square inch. The royal cells we will describe later. The comb, when finished, consists of a sheet of double cells arranged back to back with the utmost nicety, so that the greatest economy of space and material is secured (Fig. 8). Maraldi, the inventor of


Fig. 5.—BEE (magnified), SHOWING THE WAX BETWEEN THE SEGMENTS.

the glass hives, measured the angles of the cells with great care; he found them to be respectively 109° 28′ and 70° 32′. M. Kœnig, a well known mathematician, without any previous knowledge of this measurement, was requested to determine by calculation what should be the angles of a hexagonal tube with a pyramidal base, in order that the least possible material should enter into its construction. His angles, reached by the methods of calculus, were 109° 26′ and 70° 34′.

In curving their comb, as they are sometimes forced to do, and in conforming themselves to many adverse circumstances, bees often show wonderful wisdom and skill in the variation of size and shape in their cells. In curved comb, for instance, the shape of every individual cell must be changed from the ordinary hexagonal tube with parallel sides. In this case the bases of the double row of cells are of the usual size and shape; the cells on the concave side of the comb narrow from the base to the open end, while those on the convex side widen. When a transition from worker to drone comb, or *vice versâ*, is necessary, it is effected by interposing several rows of cells of gradually increasing or decreasing size. These irregular cells are used for the storing of provisions, never for food.

When first completed the comb is pure white and very brittle; it is afterward strengthened and somewhat discolored by the addition of propolis. This is a gum collected from certain trees by the bees, and is used to make the hives both airtight and watertight. The fragile white comb is sometimes varnished with a thin coating of propolis, and at times the bees have been observed pulling down the first built comb, and working the wax over with an admixture of this gum. The propolis is often kept ready for use in a lump placed in an accessible part of the hive. In this form it hardens till it is almost like stone; when the bees desire to use it, they have been observed to soften it by the application of the same saliva with which they imbue the wax.

When sufficient comb has been supplied to the hive the workers begin to collect stores; they rove the fields for pollen and honey. The pollen dust is gathered by the bee with its brushes and packed away in the pollen basket. It is generally collected in the morning, while the moisture renders it cohesive enough to be formed into the little balls with which they fill their baskets. When this is impossible, in consequence of the dryness of the air, the bee rolls himself in the pollen, and flies home as dusty as any miller. In the hive the farina is collected from his body and packed away. It has been known since the days of Aristotle that these little insects never store the pollen of different flowers in the same cell. Each bee comes home loaded with a homogeneous mass, and no temptation is sufficient to induce him to visit more than one kind of blossom in a single excursion. If the flowers visited by the bee yield both pollen and honey, he loads himself with both on the same trip.


Fig. 6.—BEES CONSTRUCTING CELLS.

The honey is gathered by means of the bee's mouth, which is a most complicated organ (Fig. 9). The proboscis penetrates the nectarium of the flower; by the aid of the tongue and other portions of the mouth, the honey is drawn up and conveyed into the honey receptacle—a sort of second stomach surrounded by powerful muscles, which enable the bee to regurgitate its contents when it reaches the hive. The saccharine secretion of flowers undoubtedly undergoes some

change while in the stomach of the bee. Honey made from the clover, sugar and water, from fruit juice, does not possess a flavor that would reveal the source from which it had been obtained. The taste is not, however, wholly independent of its source: certain plants yield much more delicate honey than others. The honey of Mount Hymettus, of Narbonne, and of Pontus, all owe their exquisite and peculiar flavors to the plants frequented by the bees.

These provisions stored by the bees have their specific uses. The honey is used as food for the mature bees, and is the material from which wax is secreted. The pollen forms the food of the larvæ, and supplies to them the nitrogenous matter necessary to growing larvæ and pupæ. Many experiments have at last proved that pollen has its use also in the secretion of wax. With pollen alone bees secrete no wax; without it and with abundance of honey they at first secrete abundantly, but soon seem exhausted.

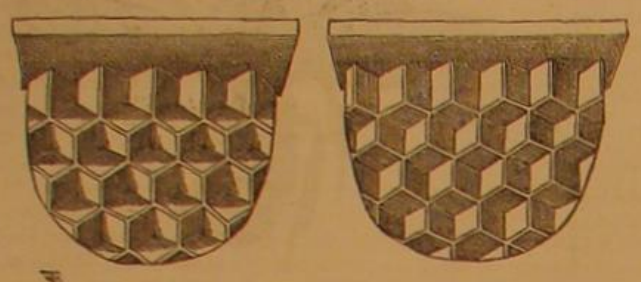


Fig. 7.—CELLS.

As our hive is supposed to be supplied with a perfect, fertile queen, it will be necessary to go back a little. An old queen almost invariably leads off the swarm. She is therefore ready to begin stocking the comb with brood as soon as the workers have built it. Soon after our queen was hatched in the parent swarm, she took her first and only flight, with the exception of that in swarming time. A single fertilization is sufficient to impregnate the hundreds of thousands of eggs laid by the queen during her life of several years. Like many other insects she is fecundated on the wing. Dr. Joseph Leidy, of Philadelphia, by the aid of microscopic investigation, discovered a small sack opening into the oviduct

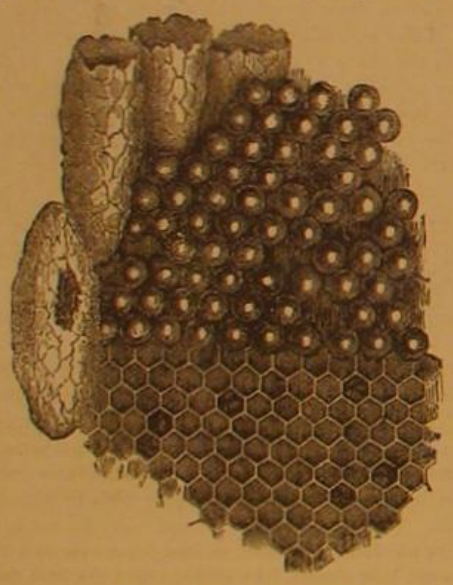


Fig. 8.—PART OF COMB.

of the queen, which is the permanent receptacle of the spermatic fluid. Dzierzon, Von Siebold, and, in fact, all the greatest living naturalists of the world, have been forced into the remarkable conclusion that female bees, workers, and queens are produced from fertilized, and drones from unfertilized, eggs. The sex of the egg is determined by several causes: if the queen from any malformation of the wings is unable to leave the hive, if she does not effect her flight before the expiration of three weeks from the time she is hatched, if she is starved for twenty-four hours, if she is subjected to intense cold for any length of time, and when she becomes old, she lays only drone eggs. The microscope proves that in each of these cases the spermatic sack has withered away, and can no longer perform its function of vivifying the eggs as they pass it. How the queen is able to effect this fertilization at will, though an ascertained fact, is an unexplained mystery.

While thousands of busy workers have been laying in provision for the young of their swarm and for themselves, the queen has not been idle. She has been actively employed in supplying the brood comb with eggs, sometimes to the number of three thousand a day. She generally begins the season with laying only worker eggs; these she is very careful to deposit only in their appropriate cells. If by accident or by way of experiment the hive possesses only drone comb, the queen will drop her eggs about anywhere rather than place them in the wrong cells, where they will not only perish, but, in all probability, fill the comb to no purpose.

Fig. 9.—HEAD OF THE HIVE BEE (magnified).

Although the queen knows what kind of an egg she is about to lay, the workers cannot distinguish their sex, as has been proved by repeated experiments. This discriminating instinct, which is perfect in the fertile queen, is wanting to the unfertilized drone-laying queen. She will frequently deposit her drone eggs in worker cells, or on the edge of comb, or any where else, though there may be empty drone comb in the hive. The bees have a wonderful way of dividing their labor, and then taking it for granted that each portion has been faithfully done. Where the workers find eggs in comb they assume that the queen has performed her part well, and they give it the treatment appropriate to the brood which should be found in that particular kind of cell.

After the eggs are laid they remain apparently unchanged for three or four days (according to the kind of bee which is to be developed); each one then hatches out into a small white maggot. The smaller workers, called nurse bees, now devote themselves unweariedly to the care of the larvæ. They swallow the pollen, with probably a minute quantity of honey, and after a partial digestion regurgitate it for the benefit of the young. The food is not only administered to the baby bees, but they appear to be always immersed in a sort of bath of the jelly-like substance, and to take in as much of their nutriment by absorption as by direct feeding. The little nurses are models of watchfulness and care; but occasionally they have to be reminded of their duties by the tapping of the baby bee against the side of the cradle. When the nurses think it time to feed their charges, the attention of the larvæ is attracted by some motion on their part, and the always welcome food administered. In four or six days the larva has reached maturity; the nurse bees then cap over its cell with a brown, porous, convex cover—the caps of the drone cells being more curved than those of the workers. The amount of food supplied to the maggot is ample, but it is carefully proportioned to its needs; no food is ever left in the cell when the workers close it in to undergo its final transformation.

Huber's observations of the cocoon spinning were made through the walls of blown glass cells into which the eggs had been removed. Two minute threads issue from the larva's upper lip; these become gummed together at a short distance from the mouth. The constant shortening and lengthening of its body finally enables it to complete its delicate silky covering. The common bees completely envelope themselves, whils the queen spins a partial cocoon,

Fig. 10.—STING AND VENOM GLANDS (magnified).

which only reaches to the second abdominal ring. The cocoon done, the bee has reached the second of its transformations, and becomes a nymph or pupa.

The drones require twenty-four days, the workers twenty, and the queen sixteen, to complete their development, from the laying of the eggs to emergence as a perfect insect. When the time for their exit comes, the common bees make

Fig. 11.—FERTILE WORKER. QUEEN, NOT BORN BUT BRED.

their way out of the cells as best they can, while the queen receives every care and assistance. In this the common bees would seem to need help far more than the queens, since their cocoons bind them more closely.

Each insect, as it quits the cell in which it was reared, leaves behind it its cocoon. As soon as a cell is vacated, some of the workers go in to clean it out and prepare it for future use; in doing this the film of silky threads is not removed, but is incorporated into the walls of the cell; as many as seven of these cocoons have been removed, one after the other, from a single brood cell. While the successive deposit of the cocoons strengthens the comb, it also contracts the cells, and in these smaller apartments the nurse bees are

Fig. 12.—LARVA OF THE DEATH'S HEAD MOTH.

Fig. 13.—THE DEATH'S HEAD MOTH.

reared. These bees differ from the other workers only in their size and in the functions which they fulfill.

A colony of bees frequently becomes queenless either by accident or through natural causes. In this case a most singular scene may be witnessed in the hive. The bees leave their ordinary work when the news has been communicated throughout the hive; they huddle together as if in the deepest consternation. A great buzz, apparently of consultation, is heard. Finally they seem to come to the conclusion that there is no mending the matter, and they agree to set to work to make another queen. Several worker larvæ, in cells not adjacent, are selected and devoted to royalty. (Several are chosen, to provide against contingent loss). The worker maggot chosen may be two or even three days old. The first thing the bees do to each of the selected larvæ is to enlarge its cell by cutting away the partition walls of three adjacent cells, thus throwing them into a single apartment. The worms occupying two of these three cells are destroyed, and all the ordinary food removed. The maggot is then supplied with different food, known as royal jelly, and with a much larger quantity of it. This jelly is a translucent substance, possessing a slight acidity and astringency of taste. The embryo bee which has been taken from the ranks and anointed queen receives the most devoted attention. She is royally supplied with a superabundance of food. When she is ready to go into the condition of a nymph, the bees cap her cell over with a pendent convex cover; and the cell looks, in this condition, more like a roasted peanut than anything else. When the queen is mature, the bees thin the cover of her cell by scooping out waved circles, till it becomes easy to distinguish the royal nymph within. She is generally retained prisoner by her subjects for some days after she has reached her full development. This is more frequently the case when the queens are reared for swarming time than when they are made by the bees in order to supply a deficiency.

The captive queen seems very impatient of her detention. She utters a cry, called by apiarians piping. The workers supply her with honey by means of a small hole in the cap of the cell, through which she extends her proboscis to be fed. Many observers, and among them some of the most accurate and faithful, say that the worker bees stand with their heads inclined, as if in reverence, while this note is sounding.

The moment a queen is released her whole energy is concentrated upon one point. She traverses the comb eagerly seeking for other royal cells. When she finds one, she falls upon it in fury, tears away the cover, and stings the nymph within to death. In this way she destroys every possible rival to her own power within the hive.

The bees generally provide against the simultaneous emergence, of the several queens which they rear, by selecting larvæ in different stages of development. Occasionally, however, two queens come out at once. They soon meet as they wander over the comb in search of royal cells. When this is the case, the workers, who under every other combination of circumstances defend their queens with their very lives, draw back, clear a space, and watch to see the result of the royal combat. The two queens rush upon each other, they grapple, and each endeavours to sting her antagonist fatally. If they happen to get into such a position that the thrust of the stings would prove fatal to both at the same time, their instinct teaches them to withdraw; the hive must not again be left queenless; private animosity must yield in favor of the public weal. They, however, soon rush again at each other. Finally one or the other gains such an advantage that she can destroy her rival without forfeiting her own life, and then the fatal thrust is given. It was long believed that the queen, like the drones, possessed no sting, because she will allow herself to be torn limb from limb rather than use it on any but a royal antagonist.

The peculiar treatment by means of which the larva of a worker is converted into a queen is, as far as we at present know, without a parallel in the annals of natural history. A difference of food, in kind and amount, increased room, and possibly a change of position, to which the embryo insect is subjected, has wrought a transformation almost too wonderful for belief. It is not a mere superficial change which has been effected, but one which penetrates far below form and structure, to the very mystery of life itself; it is a transformation alike of function, of structure, and of instinct. The larva which, under the ordinary conditions of development would have become a worker, which would have gathered the provisions and stored them, which would have defended the hive and guarded it, which would have reared the young, and performed the thousand domestic, civil, and military offices of the common hive, is converted into a queen who does not possess a single habit in common with the workers. The whole structure of the insect is also changed. The head, instead of being triangular, is round, the legs lose the pollen baskets and brushes, and the ovaries, which in the common bee are rudimentary, become enormously developed. The instincts are not only changed, but in many cases are reversed by this difference of treatment. The worker goes out of the hive many times every day, the queen but twice in her life. The worker is ready to sting anything which interferes with it, but never under any circumstances uses its sting upon a queen; the queen will die sooner than use its sting upon any ordinary foe, but will fly in fury upon another queen and thrust her through. The maternal instincts belonging to the brute creation are curiously divided between the workers and the queen. As mother the sovereign carefully deposits her eggs where they will have the best chance of coming to maturity; here her care ceases. Just at this point the workers take up the maternal duties, and they perform them with a zeal and devotion worthy of all praise. Increased room and two days' feeding on different food have wrought this miracle. It is remarkable, too, that the queens require four days less to develop, and live six or eight times longer than the workers.

Among the workers of a swarm there are found here and there, a few which are fertile. In the cases where investigation has been possible, it is found that these workers, when larvæ, occupied cells adjacent to the royal cell, and so, it is probable, partook of the royal jelly and became partially transformed. They have bodies which are longer and slenderer than common bees, and which approximate more nearly to those of the queen. They never lay anything but drone eggs.

Before swarming time several queens are reared (in this case on the edge of the comb, and frequently they depend from it by a sort of stem). It is not by any means true that swarming takes place always in consequence of the overcrowding of the hive. It seems to be closely connected with extreme heat, whether as cause or effect has not been very satisfactorily ascertained. A number of royal cells have been constructed, so that when the old queen leads off the swarm a new one may be ready to emerge and take her place in the old hive. The queen wanders over the comb in a restless way; her agitation is communicated to the other bees; a commotion arises; the bees gorge themselves with honey, send out a few scouts to discover a secure place for the swarm, and finally pour out of the entrance in a steadily increasing stream. Among them is the queen, who generally rises, and the workers cluster around her. Sometimes she falls and is lost in the grass, and then the bees return to the hive from which they have just issued. An inverted hive is held below the cluster of bees, which have happily found their queen and settled around her. As many as thirty swarms have come from a single stock in one season; some of these, however, were in the second generation.

Usually the fertilization of the queen takes place in June; after this, early in July, there is a general massacre of the drones. When there is no queen, or only a drone laying queen, in the hive, this slaughter is deferred. The bees fall upon the defenseless drones, pierce through their abdominal rings with their little barbed and poisoned darts, and then twist themselves over in order to extricate the sting without injury to themselves.

The sanitary regulations of the hive are very wonderful; nothing uncleanly or offensive is ever allowed to remain which it is within their power to remove. Réaumur mentions that a snail once invaded one of his observing hives and attached itself to a pane of glass. The weight of the creature was too great for even bee industry and enterprise, but not too much for bee ingenuity. They fastened the shell securely to the glass by means of propolis, and then sealed over the mouth of the shell with a quantity of the same gum. A slug which was once caught in one of Maralde's hives met a similar fate, except that, in this case, the whole body of the creature was entombed in the propolis.

This same substance is used to exclude every enemy of the insect tribe, as well as moisture and draft. The bees know very well that currents of air are desirable and drafts treacherous. While they cut off every avenue for the entrance of air where it would make them liable to disease, they supply a steady ventilation where it is needed. Lines of workers station themselves radially from the door to every portion of the hive: by a constant and well timed motion of their wings, steady currents of air are generated, which keep the hive pure and sweet. The force of the current is sufficient to turn small anemometers.

A guard is always stationed at the door of the hive to exclude enemies. The insects inside assume that the guards have done their work properly; for after robber bees or any other intruders have found their way in, it is generally long before any notice is taken of them. Occasionally a large moth, the *sphinx atropos*, or death's head moth, effects an entrance (Figs. 12 and 13) in spite of the vigilance of the guard. Once inside, the ravages of this creature are terrible. On dissecting one a tablespoonful of honey was found in its stomach. A very curious instance of transmitted intelligence is recorded of a swarm of bees, in connection with this foe of theirs. One of these moths had committed a serious raid upon the winter store of the swarm before it was discovered; several years afterward another member of the same family of moths entered the same hive; the bees at once took measures to secure themselves; the moth was excluded; barriers of wax were erected so that the door would not admit it, though the opening was still large enough for the bees themselves. The tradition of this Goth had evidently been handed down: they knew all about him the second time he came. Several generations of workers had been born and had died in the meantime, for the workers live only from five to seven months at the furthest. The ordinary bee moth is a terrible enemy to the hive, and does much greater damage than the sphinx, because its attacks are so much more insidious, and because it not only devours the honey, but the brood as well.

Bees are pugnacious little creatures, if roused by any fancied wrong or by the very human vice of cupidity. They are not disposed to sting if let alone, but are sure to revenge any hurt or indignity. Whole swarms often engage in pitched battles; this is almost always for the possession of territory. One piece of carelessness on the part of a bee keeper, and a whole swarm is sometimes demoralized; if they once gain access to honey, and can steal it, they are very apt to abandon all pretense of honesty, and give themselves up to a predatory life. Some of them, as has been before said, are professional sneak thieves; others are highwaymen. Huber and other apiarians mention the shameless behavior of some of these highway robbers. One of them will arrest a luckless humble bee on its way home laden with honey, and force it to disgorge its treasure. Violence will not do here, for the humble bee's honey pocket is far beyond the reach of our little thief. He does not kill his victim, but only calls "stand and deliver at the peril of your life," and generally succeeds in exacting that for which he asks. When the humble bee yields and gives up its honey, the bee allows it to depart in peace, and licks up the sweets with great gusto.

Our little honey bees, with all their wisdom and virtue, have their faults; and robbery, wholesale and otherwise, is not the only one. They sometimes make themselves thoroughly drunk on the juices of ripe fruits, and may be seen lying on the ground in a state of intoxication.

There are some things in the history of the honey bee which show a fidelity and devotion that is really touching. There is something almost human in their loyalty toward their sovereigns. Several instances are upon record where bees watched over and guarded the remains of their queen for days, licking and caressing her as though they were trying to restore her to life. Though food was supplied they refused to eat, and at the end of four days every bee was dead.

When a queen makes a royal progress through the hive she is always attended by a body guard, not a particular number of bees which are devoted to her person, but a body guard which forms itself at her approach out of the subjects through whom she is about to pass, but who fall back into their regular work when she has gone by. She never lacks the most dutiful and devoted attention; those about her, whenever she moves, caress her, offer her honey, and cluster around her to keep her warm if she is chill.

When a swarm loses a queen, they are at first in deep and violent grief; if a new queen is immediately given to them, they refuse to accept her. If, however, twenty-four hours is allowed to elapse, they reconcile themselves to the idea of her loss, and receive a substitute with royal honors.

The instinct of the bee denies all our traditions of instinct it adapts itself to circumstances, overcomes new and unexpected obstacles, benefits by experience, employs temporary expedients, and then casts them aside when the occasion for their use is gone, in a way which is marvelously like reason. It is, indeed, difficult to draw any line between the two qualities when looked at in minute detail; it is only in its cumulative power, which produces such different effects, that we can dare to make the distinction, and then we are still at a loss for a definition. It is strange to find in the insect world, among an order of beings so low in the scale of the naturalist, a faculty so nearly akin to the divine gift of reason which is man's crowning glory. But it is just here, among the bees and among the ants, that it is most marvelous and most perfect.

NEW BOOKS AND PUBLICATIONS.

HAY FEVER OR SUMMER CATARRH; its Nature and Treatment. By George M. Beard, A. M., M. D. New York city: Harper & Brothers, Franklin Square.

The theory held in this work, relative to the very distressing malady to which it is devoted, is that the disease is a complex resultant of a nervous system especially sensitive in this direction, acted upon by the enervating influences of heat, and by any one or several of a large number of vegetable and other irritants. The book is the direct result of the author's practical investigation, and it deals with its subject with a thoroughness and care which the serious nature of the ailment has long demanded. Although from the nature of the disease, no specific will likely ever be found for it which will meet every case, yet remedies almost approaching specifics have already been found for individual cases; and there are but few cases that cannot obtain more or less relief from some one of the many remedies that have been tested and laid down in this work.

MANUAL OF THE VERTEBRATES OF THE NORTHERN UNITED STATES including the District East of the Mississippi and North of North Carolina and Tennessee. By David Starr Jordan, M.S., M.D., etc. Price $2.00. Chicago, Ill.: Janson, McClurg, & Co., 117 & 119 State street.

This is an excellent catalogue of the vertebrates of the principal part of this country. The definitions are especially clear and accurate, and the classification is such as to afford the greatest facility in identifying species The information is thoroughly and judiciously condensed, so that the book, although dealing exhaustively with a very widely extended subject, is convenient in size, and may be carried by the tourist, to whom, if he have a taste for natural history, it will be especially valuable.

HANDBOOK OF MODERN STEAM FIRE ENGINES, including the Running, Care, and Management of Steam Fire Engines and Fire Pumps. With Illustrations. By Stephen Roper, Engineer Author of "Handbook of Land and Marine Engines," etc Price $3.50. Philadelphia, Pa.: Claxton, Remsen, & Haffelfinger, 624 to 628 Market street.

This book is claimed, by its author, to be the only one treating its special subject thoroughly; and he has succeeded in compiling a handy volume on the subject. He states, with becoming candor, that "Its value to the class of men for whom it is intended, lies not so much in its originality as in the judicious selection, arrangement, and presentation of the matter it contains;" to which might well be added the authorization of such selection by giving due credit to the sources whence they are derived. The volume which is in neat, pocket book form, is compendious and well arranged, and will be useful to any member of a fire brigade who desires to understand the science of his machine.

USEFUL TABLES AND INFORMATION APPERTAINING TO THE USE OF WROUGHT IRON, for Engineers, Architects, and Builders. Compiled by A. G. Haumann, C. E. Price $1.50. Pittsburgh, Pa.: Carnegie, Brothers, & Co.

These tables are among the best we have ever seen, and comprise calculations of the weights of iron beams of all forms of cross section, and the comparative strengths of cast and wrought iron of all sizes. Some extensive mensuration tables are given in addition, and also formulæ for bridges and roofs, the latter being founded on the writings of Professor Rankine. is altogether a thoroughly trustworthy handbook, and deserves a large sale

THE TEXTILE COLORIST, a Monthly Journal of Bleaching, Printing, Dyeing, etc. Edited by Charles O'Neill, F.C.S., etc. New York city: John Wiley & Son, 13 Astor place.

We are pushing England very hard in the manufacture of colored textile fabrics; and we are now enabled to learn how many of her best designs and most effective colors are produced. The monthly magazine before us contains complete treatises on various methods of dyeing and producing variegated effects as practised in the best factories in England, the explanations being illustrated by pieces of fabric attached to the page. Though only

serial, the "Textile Colorist" is handsomely printed in book form, and will, when bound in volumes, form an encyclopædia of the very interesting art-manufacture of which it treats.

THE FATIGUE OF METALS UNDER REPEATED STRAINS. From the German of Professor Ludwig Spangenburg. Price 50 cents. New York city: D. Van Nostrand, 23 Murray and 27 Warren street.

This is an excellent treatise on a subject which has been much experimented on and discussed in this country. It forms No. 23 of Mr. Van Nostrand's "Science Series."

THE FRENCH METRIC SYSTEM OF WEIGHTS AND MEASURES, ETC. By John W. Nystrom, C. E. Price, free by mail, 50 cents. Philadelphia, Pa.: Pennington & Son, 127 South Seventh street.

This little work is a complete summary of all the arguments, *pro* and *con*, on the subject of the introduction of the metric system into English-speaking nations. Many of the objections seem trivial at first; but when considered in relation to the tens of millions of people who are asked to adopt the system, their importance is readily seen.

TABLE OF MECHANICAL MOTIONS. By W. Clark, C.E. London, England: 53 Chancery Lane.

Some useful diagrams, arranged to fill a sheet folded in a pocket case.

DECISIONS OF THE COURTS.

United States Circuit Court—Southern District of New York.

CORSET LOOM.—HUGO CARSTAEDT *vs.* THE UNITED STATES CORSET COMPANY.

Shipman, J:

This court passed a decree on September 18, 1873, enjoining the United States Corset Company from further infringement of the second claim of reissued letters patent granted to the plaintiff on November 19, 1872, for "an improvement in the take-up mechanism for looms for weaving irregular fabrics."

The plaintiff has now brought a motion for an attachment against James Lyall, one of the officers of said company, for violating the injunction which was issued upon said decree.

The portion of the patent improvement which is referred to in the second claim, consisted, as stated in the specification—

In a series of needles or points arranged upon a stationary bar in such relation to the take-up rollers that the fabric is continually carried across said needles, to be received by their points, and to be arrested when a reverse motion of any parts of the fabric is commenced.

The mechanism is thus described:

K is a cross bar immediately behind the roller, C, and provided with a series of needles, *k k*, in its lower edge, which catch in the goods and prevent ts being drawn backward, under any circumstances, when the take-up mechanism releases it.

The second claim is for—

The needles or points *k k*, fixed in a stationary bar, and arranged as specified, so that the fabric being drawn by the take-up proper is continually carried across the needles to be received by their points, and to be arrested when a reverse movement of any part of said fabric is commenced, substantially as herein set forth.

The result of this improvement, which, it is said, in the opinion of the court upon the final hearing, was "the arresting of the fabric when it is released from the tension of the take-up, and so holding the cloth that it is prevented from doubling up in the center," was previously unattained in corset weaving.

The defendants have modified their needle bar since the injunction was issued, so that it now consists of a number of small independent needle rollers mounted upon a fixed shaft, which runs across the width of the cloth in the same position and relation to the take-up which the shaft had before.

Each of these rollers rotates forward toward the take-up, or in the direction of the cloth when the cloth is being moved forward and taken up by the take-up mechanism, but the rollers are prevented from moving backward when the reed recedes and the tension of the take-up is relaxed by a ratchet and pawl applied to each roller. Each roller then becomes stationary, arrests the fabric when a reverse movement has commenced, and prevents the cloth from being drawn back when the take-up mechanism has released it. When the reed moves forward and delivers its blow, the cloth is easily pulled over the rotating roller by the take-up; when the reed goes backward, the rollers are fastened by the ratchet and pawl, become stationary, catch the cloth upon the needle points, and hold it so that it will not double up.

It is contended that each a needle bar is not a stationary bar, and therefore t is not embraced within the second claim of the patent. It is a rotary bar when a stationary bar is not needed; but when one is needed, it is the same stationary bar which was previously upon both plaintiff's and defendant's machines, and accomplished the same practical result.

The needle points of the former needle bar were inclined toward the take-up, so that when the cloth was moving forward it was carried across the needles, and when it was released from the take-up the cloth was arrested upon the needle points. The new roller of the defendants, when it is rotating in one direction, permits the cloth to go forward without detention; but when a reverse action commences, the roller immediately becomes stationary, and the needle points catch and hold the cloth precisely as the old stationary bar accomplished the result.

Neither bar assists the take-up mechanism in pulling forward or taking up the cloth in any material degree, and the roller of the defendant becomes a stationary bar whenever stability is required.

The rotating character of the new needle bar is said to be an improvement upon the plaintiff's fixed bar. I think that this is true, and that the revolution of the roller with the forward movement of the cloth avoids any danger of the cloth being caught upon the needle points as it is drawn forward. But the fact that the new bar is a better one than the plaintiff's, or even performs a service which the plaintiff's bar does not perform, does not prevent the new device from being an infringement; it performs the same office which the old device performed by the same mechanical means. An infringing device is not protected by the fact that, although the device "was an equivalent of patented device in all its functions, and in its construction and mode of operation, yet by other or additional features it possessed other and further useful functions. Such a device would, perhaps, be an improvement upon the patented device, but must be, nevertheless, deemed an appropriation of the former. *Sarven vs. Hall*, (9 Blatchford, C. C. R., 524).

My conclusion is that the needle bar is an ingenious attempt to escape from the second claim of the patent, and that the motion of the plaintiff must be granted. As the defendant acted under competent advice, and had no intention of disobeying the order of the court, no fine is imposed, but he is ordered to pay the cost of the application and of the affidavits.

[*J. Van Santvoord*, for plaintiff.
George Gifford, for defendant.]

United States Circuit Court—District of Massachusetts.

BOOT HEEL POLISHING MACHINE.—DAVID H. SWEETSER, TRUSTEE, *vs.* CHARLES H. HELMS *et al.*

Shepley, J:

The bill in this case charges infringements of three patents—one to Elias S. Ingalls, dated May 8, 1860, for "improvements in machines for burnishing the edge of the sole and heel of boots and shoes," one to Benjamin Q. Budding, dated August 8, 1863, for "improved heel-polishing machine," and one to Benjamin Q. Budding, dated May 3, 1864, for "improved machine for polishing the heels of boots and shoes."

These patents all relate to a class of machines for polishing the edges of the heels and soles of boots and shoes, in which there is a combination of certain mechanism for holding the sole or heel (or both) to be polished with the mechanism of the polishing tool, under such conditions of mechanical combination that either the holding mechanism, with the material held, can be so moved as to bring the surface to be polished in proper relations to the polishing tool, or the polishing tool can be so operated as to bring it into proper relations with the surface to be polished of the material held by the holding mechanism.

The Helms machine, alleged to be an infringement, differs from these machines in this essential feature. There is no attempt in the Helms machine to so combine a shoe-holding mechanism with the polishing-tool and its mechanism that the two will operate properly together. On the contrary, in the Helms machine the shoe-holding mechanism is dispensed with, and the operator puts the shoe into proper relations with the polishing tool, and holds, and keeps and guides it there, by and with his own muscular strength and will. There is no shoe-holding mechanism which is made to travel in a fixed path in relation to the polishing tool, nor any polishing tool made to travel in any fixed path in combination with or in any relation to a shoe-holding mechanism.

This radical difference between the two classes of machines is fatal to the claim of infringement, and renders unnecessary a consideration of the other questions presented at the argument of the case.

Bill dismissed.

[*Thomas L. Livermore*, for complainant.
James E. Maynadier, for defendant.]

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From June 13 to June 26, 1876, inclusive.

ADJUSTING WRENCH.—E. H. Knight, Philadelphia, Pa.
CARRIAGE WHEEL.—R. W. Davis *et al.*, New York city.
COMPASS CARDS, ETC.—E. S. Ritchie, Brookline, Mass.
ENAMELING IRON.—F. G. Niedringhaus *et al.*, St. Louis, Mo.
FASTENING BAG MOUTHS.—J. E. Walsh *et al.*, New York city.
FOLDING PAPER, ETC.—L. C. Crowell, Boston, Mass.
FOLDING SEAT, ETC.—C. A. Hardy, Philadelphia, Pa.
FRICTION CLUTCH, ETC.—C. H. Addyman, New York city.
GAS FURNACE, ETC.—F. Carroll, New Orleans, La.
GEAR WHEEL.—J. Comly, Lincoln Park, N. S.
HAT BODY.—A. Freshfield, New York city.
HEATING BUILDINGS, ETC.—E. S. Jenison, Chicago, Ill.
HYDROSTATIC PRESS, ETC.—J. W. Hyatt *et al.*, Newark, N. J.
LIQUID METER.—D. W. Huntingdon *et al.*, South Coventry, Conn.
MARINE GOVERNOR.—G. Steele, New York city.
MOLDING IN WAX, ETC.—C. Grasser, Somerville, Mass.
PARQUET FLOORING.—S. P. Groocock, New York city.
PIPE COUPLING, ETC.—E. A. Leland, New York city.
PREPARING BONE BLACK, ETC.—O. Lugo, New York city, *et al.*
REFRIGERATOR.—D. W. C. Smiley, Brooklyn, N. Y.
SEWING BOOKS WITH WIRE, ETC.—H. R. Heyl, Philadelphia, Pa.
SHAPING METAL, ETC.—W. Sellers *et al.*, Philadelphia, Pa.
SMELLING BOTTLE.—H. Warner, Boston, Mass.
SPEED INDICATOR, ETC.—C. Neer, Brooklyn, N. Y.
STATION INDICATOR.—C. A. Evans, Upland, Pa.
STOVE.—H. L. McAvoy, Baltimore, Md.
TOY FIGURES.—L. Schmetzer (of Chicago, Ill.), Rothenburg, Bavaria.
WEFT KNITTING LOOM.—C. L. Spencer, Providence, R. I.
WOOD PAVEMENT.—B. F. Pond, Brooklyn, N. Y.

Recent American and Foreign Patents.

NEW AGRICULTURAL INVENTIONS.

IMPROVED BUCKWHEAT CLEANER.

Harker R. Ward, Loveton, Pa.—This consists of a horizontal concave and cylinder, respectively armed with spirally arranged strips of clothing thereon. The essential function of the machine is to act upon the grain after it has been treated by the hulling stones, to detach the matters not removed from the grains by the stones.

IMPROVED COMBINED PLOW AND CULTIVATOR.

Charles Frank, Freeburg, Ill.—This embodies several new mechanical devices whereby the machine may be readily adjusted for use as a plow or as a cultivator, and which can be conveniently manipulated. These devices enable the frame to be raised or lowered so that the plows may work at any depth, allow of the plows and cultivators to be easily attached or detached, and permit of the tongue being adjustably secured to the frame.

IMPROVED STRAW CUTTER.

Alexander Anderson, London, Canada.—This relates to a straw cutter in which the cutting box is arranged obliquely to the plane in which the cutter works; and it consists in the combination of a gage with a vertically sliding cutter and diagonal feed box, for regulating the feeding of the hay and straw to the cutter. The said gage is so mounted and connected with the cutter that it moves out of the way of the cut material to allow it freedom for escape when the cutter acts, and moves back in time to perform its function when the cutter rises. It is also fixed adjustably to gage the material longer or shorter, as desired.

IMPROVED REVOLVING HARROW AND PULVERIZER.

Thomas A. Kershner, Seymour, assignor to himself and Alexander Carr, Medora, Ind.—The new feature consists in the teeth made with curved forward edges, concaved rear edges, and broad heads pointed to the rearward, in combination with a rotating cylinder.

IMPROVED MILK COOLER.

William Eaton and John A. Randall, Norwich, N. Y.—This is a double milk pan, consisting of two milk compartments, separated by an intermediate cooling chamber, extended longitudinally between them.

IMPROVED CURCULIO CATCHERS.

Evlyn T. Hull and Edward Hollister, Alton, Ill., administrators of Edwin S. Hull, deceased.—This is a frame made with jointed and adjustable arms and covered with muslin. It encircles the trunk of the tree and catches the insects which are shaken down upon it, the insects afterwards being swept into suitable pockets.

IMPROVED GATE.

Edward A. Shugart, Athens, Tenn.—This is so constructed that it may be easily opened and closed, may be secured in place when opened to any desired extent, cannot be raised or pushed open by stock, and will shut itself when released.

IMPROVED GATE.

John A. H.Wilson, Deer Creek, Ill.—The operation is as follows: Any one approaching the gateway from either direction, and desiring to pass through it, will seize a cord, and by pulling it will move levers to raise the outer end of the gate over the shoulder of a tilting rail. The inner end of the rail itself is simultaneously raised. The gate is then caused to run along the rail by the operation of gravity until it is arrested by a post.

IMPROVED HARROW.

James Elliott, Jefferson, Wis.—This consists of a number of toothed harrow sections that are connected by pivoted side pieces, and made to slant by slotted angular braces and clamp bolts. The harrow sections are coupled latterly by interlocking hook devices.

IMPROVED CULTIVATOR.

Daniel F. Vickery, Oxford, Ala.—This invention is an improvement in that class of walking cultivators whose shares or teeth are made adjustable toward and from each other laterally. The improvement relates particularly to the construction and arrangement of parts whereby the shares or teeth are made laterally adjustable, separately or together, without changing their relation to the line of draft. The teeth are attached to a horizontal bar pivoted to the beam and provided with curved braces for regulating its adjustment.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED STENCIL PLATE.

David P. Lake, Helena, Montana Ter.—This is an improved stencil frame, that is adjustable to letters of different sizes and to any number of lines. It is made of lateral clamping plates, slotted and pivoted side guide pieces, and clamp screws.

IMPROVED HORSE-DETACHING DEVICE.

John V. Ericson, Escanawba, Mich., assignor to himself and George English, same place.—This is an improved device for detaching horses from the wagon or carriage in case of danger, which device causes also the carriage to run in straight direction after the horses are detached to prevent upsetting. The invention consists of the shaft bar, that is locked to the axle by swinging fingers and clips, and a central yoke part, which is retained by a stop pin until released by a connecting rod. The pin-carrying arm is fulcrumed to the reach, and extended below the same to lock into the notched or toothed fifth wheel of the carriage. The pin arm acts thereby as a pawl or stop to the fifth wheel, and produces the locking of the same, and consequently the forward motion of the carriage in straight direction.

IMPROVED FEED BAG FOR ANIMALS.

Thomas Miller, Jersey City, N. J.—This consists of a secondary bag inside of the ordinary bag, with a spring between its bottom and the bottom of the outside bag, so contrived that the spring, which is contracted by the weight of the food placed on it, will rise as the food is consumed, and thus the level of the food will be maintained in convenient proximity to the mouth of the animal.

IMPROVED DINNER PAIL.

Otto Cæsar, New York city.—This consists of a dinner pail with a recessed bottom and a heating attachment that may be lowered to form a support for the pail, and replaced and stored at the inside of the pail after use.

IMPROVED CARPET RAG LOOPER.

Charles F. Gronquist, Genoa, Ill.—This is a contrivance of a knife for slitting the rags to be looped together, with a hole in it, through which a looping hook is caused to project over the rags when pressed down on it, for making the slits, to pull the free end of the rag through the hole previous to the escape of the slitted ends from the knife, so that when the slits pass off they draw over the end of the rag passing through the cutter, forming a loop, which is tightened up by catching hold of the rag by the thumb and finger, and drawing it up taut in the slits.

IMPROVED DOLL SUPPORTER.

Mrs. E. C. McCutchins, Washington, D. C.—This invention consists of a metallic ring or girdle, to surround the waist of the doll, attached to legs made of stout wire, with their lower ends bent outward and flattened to form feet. The girdle is closed by a string or pin passing through holes in its end, and is provided with an upright back piece or support on its rear portion, through holes in which strings run and tie over the breast of the doll.

IMPROVED BOOT AND SHOE.

David J. Rogers, Bardstown, Ky.—This invention is an improvement in the class of boots and shoes provided with wooden soles, and relates particularly to the mode of securing the wooden heel, and also the rear edge of the wooden sole, to the leather sole, by screws, in such a manner that the screws are concealed and prevented from tearing out of or wearing the sole.

IMPROVED FOUNTAIN PEN.

Henry N. Hamilton, White Plains, N. Y.—The lower end of a tube, which serves as a socket to receive the handle, is halved and closed with a plate, which is extended into a tongue. The lower part of the tongue fits into the hollow of an ordinary pen, and forms a chamber to receive and hold the ink. The tongue is perforated with numerous holes, into which the ink enters, so that the ink may be partly supported by capillary attraction, and thus rendered less liable to run out too rapidly. The pen may be readily removed from and inserted in the holder by sliding down a ring.

IMPROVED FAUCET.

Minrad Obermiller, Toledo, Ohio.—This relates to a pump attached to a faucet, contrived in such a manner that when the faucet is opened it forces air into the barrel, either through the faucet or a tap fitted in the barrel.

IMPROVED ARTIFICIAL TEETH.

Merrick Bemis, New London, Conn.—The object of this invention it to furnish sets of teeth for eating purposes for those whose front teeth remain good, which will enable them to thoroughly masticate their food, and, at the same time, will avoid the necessity of having the remaining teeth drawn. It consists in artificial teeth in which the plates are formed to fit over the natural teeth, and in which the teeth are all molars, and are arranged with the longer side inward.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED CAR SPITTOON.

James H. Quackenbush, Kalkaska, Mich.—This consists of an outer tube with rim of inverted conical shape, an intermediate layer of suitable paper, closed at the bottom, and an interior tube with corresponding and overlapping top rim, the whole to be seated into a perforation or seat of the car floor. The device keeps the car clean, and may be easily cleansed and kept in order.

IMPROVED MACHINE FOR SAWING SHINGLES.

Erastus P. Kidder, New Alstead, N. H.—This consists of a carriage working vertically, and presenting the block to the under side of the saw, together with a tilting gage to regulate the thickness and taper, and a discharging chute, which the shingle being cut off pushes out of the way to pass by it, and which falls back to catch and discharge the shingle. By feeding the block upward to the saw, it can be held on the carriage without dogs, and is more convenient to manipulate on the carriage.

IMPROVED WHIFFLETREE HOOK.

Peter P. Kunz, Florence, Iowa.—The ferrule is cast with a solid outer end, and upon its forward side is a hook arm, in the cavity of which rests the end of a bar. The bar is bent at right angles, and its other arm passes through a hole in the ferrule at the end of the whiffletree. Upon the bar, within the cavity of the ferrule, is placed a spiral spring, by which it is pressed forward against the hook, so that the tug or cock eye placed upon the said bar cannot become accidently detached. The tug is attached and detached by pressing the bar to the rearward and turning its free end upward.

IMPROVED VENTILATING CAR.

Cornelius G. Van Pappelendam, Charleston, Iowa.—This consists of a contrivance of a system of pipes in the upper portion of the car to take out the vitiated air by the draft caused by the motion of the car. There is also an arrangement of pipes with a hood on the top, for catching the air and conducting it down along a heater, in cold weather, to a conductor along the floor and below it, the floor being perforated to allow the air to rise into the car.

IMPROVED LOG TRACK.

Jewit N. Russell, Augusta, Wis.—This is a track for hauling logs, by which, it is claimed, they may be transported in cheaper and quicker manner than by the use of sleds, wagons, or tramways. It consists of a track made of longitudinally jointed sleepers, with lateral braces, revolving rollers, and side guards. The logs are coupled and drawn or pushed uphill and over the levels by horses walking at both sides of the track, being allowed to move downhill by merely letting them go.

IMPROVED SHINGLING BRACKET.

Stephen N. Chapman, Moodus, Conn.—This is a bracket clamp or stay for the purpose of putting up stagings on shingled roofs. It consists of a clasp piece that is slipped on the butt of the shingle, and fastened by a supporting arm with an eccentric spur locking thereto. The bent-up end of the supporting arm rests on the roof and supports the staging.

IMPROVED SAW GUMMER.

Jason W. Mixter, Templeton, Mass.—This consists in improvements in saw gumming machines so that they may be readily set to any angle of cutting in connection with a feed that may be controlled either automatically or by hand, as desired.

IMPROVED WOODEN HOOP FASTENING.

Wilbur J. Squire, East Haddam, Conn.—This consists in a wooden hoop having its ends locked by a band drawn into a notch at each end. It seems to be a very simple and useful device.

IMPROVED MACHINE FOR BORING FENCE POSTS.

John Dickens, Kingston, N. J., assignor to himself and George R. Kelly, same place.—The novel feature in this is found in the carriage, which is secured in place by a clamp bar, through the center of which a screw passes, and is swiveled to the table, and has a hand wheel attached to its lower end, below the said table. The clamp bar moves up and down upon guide pins, and upon its under side are formed points, which enter holes in the bars of the carriage to center said carriage when adjusting it.

Notes & Queries

H. F. is informed that the metal manganese is mixed with copper to make manganese bronze. —S. O.K. should stuff his saddles with well cleaned wool.—T. J. L. will find directions for ridding his house of water bugs on p. 315, vol. 32.—F. W. S. is referred to our advertising columns for a good system of short hand.—L. N. will find a recipe for aquarium cement on p. 80, vol. 31.—J. T. M.'s questions as to the first year, etc., are absurd.—B. B. will find directions for cultivating mushrooms on p. 129, vol. 34.—W. R. K. can waterproof paper by the process described on p. 17, vol. 33.—E. T. C. will find directions for polishing brass instruments on p. 57, vol. 34.—H. H. is informed that the only import duties in England are on tea, tobacco, and alcohol in all its forms. A few duties are put on silver plate, playing cards, etc., to compensate for the internal taxation on these articles.—D. H. can get rid of ants by applying the remedy given on p. 172, vol. 33.—W. A. W. will find the formula for the friction of water in pipes on p. 250, vol. 34. —H. F. L. will find a description of a pantagraph on p. 179, vol. 28.—H. W. will find some notes on boiler furnaces and bridge walls on p. 339, vol. 33. —J. S. will find a description of M. Jamin's magnet on p. 383, vol. 29.—A. J. D, is informed that the process of type founding is too complicated for description in these columns.—B. F. K. will find directions for making vulcanized rubber stamps on p. 155, vol. 31.—W. B. H.'s specimen of paper board is too hard to be penetrable by oil. It could be softened by soaking in hot water.—A. B. will find directions for preparing lime for oxyhydrogen light on p. 315, vol. 33.—W. J. B. will find directions for preserving eggs on p. 306, vol. 34.—C. B. R. will find a recipe for cement for cracks in stoves on p. 183, vol. 34. For bronzing iron castings, see p. 243, vol. 34.— D. B. T. will find formulæ for the pressure and temperature of gases on p. 123, vol. 33.—S. H. G. will find a good recipe for indelible ink on p. 129, vol. 28.—F. F. T. will find an answer to his query as to dynamometer brake on p. 273, vol. 31.—E. D. R. can fasten mother-of-pearl to glass with the cement described on p. 46, vol. 33.—E. O. T. will find several good recipes for bronzing on pp. 38, 243, 312, vol. 34.—S. S. D. will probably find that the oxyhydrogen light will answer his purpose.—G. H. F. will find directions for making gas for domestic use on p. 131, vol. 30. For gilding wood, see p. 90, vol. 30. A compound of pounded ice and salt makes an excellent freezing mixture.—R. can obtain a copy of a print in facsimile by the photo-engraving process advertised in our columns.—A. O. F. will find directions for making concrete pavements on p. 185, vol. 33.—C. F. S., H. S. U., G. W. S., J. L. B., and others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) W. U. L. asks: 1. Is it possible to run a band saw by foot power? A. Yes, for light work. 2. What speed does it require? A. The saw should run by foot power at about 4,000 feet per minute.—J. E. E., of Pa.

(2) N. F. C. asks: What is the matter with a telescope which "looks smoky," and does not give a sharp definition? A. Either the spherical aberration is not corrected or the glass is not homogeneous. The probabilities are that the center and edge are not of the same focal length. Take a piece of paper the size of the lens, cut a circular piece from the center one half its diameter, cover the marginal portion of the lens with the outer part of the paper, allowing the light to pass through only the central portion of the lens; focus on some well defined object, then put the central piece of the paper over the center of the lens and remove the other, and focus with the light passing only through the margin: thus, by using diaphragms of different sizes over different parts of the glass it can be seen whether all parts of the glass have the same focus; if not, the glass must be corrected accordingly.

(3) P. F. asks: Can I successfully transmit motion from one friction pulley, 6 inches in diameter, going at 4,000 revolutions per minute, to another pulley 4 feet in diameter, by bringing the large one in contact with the small one, by a hand lever? A. Yes, if the faces of the pulleys are grooved. See diagram No. 60, "Mechanical Movements," in SCIENTIFIC AMERICAN REFERENCE BOOK.

(4) J. B. L. says: My telescope is constructed according to a description given some three years ago in the SCIENTIFIC AMERICAN. The eye leys is plano-convex, and gives an inverted image. I wish to know if, by using a double concave eye lens which does not invert the image, I can get the same field. A. No, only about one third as much, with a lens of the same focal length.

(5) S. B. & Co. ask: What will remove grease from emery wheels without injury to the wheel? A. Bisulphide of carbon is the best known solvent for oil or grease. Naphtha and benzine are also good solvents.

(6) F. R. says: In p. 6, vol. 35 of the SCIENTIFIC AMERICAN, in giving the composition of sulphate of potassa, you use KO as the symbol of potassa and H O as the symbol of water, while according to Youman's "New Chemistry" K_2O is used as the symbol of potassa and H_2O is used as the symbol of water. These compounds (KO and HO) could not exist according to Youman's "Chemistry," as there would be an odd bond in the molecule, thus: K—O—, H—O—. Please explain. A. The symbols were given according to the old system of nomenclature, but the new system is for many reasons preferable. Whether the old or new system, however, be employed in calculating the percentage composition of compounds such as you mention, provided the systems are not confused with each other the final result will be the same. For instance: According to the old system, sulphate of potassa would be written KO,SO_3, while according to our present theory of chemistry is written K_2SO_4. While in the present system the atomic weight of potassium remains the same as in the old, those of oxygen and sulphur have been doubled:

	Old Theory.	New Theory.
Potassium (kalium).....	39·2	39·2
Sulphur.....	16·0	32·0
Oxygen.....	8·0	16·0

As there enters into the composition of the above salt, according to the old formula, one atom of potassium, one of sulphur, and four of oxygen, and according to the new theory, two of potassium, one of sulphur, and four of oxygen, the composition by weight will be as follows:

Old.	New.
K 39·2×1=39·2	K 39·2×2=78·4
S 16·0×1=16·0	S 32·0×1=32·0
O 8·0×4=32·0	O 16·0×4=64·0
87·2	174·4

87·2 : 39·2 : : 100 : x, or 174·4 : 78·4 : : 100 : x. In these two proportions, x, or the amount of potassium as calculated from either of the above systems = 44·9541 $\frac{5.1}{10.9}$. And as determined by like methods the proportions of the constituents of the salt in 100 parts by weight are S 18·3486 $\frac{3.6}{10.9}$, O 36·6972 $\frac{5.2}{10.9}$.

(7) A. R. asks: Is there to be an occultation of Saturn by the moon on August 6? A. Yes, between 10 30 and 14.0 P. M., duration about 20 minutes. There will be another on September 3, commencing about 2.30 A. M. with a duration of 1 hour.

(8) W. G. F asks: What is the cause of mildew and blotches appearing on the fresco painting in a church? A. The roof may leak and wet the ceiling and walls slightly, or dampness may be generated under the floor, and the church may not be sufficiently ventilated during the week. A warm day and a cool night would occasion a precipitation of moisture on the interior of the walls, unless there were means of ventilation.

(9) M. W. asks: What is the weight of a cubic foot of solid ice? A. About 57½ lbs.

(10) R. S. asks: 1. Is there any substance that will prevent the oxidation of galvanized iron when used for water coolers, and the consequent taste thereby imparted to the water? A. Try the application of melted paraffin. The surfaces may be uniformly covered by means of a brush. Pure paraffin is both tasteless and inodorous, insoluble in water, and not attacked by either acid or alkaline solutions. 2. Is there any substitute for muriatic acid in soldering the same that will not discolor the iron or affect the water? A. Pulverized rosin is sometimes preferred for this purpose.

(11) C. B. Q. asks: Why is it that the sun, shining through small apertures of any irregular form, produces circular bright spots instead of spots of the shape of the aperture? A. The light from a bright object passing through a small aperture forms an image of that object. It is therefore an image of the sun and not of the aperture which is seen; and as the aperture is increased the image of the sun is less, and that of the aperture more, defined. Eclipses of the sun are sometimes observed by this means.

(12) L. C. M. asks. Will a vertical steam boiler 30 inches high by 16 inches diameter, with 12 upright flues, 1¾ inches in diameter, running the length of boiler, set on the lower half of a common coal stove, be of sufficient capacity to warm a house by hot water, the house containing 4 rooms, each 16 feet square by 9 feet high? A. If you have a strong draft, and a good arrangement of heating pipes, we think your boiler might answer.

(13) N. P. M. says: We desire to heat and ventilate a schoolhouse in the most efficient manner and at the least possible cost. The size is 25 feet by 38 feet, and 12 feet from floor to ceiling, with four windows on each side, and two doors in front end. The floor is about 1 foot from the ground. It is a frame building. A. If there is no cellar under the building, excavate a small one at the windward end and provide a good warm air furnace; supply air to the air chamber of the furnace from the exterior of the building by means of a long wooden box or shaft extending to the point where the most prevalent winds strike the house, and insert in said shaft a sliding board valve, to close it or limit its capacity at pleasure. Supply the warm air to the room by means of two large floor registers, one upon each side thereof, conveniently arranged for drying the feet. For the ventilation, place three vertical pipes of tin or wood, about 6 by 12 inches, on on either side, one between each two windows, and extending from the floor to the ceiling and discharging into the space above the ceiling, and provide two ventilating registers in each pipe, one near the floor and one near the ceiling; in cold weather, the lower one alone may remain open, in warm weather both. If your building has gables, place a window in each gable, filled in with blind slats so set as to effectually protect the interior from storms, and these will give the proper ventilation to the space between the ceiling and roof. If, however, you have a high roof, ventilate by a small cupola provided with windows of like description. As a matter of economy, your present stoves enclosed within brick walls may give you a very effective furnace. Be careful to see that the fire chambers are tight, so that no smoke or gas can escape to contaminate the air.

(14) G. D. S. asks: How can I destroy grass, weeds, etc., in gravel walks? A. Dig them up by the roots. Cutting off the tops does no good.

(15) E. T. C. asks: How can I prepare calf and sheep skins for drumheads? A. Remove the hair or wool from the skins by steeping in a solution of lime; then shave all the fleshy matter from the inside, wash, and stretch the skins tight on frames; rub well with pumicestone, polish with powdered chalk, and dry. Finish with a coating of white of egg.

(16) E. & D. ask: 1. How can we make colored printing ink? A. To make printing ink, old linseed oil, boiled and ignited, must be taken, and good black rosin selected. Soap is another important ingredient, yellow rosin soap being used for black ink, and white curd soap for the various colored inks. Vegetable lampblack is the best for making black ink. Boil 6 quarts linseed oil till the smoke begins to rise, and ignite the vapor with a bit of lighted paper in a cleft stick; let it burn till the oil, now transformed into a varnish, will draw out into strings half an inch long. Then 6 lbs. rosin should be gradually added, and then 1¾ lbs. soap in slices, which must be put in cautiously, as the water contained in it causes a commotion. Set the pot on the fire and stir well with a spatula. Put 8 lbs. of the pigment into an earthen pan, and add the varnish by slow degrees, and stir carefully till the whole is incorporated. Then grind in a mill or on a slab with a muller. The pigments commonly in use are carmine, the lakes, vermilion, red lead, Indian red, Venetian red, red, yellow, and orange chromes, burnt sienna, Prussian and Antwerp blues, etc.

(17) M. B. asks: How are potatoes desiccated and preserved? A. They can be cut in small cubes, or powdered on a grater, and dried in an oven.

(18) R. R. asks: 1. What is the composition used in rockets composed of? A. Mix together 12 parts (by weight) saltpeter, 6 parts charcoal, and 4 parts sulphur. The ingredients should be powdered separately. 2. How is golden fire made? A. If you mean golden rain for rockets, take meal powder 6 parts, saltpeter 1 part, charcoal 2 parts. Powder separately and mix.

(19) O. A. J. asks: In balancing a crank shaft for a steam engine running at high speed, should I put the combined weight of connecting rod, crosshead, and piston opposite the crank pin on the balance crank, or should any allowance be made for the lower end of the connecting rod resting on the crosshead? A. For a vertical engine, the first method is necessary. For an horizontal engine, balance the crank and two thirds the weight of the connecting rod.

(20) E. L. says: My house stands on level land. At the present time the water in my cellar is 30 inches deep, caused by the heavy rains. I have thought I would pump the water out when drier weather comes on, and then with a sledge hammer drive stones in the soft bottom, and cover the stones and sides of the wall with water lime cement, hoping thereby to have a good dry cellar. Do you think my method a good one, or will the upward pressure of the water burst up the cement? A. The upward pressure of the water will be equal to the weight of the water, according to the hight it would rise above the floor. At 30 inches deep the upward pressure would be a little more than 1 lb. per square inch, or 156¾ lbs. per square foot. To sustain this, you require a stone bottom about 10 inches thick, more or less, according to the weight of the stone. This should be laid in and grouted in cement, when the cellar is dry. For the sides, build up on the inside of your present cellar wall another lining wall as high as the water rises, and 12 inches thick, carefully laid up in the cement. If you wish to retain the present hight in the clear in the cellar, you must excavate to the depth required by the stone bottom. Use the best hydraulic cement, and grout it well into the joints of the stonework.

(21) H. L. C. says: Would a dam, 300 feet long and 15 feet in the middle, running out to nothing at the ends, and 2 feet thick at the top and 4 or 5 at the bottom, filled in with loose rocks and dirt (on the water side), be sufficiently strong to hold the water to make a pond for cutting ice? A. The weight of wall and backing would be sufficient to resist the pressure of the water; but the permaneney of a dam depends mainly upon its capacity to retain the water without leakage. The wall should have a proper foundation deeply laid, and the interior slope made watertight with a clay puddling extended over the bottom of the pond for some distance in from the dam. The least discharge of water through or under the dam washes the earth away, and continually increases the size of the aperture, until it threatens the stability of the whole work.

(22) J. L. W. asks: 1. In building a heavy brick wall, which of the two makes the best and most secure job of brickwork, making every third or every sixth course of brick headers? A. Every third course is the stronger, although they are seldom laid so frequent as that. 2. In turning arches in a cell building for a prison, where one cell will be above the other for four stories high, should the centers that the arches are turned over remain in the first stories until the entire upper stories are completed? Will it damage the work to strike the centers when the first story is complete, so as to use the same in the next stories? A. The centers should be struck as soon as the mortar is well set, in order that the arch may come to its proper bearing, it being understood that the exterior walls of the building, where the last arches are received, are sufficiently thick and high to resist the thrust of the arches. 3. The cells are 5 by 8 feet, the arches are semi-circular, turned the 5 foot way. Should the ends of the arch, where they come in contact with the main walls, be built in solid, so as to tie them together, or should the arch be turned separately, merely finishing against the main wall? A. It is not necessary; the stability of the arches will depend upon the sufficiency of the final abutment at the termination of the series against the exterior wall at the two ends.

(23) E. O. K. says: 1. I am building a house, and wish to supply a range and bath tub by means of a tank in the attic over the kitchen. Is there any better way to make the tank than to build an outside frame of pine plank, and set inside it a watertight tank of zinc? A. The best kind of tank for your purpose is one formed of cast iron plates, 18 by 18 inches, and 9 by 18 inches, with exterior flanges at the joints through which the plates are bolted together. A tank 6 feet by 4½ feet and 2 feet 3 inches high would be a suitable size and could be made from these plates. The next best kind would be one made of 2 inch plank, tongued and grooved together, rectangular, the ends tongued into the sides, held together with frames of light timber, and lined with sheet lead. As for zinc it is too brittle, and is injured by the contraction and expansion which it has to undergo. 2. I wish to construct in my outdoor cistern such a filter as will render the water drinkable. How shall I best accomplish it? A. Make the crosswall of brick with openings at bottom, enclosing one third of cistern; fill in this space with a layer of sand, a layer of charcoal, and a top layer of sand, and the clear water will rise through it.

(24) J. M. B. asks: What is the compound used for penciling or tucking brick walls? A. White lime mortar, consisting of pure lime paste and a little white sand.

(25) J. A. G. asks: Which is the best for grinding a turning or planer tool on, an emery wheel or a grindstone? A. A grindstone is the best.

(26) J. E. L. asks: How many revolutions per minute, and what particular way of filing a circular saw will enable us to cut ¾ inch dry, straight grained, black walnut boards into ⅛ inch strips, smoothly, so as to dispense with planing afterward? A. Make the saw about 6 inches in diameter, of No. 19 gage, 6 teeth to the inch, each alternate tooth to be filed to a very flaring (bevel-ing) edge on the front side. Twist each alternate tooth a very little for the set. Use a fine oilstone on the front part of each tooth after filing, so as to present a wide and very sharp cutting edge to plane the sides of the kerf. File the tops of the teeth square across.—J. E. E., of Pa.

(27) J. L. B. asks: I have three wheels, two of 40 and one of 48 inches in diameter, all of which weigh 38 lbs. Please give me the dimensions for making a tricicle, using said wheels. A. The ordinary method is to have the driving wheel in front, the standard in which it is hung being capable of turning in any direction, at the will of the rider. If your driving wheel would not stand erect, the bearing must have been very short, or the workmanship very poor.

(28) P. B. G. says: I am running a steam pump located 18 feet above the river, and draw the water through 200 feet of suction, and force the water 25 feet above the pump. The suction pipe is 1½ inches in diameter, which is rather small for the pump. When running, the valves and piston thump heavily. I use a foot valve. I would like to know if I can remedy the matter by putting a vacuum chamber on the suction? A. We do not imagine that you will find any remedy other than the use of a larger pipe very efficacious.

(29) G. F. B. says: 1. I am using a foot power lathe for wood turning, and I would like to know what part of 1 horse power I exert in treading said lathe? A. Probably not more than $\frac{1}{12}$ or $\frac{1}{10}$. 2. Of what diameter and stroke should a small engine be to successfully run said lathe? A. Diameter 1½ inches, stroke 3 inches. 3. What horse power does it require to run a circular saw so as to cut up 1 inch hard wood boards to good advantage? A. From 1 to 1½.

(30) W. T. says: I have a 9 inch circular saw, and in the room below a 4 feet 6 inch drive wheel with crank, with a leather belt round the wheel and pulley of mandrel; it is extremely hard work, turning by hand, even to cut thin pine. How can I remedy that or make it easier? A. It will be very hard work turning such a machine by hand. Power stored up in a heavy balance wheel when the saw is not in actual use will assist greatly in making each cut.

I have also a home made machine for teasing hair or wool. It consists of a frame and 2 drums, one about 15 inches, the other 6 inches diameter, with teeth in each. They are made to revolve in opposite ways by a strap over a pulley at the end of each drum, with a crank on the larger one. The hair wraps round the drums and clogs it without getting teased. How can I remedy it? A. I am of opinion that you cannot obviate the difficulty, and that a back and forward or reciprocating motion over a stationary toothed bed would be preferable.—J. E. E., of Pa.

(31) W. H. says: Is there any difference between concussion and weight? If I break a block of iron by dropping a 2 tun weight from a hight that gives it a striking force of 120 tuns, could I break a similar block by placing upon the same space covered by drop weight (about 3 inches in diameter) the same weight, 120 tuns? If not, why? I have broken an anvil block by the above weight. Practical men say that 500 tuns laid on same space would not tear the block. Weight of block 12 tuns. A. The sudden application of a load, as in the first case, ordinarily has a greater effect than its gradual action, as in the second. One reason for this seems to be that, when a force is suddenly applied, there may not be time to communicate the shock all over the struck body, so as to allow it to offer the maximum resistance before rupture takes place.

(32) E. E. asks: How does an injector compare with an oldfashioned plunger pump for forcing water through a good heater? A. There is a difference of opinion on this subject, the majority inclining to allow a little superior economy to the injector.

(33) L. H. E. asks: In grinding lathe and planer tools, chisels, etc., should the stone run to or from the grinder? A. Towards the operator.

(34) G. T. P. says: We are running a 20 horse engine. The pump would not work to satisfy us, so we blew out steam and water, after taking all the fire out. Three hours after, we commenced refilling by hand pump, letting water in at the safety valve. After the water had been pouring in about 15 minutes, there was a loud noise in the boiler, as though it had been struck with a heavy sledge hammer. Upon examination we found a crack 14 inches long across the crown sheet. Can you tell us the cause? A. Your boiler was probably warm, and the contraction due to putting in cold water produced a strain, causing both the crack and the noise.

(35) J. K. Jr. asks: What is the horse power of the following stream of water? The stream is 7 inches square, flows at the rate of 3 feet per second, and runs on to an overshot wheel whose diameter is 18 feet. A. Find the cubic feet of water that falls per second, multiply this by the weight of a cubic foot of water in lbs., and by the fall in feet, and divide the product by 550. The resulting power is quite small, and possibly some of your data may be incorrect.

(36) J. B. says: A person wishing to build a butcher shop with double board walls thinks that, by leaving between the walls nothing but air, he will do best, while I think that, if he would fill the space up with sawdust, it would be cooler. The walls will be about 6 inches apart. Am I right? A. If the space in the wall could be made perfectly airtight, so that the cool air could not escape and warm air take its place, the air alone would be better than sawdust; but as this is impracticable in your case, you had better fill in with the latter.

(37) C. M. A. says: We are building a three-story school house, with two rooms on each floor; each room is 28x28 feet, and 12 feet high. We are to have one ventilating flue for all four rooms; each room is to seat 60 scholars. How large should the ventilating flue be, and how large and what should be the position of the registers? Each room is heated with a wood stove. A. Build a brick flue, 24x44 inches, between the two rooms in each story, and run up through the center of it a 20 inch diameter heavy sheet iron smoke pipe, kept in place by means of a 4 inch brick cross partition, from the middle of each side, dividing the large flue into 4 shafts or smaller flues, averaging about 10 by 16 inches each. The latter will give you a separate ventilation flue for each room, the air in which will have a constant upward current by means of the heat imparted to it by the central smoke pipe. This pipe should also be divided into 4 parts, to afford a separate smoke flue for each stove. Put in two 14x22 inch registers in each room, one near the floor and one near the ceiling; by these you can grade the ventilation to suit circumstances.

(38) B. D. asks: 1. I have a piece of gold, which has been polished with mercury. What will remove the mercury? A. Heat it strongly over a flame until the mercury has all been driven off. Do not inhale the vapor. 2. Will mercury injure gold? A. Yes. It forms with it a soft amalgam.

(39) E. W. V. asks: Do you know of anything that will take mud off paper? We had a flood in Dubuque, and the water got in our house. Two volumes of SCIENTIFIC AMERICAN and *Picturesque America* got wet and full of mud. A. Try the following: Moisten the paper thoroughly and then dry under considerable pressure. When perfectly dry (which will probably require a week or more) the greater part of the clay may be removed by means of a good stiff brush; it will not, however, be practicable to remove, completely, all of the stains.

(40) P. asks: Will water have any mechanical effect on a diamond, falling on it drop by drop, time not being limited? A. Yes.

(41) J. H. asks. What test can be applied to the colors of two samples of woolen fabric to indicate their comparative ability to withstand such exposure to light, heat, etc., as the furniture of an ordinary sitting room is subject to? A. This could best be determined by an analysis of the coloring matter of each.

(42) C. H. asks: How can we purify our cistern water? It has thousands of little semi-transparent "mites" in it. A. Try the addition of several bushels of finely ground well burnt charcoal. It is probable that the pump tube has contaminated the water by decay.

(43) J. S. P. says: The walls of the room in which cotton lint is thrown from the gin are quite rough, and long locks of lint hang from the walls and ceilings. If the gin strikes fire (which sometimes happens) the house is burnt. Would a coating of 1 part liquid sal ammoniac 2 parts sulphate of lime, as given on p. 405, of your vol. 34, or so-called soluble glass, be the best or cheapest for making the room fireproof? A. The recipe is a good one, and we think would offer no little protection from fire. The parts are by weight. By sulphate of lime, plaster of Paris is to be understood.

(44) W. B. asks: 1. Is there any truth in the statement that a French chemist has discovered a means of producing a gas 9 times lighter than hydrogen, and non-combustible? A. There is no truth in the statement. 2. Would hydrogen or coal gas preserve or lose its buoyancy if bottled or kept from contact with air? A. It would suffer no change. 3. What would be the size of a sphere of copper filled with hydrogen, made thick and solid enough for safety in ballooning, with a lifting capacity of 300 lbs.? A. If made of copper, it would require a sphere of about 150 feet in diameter. On account of the great weight of the material used, the balloon would be little, if any, stronger in proportion than one of smaller dimension, of lighter fabric, but having a like surplus buoyancy.

(45) W. A. T. asks: Reading in the SCIENTIFIC AMERICAN, of March 25, an account of the aqueduct of La Vanne, France, being built of sand, gravel, and cement, it struck me that, if not too costly, such a composition would do in the southern part of California for fencing, as it is very expensive fencing with boards. Do you think, to make walls from 4 to 6 feet high, of the proper thickness, that a less proportion of cement would do? And would it be necessary to put it through a mill? A. Adobe fences are in use in New Mexico, and might be adopted in Southern California. They are built of sun-dried bricks, composed generally of clay and a little straw. Of course a much more permanent fence could be made of cement concrete. No specially skilled labor would be required in its construction, nor any very elaborate machinery. To 1 barrel of cement or good hydraulic lime, 3 barrels of clean sand and 2 barrels of broken stone might be used; the whole should be well mixed together.

(46) A. J. asks: 1. How big a box will just contain 20 bushels of charcoal? A. The bushel contains 2150·4 cubic inches, nearly; therefore, $\sqrt[3]{2150{\cdot}4 \times 20}$ = the dimensions of the box required. 2. Is it right to heap such a box? A. No. 3. What is the legal weight of a bushel of charcoal? A. There is no legal weight for charcoal: it varies greatly in weight, owing to the absorption of moisture and incomplete charring.

(47) F. Mc. M. asks: How can I take nitric acid out of a mixture, and leave the mixture unaltered? A. You must state the other constituents of the mixture. It is not possible to answer your question without knowing them.

(48) G. A. B. asks: 1. Will common sheet zinc do to put in muriatic acid for soldering fluid, or is a purer quality necessary? A. Sheet zinc will answer perfectly. 2. What is indicated when small, black, irregularly shaped lumps appear floating in the acid after the zinc is dissolved? A. These are the impurities of iron and carbon contained in the metal.

(49) I. H. T. asks: Is there anything that will remove violet ink from woolen goods? A. We do not think you will be able to remove it completely without injury to the fabric. Try hot alcohol and water.

(50) P. M. asks: 1. Where is the proper place to put a ventilating register in a sleeping room, right above the hot air register or about 18 inches down from ceiling downward? A. A ventilating register should not be placed too near a hot air register, as the warm air in that case will have a tendency to pass direct from the one to the other without circulating in the room. A desirable place is on the opposite side of the room, near the floor. It is better, however, to have two registers in the flue, one at bottom and one at top, and graduate the extent of their opening by experiment. 2. What are the right proportions for an ellipse? I generally make one 9 inches in hight for every foot in width; but I do not know the right proportion. A. Ellipses may be constructed of any proportion in harmony with their use. The proportion you have adopted is a good one for ordinary purposes.

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

S. E. E.—It is black oxide of manganese, containing a large percentage of sesquioxide of iron. —N. T. W.—It is galena or sulphide of lead.—H. K. (June 27) It is iron pyrites and chalcopyrite.—J. H. T.—No. 1 is a piece of hornblende. No. 2 is an iron ocher.—J. F. F.—It is a kind of Tripoli powder, used for polishing purposes.—M. F. T.—One is iron pyrites, the other quartz rock and mica.—J. S. H.—It does not contain lead nor silver. A complete analysis would be necessary to determine all of its constituents.—H. E. F.—It is black mica.—W. W. E.—It is galena or sulphide of lead. If in large quantities, it is a valuable ore.—We have received some minerals in a match box, with no letter. No. 1 is a piece of trap rock. No. 2 is a partially decomposed granite, containing iron pyrites. No. 3 is red sandstone. No. 4 is a piece of glass.—H. K. (July 5).—It is decomposed sandstone, not valuable.—E. L. S.—It is a piece of slate, with a little iron ocher adhering.—We are in receipt of a small section of brass pipe, the thread on the outer surface of which is much and deeply corroded. It is labelled "Oneida Community." There is no letter with it.—W. W. N.—Iron pyrites (sulphide of iron).—B. McD.—No. 1 is magnesian limestone, containing crystals of iron pyrites. No. 2 contains silica, alumina, lime, magnesia, and iron.—C. S. B.—The specimen consists of partially decomposed sulphide of iron. We do not think it is of meteoric origin.

E. E. asks: What are the colored fluids put in bottles for display in druggists' windows?—B. C. asks: How can I make a soap for extracting grease and dirt from woolen cloth, without injuring the texture?—C. J. J. asks: How can I polish and color wooden smoking pipes?—W. J. B. asks: What is the best mocking bird food?—T. C. D. asks: What is the lowest point marked by the thermometer in any of the polar expeditions?

COMMUNICATIONS RECEIVED.

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

On the Meteor of July 8. By J. M. D.
On a National Monument. By L. S. B.
On a Little Brag. By Y.
On Irrigation. By F. C.
On Oracles. By A. M. S.

Also inquiries and answers from the following:

E. L. C.—F. W. W.—C. J. G.—C. F. S.—H. W. C.—A. R.—F. S.—J. B.—A. M. S.—J. B. L.—J. S. L.—F. G. B.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who buys white soapstone? Who buys corundum? Who makes the best brass wire? Who sells barometer tubes? Who manufactures Yankee "notions"? Whose is the best rotary engine? Who sells spectroscopes? Who makes the best propeller wheels for steam yachts? Who makes wind wheels? Whose is the best elevator for raising water? Who makes the best flexible hose for conveying water? Whose is the best steam fire engine?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

July 11, 1876,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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DESIGNS PATENTED.

384.—SCARF BOXES.—J. H. Fleisch, New York city.

385.—TEA SET HANDLES.—E. Haviland, Brooklyn, N. Y.

9,386.—REVOLVER CYLINDER.—W. A. Hulbert, Brooklyn, N. Y.

9,387.—CALENDAR, ETC.—D. C. Newell, Yonkers, N. Y.

9,388.—HANDLE SOCKETS.—W. M. Smith, West Meriden, Conn.

389.—DRAWER PULL.—P. J. Clark *et al.*, West Meriden, Conn.

9,390 to 9,392.—CENTER PIECE.—S. Kellett, San Francisco, Cal.

393.—HANDLE LUGS.—W. M. Reid, Amsterdam, N. Y.

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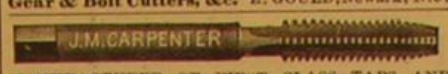

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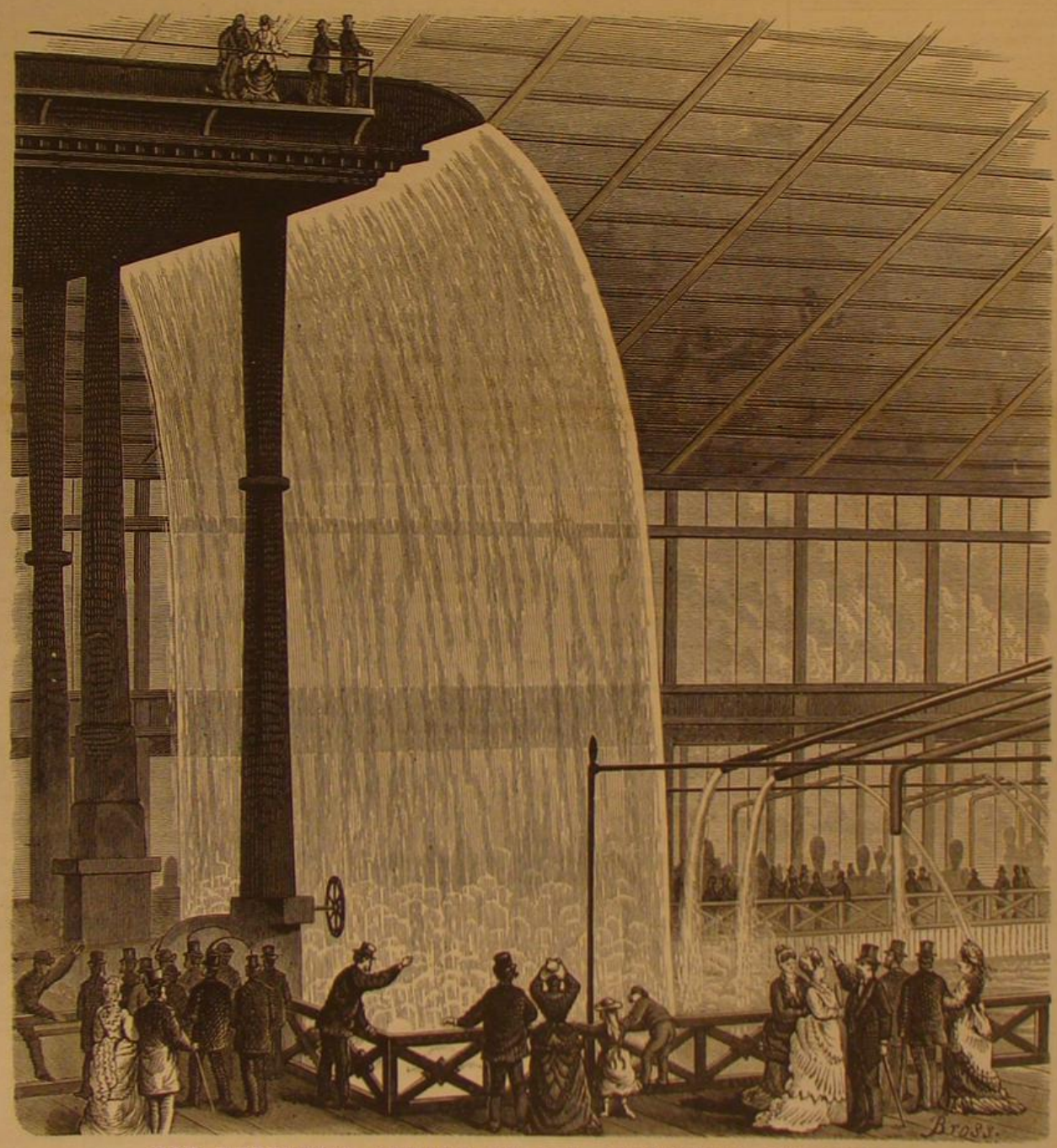
There are few more attractive features in the Exposition than the wing or annexe of the Machinery Hall which is devoted to the display of the hydraulic apparatus. Long before the locality is reached the sound of "the rushing of mighty waters" reaches the ear, drowning the clatter of the vast area of mechanism in the vicinity; and the eye is greeted by a score of great streams, first curving majestically into the air, then lashing the waters of the huge tank below into spray; while in rear of all, a moving background of crystal and foam, falls the grand cataract. From a point behind this superb sheet of water, our artist prepared the drawing from which the annexed engraving was made. The tank is an immense brick and cement basin 146 feet long and 60 feet wide, the bottom being 8 feet below the floor of the Hall. With the water level 14 inches below the floor, it contains nearly 500,000 gallons of water, which is used over and over again in the pumps, and drawn off only when it becomes foul and unfit for use, when a new supply is let in from the mains.



THE HYDRAULIC ANNEXE AT THE CENTENNIAL EXPOSITION.

At the south end of the basin is the apparatus for testing turbine wheels, and this includes the miniature Niagara already referred to. Upon six columns, three of which are supported upon an oblong pier, erected within and near the end of the reservoir, and extending across it to within about 4 feet from each side (the other three resting on foundations within the basin) is placed a tank of boiler iron 36 feet long by 18 feet 6 inches wide and 5 feet 6 inches deep. On the side of the tank, overhanging the reservoir, is a weir overflow of the proper curved form, extending the whole length, and placed about 32 feet above the level of the main tank: by means of which weir, measurements of water discharged may be made. It holds about 19,000 gallons. The water falls over the weir into the tank in a single magnificent sheet, at the rate of 30,000 gallons per minute. This supply is maintained by two Andrews' centrifugal pumps of 100 horse power each, which are able to fill the tank every 38 seconds and to empty the main reservoir in 16⅔ minutes. The elevated tank also serves to obtain a head under which other pumps may discharge while under test. From the bottom of it is led, directly downward, a penstock tube 4 feet in diameter, and immediately under it is a cylindrical chamber of brick and cement 8 feet in diameter, built in the foundations of the tank columns. In this chamber the water wheels will be placed

Ranged along the sides of the main reservoir are numerous hand and steam pumps of all sizes, grades, and patterns, the steam apparatus having delivery pipes measuring from 1 inch to 12 inches in diameter. These pipes are represented in the engraving at about 12 feet from the floor, and projecting over into the tank. At the north end of the latter a crane pump throws a 2 inch stream of water almost to the opposite extremity. Numerous tests of the hydraulic machines are to be conducted; and the results, it is believed, will prove of great value towards determining the economy and merit of the various apparatus for raising water and producing power

A GOOD bell metal consists of copper 100, tin 20 parts.

Bodily Weight and Nutrition.

Professor C. Voit, in a lecture at the Public Health Congress held at Munich, remarked: "The weight of the body has often been assumed as an infallible proof of the maintenance of the condition of the body, or of a deposition of tissue, and the food which keeps up a man's weight has been regarded as on that account satisfactorily nutritious. But the weight of the body is no criterion of the value of the food taken, because while the weight remains constant, or even increases, water may increase in the tissue and albumen and fat diminish; or there may be an increase of weight and deposition of fat, while there is also at the same time a diminution of the albumen of the body. Badly nourished people are usually not lighter than others, but their bodies contain more water and less albumen and fat than those who are well nourished. Every cattle feeder knows that cattle which are being fattened do not at first increase in weight proportionately to the food they take And yet people commonly regard weight as of great importance in the case of men, though a butcher will not buy a carcass on the merits of its weight alone; he must know the quality of the meat.

"The subjective feeling of satisfaction is equally deceptive. The Irish peasant who consumes ten pounds of potatoes in the day feels quite satisfied, and yet is badly nourished. The bad effects of an improper dietary are often seen only after a considerable period has elapsed."

New Sulphur Mines in Nevada.

A new and extensive sulphur bed has recently been discovered in Washoe county, Nevada. The sulphur is imbedded in a light colored formation similar to steatite, which is half a mile in width, and can be traced north and south for about a mile. The mine has been opened to a depth of some 20 feet, and the sulphur is abundantly met with in the shape of crystalized bunches. It assays about 75 per cent of the pure article, and is worth $50 a tun in San Francisco A very large yield is predicted; and owing to the proximity of the bed to the railroad, the expenses of transportation will be small.

The Universal Distribution of Chromium.

With regard to the new mineral daubretite, which has lately been observed in meteoric masses, Professor J. Lawrence Smith considers it to be a photosulphide of chromium, of the composition: sulphur, 37·62; chromium, 62·38. This, taken into consideration with the revelations of the spectroscope regarding the vapors which surround the sun, shows that chromium is largely diffused through the material of the Universe.

Experiments with Frozen Dynamite.

Some interesting experiments were recently made at the works of the British Dynamite Company at Stevenston, Ayrshire, with the view of proving that dynamite in a frozen state is as safe to handle and to transport as in an unfrozen state. Professors James Thomson and Bottomley, of the University of Glasgow, were present. In the first experiment, several cartridges, in a frozen state and in some parts beginning to thaw, were thrown one by one from the hand, with great force, against an iron plate without explosion. In the second experiment, a block of iron, of about 400 lbs. weight, was allowed to fall from a hight of about 20 feet on a light wooden box containing 20 lbs. of dynamite cartridges in a frozen state, and with slight signs of incipient thawing in spots more exposed to the warmth of the air. The box was smashed, and the cartridges were crushed flat and pounded together, but there was no explosion. The crushed cartridges were next made up into two heaps to be exploded. The ordinary detonator shatters but does not explode the frozen dynamite. The explosion was therefore effected by inserting in each heap a small unfrozen cartridge, with the ordinary detonator inserted into it, and then firing this off by a Beckford fuse. The two heaps were exploded successively, and it is worthy of remark that the explosion of the first, though very violent, did not set the other off, the unfrozen cartridge being the only means for effecting this purpose.

Poisons.

On April 21, the Austrian government published a decree in regard to the traffic in poisons, declaring the following substances to be included under the term poison: 1. Arsenic and all its compounds. 2. Chlorides and oxides of antimony. 8. Oxides and salts, including the chlorides, iodides, and bromides, of mercury. 4. Ordinary phosphorus. 5. Bromine. 6. Prussic acid, and preparations containing it, as also all cyanides, with the exception of those containing iron. 7. All violently active preparations made from poisonous plants and animals, or manufactured artificially, such as the alkaloids, curare, cantharides, etc.

PARAGUAY TEA.—We learn from the *Deutsche Industrie Zeitung* that Paraguay tea (*maté*) has recently been introduced into two *cafés* in Vienna, and has already found many admirers.

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BERTHELOT'S NEW ELECTRO-CHEMICAL DISCOVERIES.

M. Berthelot, the distinguished French chemist, has lately brought before the French Academy of Sciences a series of remarkable experiments, which, in addition to affording other results, point to an important and brilliant discovery relative to the reactions which occur between the gaseous elements of the air and the organic compounds of the earth. The nature and effect of these reactions on vegetation constitute no small portion of the science of agricultural chemistry. And regarding the question of the source of the supply of nitrogen to plants, it is well known that none is more closely enlisting the attention of chemists who find, in the doubt encircling present accepted theories, the stimulus for further and deeper investigation.

We know that, for the support of vegetation, carbon, hydrogen, oxygen, and nitrogen are needed, and that the source of carbon is the carbonic acid which exists in the atmosphere in the proportion of $\frac{1}{2500}$ of its volume. Similarly, the water always present in the air supplies hydrogen and oxygen necessary. It is not so easy to trace whence the nitrogen is derived, and here opinions have fiercely conflicted. Previous to Liebig's time, it was supposed that organic matter (humus) supplied the chief nutriment of plants; but this the great German chemist denounced as "baseless and absurd;" and after detailing his own experimental researches and those of others, he affirms that nitrogen "is derived either from the air, whence it is conveyed to the earth in rain or dew, or from organic substances accumulated from a series of generations of dead or decayed plants, or else from animal remains contained in the earth or incorporated with it by man in the form of excrements. * * * The remains of extinct animal life, which are embedded to an enormous extent in sedimentary strata, or which of themselves constitute whole masses of rock, attest the extraordinary distribution of organic life in the former ages of the earth: and it is the nitrogenous constituents of these animal bodies, passing over into ammonia and nitric acid, which still play an important part in the economy of the vegetable and animal world." Such is the present theory. It is difficult to conceive of its more complete reversal than must follow the acceptance of the facts which M. Berthelot now places before us—facts which the clearest of subsequent investigation must substantiate before they will prevail over Liebig's conclusions—facts which lead to the assertion that free atmospheric nitrogen is fixed in organic nature, unchanged in form by atmospheric electricity.

It has long been known that the silent electric discharge is capable of producing special chemical reactions. In order to study these, M. Berthelot devised a simple little apparatus, composed, first, of a bell-mouthed test tube about which a ribbon of platinum was coiled; and second, a V tube of glass closed at one extremity. The test tube filled with the gas or liquid to be tested was inserted over a mercury bath, and the closed end of the V tube was inserted in it. One pole of a Ruhmkorff coil was attached to the platinum ribbon, the other communicated with a conducting liquid (acidulated water) in the V tube. The current then passed through the then annular space comprised between the vertical leg of the V tube and the inner periphery of the test tube, which space was of course filled with the material under examination. By this instrument he found that organic compounds, at ordinary temperatures, absorb free nitrogen, while under the influence of the current. In a few hours, 15·4 grains absorbed from 0·24 to 0·3 cubic inch of nitrogen, the greater part remaining unaltered; a solid resinous polymeric product was generated, which, on being heated, decomposed with evolution of ammonia. Turpentine and marsh gas acted similarly. Taking the constituent principle of vegetable tissues—in the shape of a piece of white filtering paper, which is none other than cellulose or ligneous principle—after having slightly wet it, he submitted it to the action of the current in presence of pure nitrogen. In eight or ten hours, a notable quantity of gas had been absorbed, and subsequently the nitrogen, combined with the paper, was extracted in the state of ammonia.

The presence of oxygen does not hinder the absorption of nitrogen. By causing the discharge to act on atmospheric air in contact with a sirupy solution of dextrin, M. Berthelot observed that a certain quantity of nitrogen and oxygen combined with the organic matter. Furthermore, hydrogen is absorbed in the same manner and even more rapidly than nitrogen; 0·06 cubic inch of benzine took up 15 cubic inches of hydrogen, or about 2 equivalents, and the result of the combination was a resinous substance analogous to a dried varnish, possessing a very strong and disagreeable odor.

The reaction produced by the silent discharge appears to be much greater than when the electric spark is used. With the current the proportion of ammoniac gas reaches about 0·03 in the normal mixture of nitrogen and hydrogen; with the spark, but a few hundred-thousandths. The decomposition of ammoniac gas by the current tends to the same limit. This identity of the two limits produced by the inverse action of the current is remarkable, and is as important to be noted as that of the diversity which exists between the action of the silent discharge and that of the spark. Protoxide and binoxide of nitrogen, sulphuretted and phosphuretted hydrogen, sulphurous acid, etc., are all more or less profoundly decomposed; and in brief, the action of the silent discharge, like that of the spark, tends to resolve compound gases into their elements, with the production of phenomena of equilibrium due to the inverse tendency of recombination. Only, in the case of the discharge, a portion of the isolated elements unites with the compound itself to form condensed products, to the formation of which, however, are opposed the longer duration of the spark, and especially the heating effect thereof.

"It is not doubtful," says M. Berthelot, turning to the practical results of his discovery, "that analogous phenomena (accompanied by an absorption of oxygen) manifest themselves during storms, and even when the air is electrified or presents a different potential in its upper strata and in those exposed to the sun, which is, after all, its normal state. Under these conditions, the organic matters in contact with the air very probably absorb nitrogen and oxygen. This absorption may be revoked at the moment of lightning discharges, which correspond to the differences of tension analogous to and greater than those of the Ruhmkoff apparatus; and the same is likewise probable for weaker differences that are incessantly produced. Perhaps even this absorption of nitrogen and oxygen, joined to the molecular condensations and other chemical changes developed in the tissues under the influence of the electric discharge, causes corresponding physiological modifications which play a certain part in the singular ailments manifested in the human organism during storms."

Without stopping to dwell on these points, however, the discovery may be regarded, as we stated in the beginning, as showing a new cause for the fixing of atmospheric nitrogen in Nature. It engenders condensed nitric products, of the order of the humic principles so widely extended over the earth's surface; and however limited the effects may be, at each instant or at each point of the terrestrial superficies, they may evidently become considerable by reason of the extent and the continuity of the reaction universally and perpetually taking place.

IS THE UNIVERSE COMPOSED ENTIRELY OF HYDROGEN?

There are many eminent chemists, Professor Cooke among the number, who believe that, instead of there being 64 elements, there is but one. That this one universal element assumes more than 60 different forms (according to the velocity with which the atom moves), which constitute the molecules, or their arrangement, or number, is not more wonderful than the changes which some of our so-called elementary bodies suffer in their allotropic modifications. Sulphur, phosphorus, and carbon are, to a certain extent, protean; but they are distanced in the allotropic race by isomorphous hydrocarbons. Dr. Wurz defines organic chemistry as the chemistry of the hydrogen compounds, for he believes that it is protean hydrogen, with its ever-changing atomic volume that makes organic chemistry so complex. If we combine the two theories, that all matter is but various forms of one simple body, and that hydrogen is the most protean of our so-called elements, we have an affirmative answer to the query which forms the title of this article.

What force we shall employ to dissociate the elements and convert them into that primitive form, we are at a loss, as yet, to say; but the spectroscope leads us to think that heat, if sufficiently intense, may accomplish it. Lockyer, the great English spectroscopist, has recently been studying the spectrum of calcium, and says that when this metal is heated above a certain temperature the hydrogen line appears, as though, at that temperature, a partial dissociation took place. This fact alone is a feeble basis for the grand hypothesis that all things are hydrogen, and so too is the coincidence of the blue indium line with one of the hydrogen lines; but we shall wait for farther research, thankful that Professor Lockyer has directed our attention to that direction. The hottest known body is the sun, and about it play enormous lambient flames of hydrogen; and perhaps this unlimited supply of hydrogen is due to dissociation. Will spectroscopic astronomers tell us?

OCULAR COLOR SPECTRA AND THEIR CAUSATION.

It is a well known fact that by certain simple combinations of lines the eye can be so completely deceived as to make it altogether unreliable as a means of estimating distance and direction. Similarly, by certain grouping of masses of light and shade, the organ can be misled into recognizing apparently tangible and solid objects from mere pictorial representations. These deceptions, however, are independent of color. When that element is added a remarkable group of optical phenomena is engendered, by which the eye is led even more completely, and with less obvious reason, into error.

The reader will gain an idea of these appearances by the performance of a few simple experiments which we will indicate. On a black background, place a disk of white paper about the size of a half dollar piece. Gaze at the disk fixedly for a couple of minutes, then suddenly regard a blank white wall: when a dark spot, having the outline of the disk, will be beheld on the white surface. If a dark body on a white ground be first looked at, then, on lifting the eyes to the wall, a brilliant white figure of corresponding shape will appear, To these appearances the name negative spectra has been given; they may be considered, in fact, as genuine specters, ghosts, of the solid objects gazed on. Next, prepare from brilliantly colored paper, red, blue, yellow, and green circles. After gazing fixedly at the red circle and transferring the eyes to the wall, a green circle will appear thereon, the blue will cause a yellow specter, the yellow a blue one, the green a red, and so on, each color producing a specter of complementary hue. These are termed complementary color specter, and they may be produced in a variety of ways. Near sunset, the rays of the sun passing through an orange colored cloud cast blue shadows; the shadows of objects seen behind red curtains are green. If the sunlight be transmitted through colored glass so as to fall on white ground, the shadow of an object, placed so as to intercept the light, will have a shadow of the color complementary to that of the transmitting pane. And yet, if we look at the shadows so thrown through a tube, so as to shut

off all else from the eye, the shadow appears without color; or, if the same shadow falls on a black surface, no shadow appears.

The theory advanced by Dr. Thomas Young, and accepted by Helmholtz and others, to explain these phenomena, asserts the existence of different susceptibilities to color rays in different portions of the retina, or among the different optic nerve filaments. Color spectra and color shadows are all explained by partial or local fatigue of the retina under impressions of light; so that the part of the retina impressed by a particular color becomes, through fatigue, less sensitive to the same color, kind, or degree of light; and therefore an impression is, during the time of that fatigue, made upon our visual consciousness only by the opposite or complementary rays: these affecting those parts or elements of the retina which are fresh not having been wearied by use. We become, in short, color blind to certain hues, while our capacity for perceiving other colors remains vigorous.

This theory has recently been reviwed by Professor Henry Hartshorne, and the results of that author's investigations are opposed thereto, while they have led him to suggest a new hypothesis. The more prominent experiments of Professor Hartshorne are easily repeated. It is obvious that, for the retina to become fatigued, an appreciable length of time is necessary. To show that no interval of time elapses in which fatigue can occur, it is only necessary to make a few black lines on, for example, a piece of bright green paper. Cover these lines with a sheet of very thin writing paper, such as is used, on account of its light weight, for foreign correspondence. The black lines, seen through the thin paper, at once appear red, and appear so instantaneously on the placing of the covering sheet. Any other colored paper than green may be used; the colored lines will always show the complementary color. Professor Hartshorne goes on to show that the same instantaneous color is seen in color shadows. Another experiment which he describes consists in looking at sunlight through panes of colored glass, and then turning the eyes toward a white wall. In each case a strong complementary (so-called negative) color spectrum was seen; but on closing the eyes an almost equally intense positive spectrum, having the same color as the stained glass looked through, appeared. On opening the eyes the complementary spectrum returned; on closing them, the positive one, and so on for several times in succession. This seems obviously to be quite fatal to the supposition that retinal fatigue can account for any class of spectra such as has been considered; for if ordinary luminous impressions produce temporary fatigue and loss of sensibility, stronger impressions ought to produce still greater fatigue and greater loss of sensibility: whereas the reverse is the fact.

Professor Hartshorne's hypothesis is simply as follows: The eye becomes charged, saturated, with the particular colored light, and this, having a certain strength, is neutralized by the similar colored rays in light reflected from the white surface, so that only the complementary rays of that light affect the sight. The minute retinal nerve elements respond in vibration to the luminous ether waves of the color reflected to the eyes, and are excited to motion thereby; and by irradiation or communication of vibrations, all retinal elements which have the same period of vibration are made to partake in some degree of this movement. Then, when turning from the colored object, white light, consisting of all the color rays or waves together, impinges upon the eyes; those ether waves of the white light, which belong to the color first acting on the retinal nerve elements, interfere with and for the time relatively diminish or annul the special vibrations already produced in the retina; leaving the other waves of white light to take effect upon the retinal elements which respond to or "resonate" with them, so that the complementary color only is seen.

A NEW THEORY OF HAY FEVER.

Hay fever, rose cold, peach cold, hay asthma, or autumnal catarrh—the names being indifferently applied to the same malady—is a disease which has so long baffled medical skill that a deep-rooted popular notion has been engendered that it is incurable. Having the characteristics of a cold or asthma in some respects, it differs widely from them in others, and fails to succumb to timely remedies which, in the early stages of the ordinary catarrh or cold, induce perspiration and so break up the affection. As to the nature of the strange ailment, physicians have long disagreed; but up to the present time, the dominant theory has been that suggested by Helmholtz in 1869. The German physiologist stated that he had found in the nasal secretion "certain vibrio-like bodies" (infusoria), very delicate and small, and observable only through microscopes of high power. These he endeavored to eradicate by injections of quinine solution, and met with apparent success. Helmholtz, however, experimented only upon himself, and there is a failure of evidence throughout his investigation which may justly prevent the acceptance of its results without the corroboration of much more extended inquiry.

In 1872 Dr. Morrell Wyman, of Cambridge, Mass., published a treatise on the disease in which he recognized two distinct forms, namely a "rose cold" or "June cold," occurring in May or June and corresponding to the hay asthma of England and the Continent, and a later form beginning in August and lasting several weeks into the fall, to which he gave the name of "autumnal catarrh." Subsequently Dr. Blackley, of Manchester, England, pursued a series of ingenious researches to support a theory that hay fever is caused mainly if not exclusively by the pollen of grass. The studies of Helmholtz, Wyman, and Blackley we refer to because, in point of time, they are among the latest, and for the reason that they have each been regarded as important steps toward the thorough comprehension of the malady. A new work on the subject has now just left the press, in which all previous theories are reviewed, and the results of probably the most extended investigation ever made into the causes and nature of the disease are placed before the public. The author is Dr. George M. Beard of this city, and the method in which the inquiry has been conducted, together with the facts elicited, will commend the work even to those who may not be disposed to accept the theories adduced. Following the example of Darwin and Galton, Dr. Beard prepared a series of fifty-five questions, which were designed to exhaust all sources of facts of which the majority of physicians and patients were capable of judging. From the answers, critically compared and statistically arranged, covering the circumstances of two hundred cases, the author reaches the following general conclusions:

Hay fever is essentially a neurosis, that is, a functional disease of the nervous system. In order to induce an attack there is necessary, first of all, a predisposition, frequently hereditary, to special and excessive sensibility of the nerves supplying the affected parts. All forms of the disease in all countries, whether occurring in the spring, summer, or autumn, are but manifestations of one disease, for which the most appropriate name is "summer catarrh," which may be subdivided into an early form, middle form or July cold, and the latter form or "autumnal catarrh." As the disease is not due to any single specific cause, animal or vegetable, as has been supposed, no specific will ever be found for it. The attacks may be prevented and relieved, and some remedies will act specifically on individuals; but no one remedy will ever be found to act in all cases. The leading indications in the prevention and treatment of the disease are the avoidance of light, heat, worry, dust, vegetable and animal irritants, and other exciting causes, fortifying the system by tonics before and during the attack, and relieving the symptoms by those sedatives and anodynes, locally or generally administered, which are found by experience to be best adapted for each individual case.

These indications can be met by spending the season of the attack at sea, or in elevated mountainous regions, or in high latitudes at any elevation where the air is sufficiently cool, or at the sea shore, or, for those who cannot leave their homes, in quiet, cool, closed, and darkened rooms.

For those who, in spite of these precautions or from inability to take them, are attacked with the disease, ther emedies should be quinine, arsenic, iron, and electricity, before and during the attack; local applications of quinine and camphor by the atomizer; and for palliatives, any one or several of the great variety of remedies that experiment shows to be most useful for each individual.

SHALL WE CHANGE OUR WEIGHTS AND MEASURES?

The reasons for and against making the metric weights and measures the only legal standards in this country are pretty thoroughly canvassed in the majority and minority reports of the committee of the Franklin Institute, appointed to consider the question at the request of the Boston Society of Civil Engineers.

The majority report, submitted by Messrs. Coleman Sellers and W. P. Tatham, urgently opposes the change, believing that the possible benefits to be reaped from it would not make up for the damages done during the transition; and that our government has already done all that can fairly be asked of it by making the metric system legal.

In the first place the motive for change which originally gave rise to the French system does not exist with us. There is among us nothing like the legal confusion of weights and measures which existed in France when the Bishop of Autun first proposed a reform. Our standards are few, and have the same value in California as in Maine; those which the metric system was designed to supersede were numerous, widely various, and of narrowly local use. There were, for example, thirteen different lengths of the foot, all legal, in France; eighteen legal yards, twenty-one legal pounds, twenty-four legal *bosseaux*, thirteen legal *tonneaux*, and so on; and the range of quantity represented was often enormous, as between 12,203 cubic inches and 97,980 cubic inches in the various *tonneaux*.

Then the opportunity presented to France was favorable for a change: a time of revolution, when the social order was overturned and a new political system inaugurated. Besides, the people of France had always been used to having the government interfere with their private affairs. We are not. The general government has not even undertaken to enforce compliance with existing standards, which the constitution authorizes it to fix; and if enacted, a law abolishing them and substituting the metric weights and measures would probably remain a dead letter unless enforced by means which the people would not submit to.

The argument of the committee is broken at this point by a digression in regard to the difficulties which the French experienced in bringing about the change: an interesting summary of the history of the origin and development of the metric system, but without any bearing on the present question, since the system is now complete, if not perfect, and many other countries have adopted it without any such difficulty or derangement of trade.

The objections to the meter as a standard are more cogent. It cannot be made universal. It was drawn from the circle and the sphere, yet neither of these forms will submit to the decimal metrical system. "The measurement of time, of the degrees of the circle, of navigation, geography, and astronomy, successfully rejected it, although the prime idea of the Commission was to connect these subjects with ordinary weights and measures, by making the meter (the forty-millionth part of the circumference of the earth) the unit of lineal measure, and the second (the hundred thousandth part of the day) the unit of time, by means of the pendulum beating 100,000 seconds. The meter and the second were then the intermediate links in a long chain connecting Science and practical life, having the solar system at one end and a quart measure on the other. It is singular that the parts of this chain applicable to the calculations of Science were at once abandoned for their inconvenience, and the parts applicable to the uses of yard sticks, pound weights, and quart measures were imposed upon the people by compulsory laws for nearly twenty years, without regard to the still greater inconvenience to them."

In the end a compromise had to be made for the convenience of commerce, and arbitrary standards, susceptible of divisions into halves, quarters, thirds, and so on, were authorized, "in harmony with the daily wants and usages of practical life."

Another serious objection to the meter as a standard arises from the fact that it is as arbitrary as the foot. Theoretically, it is the ten millionth part of the earth's quadrant, but the adopted length has been proved incorrect, so that the actual standard is not a definite fraction of the earth's circumference, but the arbitrary rod in the public archives. As there remains not even a sentimental reason for accepting the meter as a standard, convenience alone should determine the question of its adoption. On this point the committee hold that it is not nearly so satisfactory as the foot, while the confusion, labor, and expense of changing standards would be enormous. The meter is only decimally divided, whereas the foot, besides being divided into tenths and hundredths, is also divided into inches, giving the even half, third, fourth, fifth, sixth, tenth, twelfth, and hundredth of the foot, and the half, third, fourth, fifth, sixth, eighth, tenth, twelfth, and sixteenth of the inch.

Again, if we change our standard for the sake of uniformity with France, we must sever our uniformity with Great Britain, with which three fifths of our foreign commerce is transacted. And the change would entail a much greater expense than is usually imagined. All our land surveys have been made in acres, feet, and inches, and are so recorded in our public records with the titles to the land. "Hundreds of years would elapse before we could permit ourselves to forget these old measures." The industrial arts have of late years acquired a far greater extent and precision than ever known before, with an infinite variety of costly tools for working to exact measurements. To change our standards would necessitate a corresponding change in all these, entailing enormous loss. A new outfit for a well regulated machine shop, employing 250 workmen, for example, would cost, it has been estimated, not less than $150,000, or $600 for each workman. "If new weights and measures are to be adopted, all the scale beams in the country must be regraduated and readjusted; the thousands of tuns of brass weights, the myriads of gallon, quart, and pint measures, and of bushel, half-bushel, and peck measures, and every measuring rule and rod of every description throughout the land, must be thrown aside, and others, which the common mind cannot estimate, must be substituted." Further, "the great mass of English technical literature would become almost useless, and must be translated from a language which we, and the nation which we have the most to do with, understand perfectly, into a new tongue which is strange to most of our people." The change may seem easy enough to closet scholars who use weights and measures only in calculations; but to practical users of weights and measures, the producers and handlers of the material wealth of the country, the necessary cost of the change would vastly outweigh any possible theoretical benfit to be derived from it.

The report of the minority of the Committee, Mr. Robert Briggs, is less an argument than a vigorous protest against the positions taken by the majority, as untrue, irrational, or absurd. Mr. Briggs agrees with the majority, however, in holding that "it is inexpedient to attempt at present to anticipate by enactment the time when this great step in the progress of human civilization and unity (the adoption of the metric system) shall be taken by the national government of the United States." But he does so "solely upon the grounds of the incomplete preparation and education of the people, and their want of appreciation of the immense advantages in the progress of the arts and the applications of the sciences which the metric system presents."

The opportunity was a favorable one for presenting a strong argument for the change, based on the practical experience of those European and South American States which have adopted the metric system; and it is a pity that Mr. Briggs did not avail himself of it. Much better than any protest against the statements of the majority of the committee would have been an array of facts showing that the metric system had been adopted by countries, other than France, without the evil results predicted.

Chloride of Silver Battery.

For the last year or two Mr. Warren De la Rue, in conjunction with Mr. Spottiswoode, has been making a series of interesting experiments with a gradually increasing series of elements, whose chief interest centers in the employment of chloride of silver as the electrolyte. Starting with a thousand cells, he has increased the number to over five thousand, and has published some remarkable facts in connection therewith. It is not impossible that, some day, chloride of silver may play the part of light producer in addition to its usual well known *rôle*. The experimentalists named estimate that 100,000 of these batteries would give a spark in air of nearly three yards.

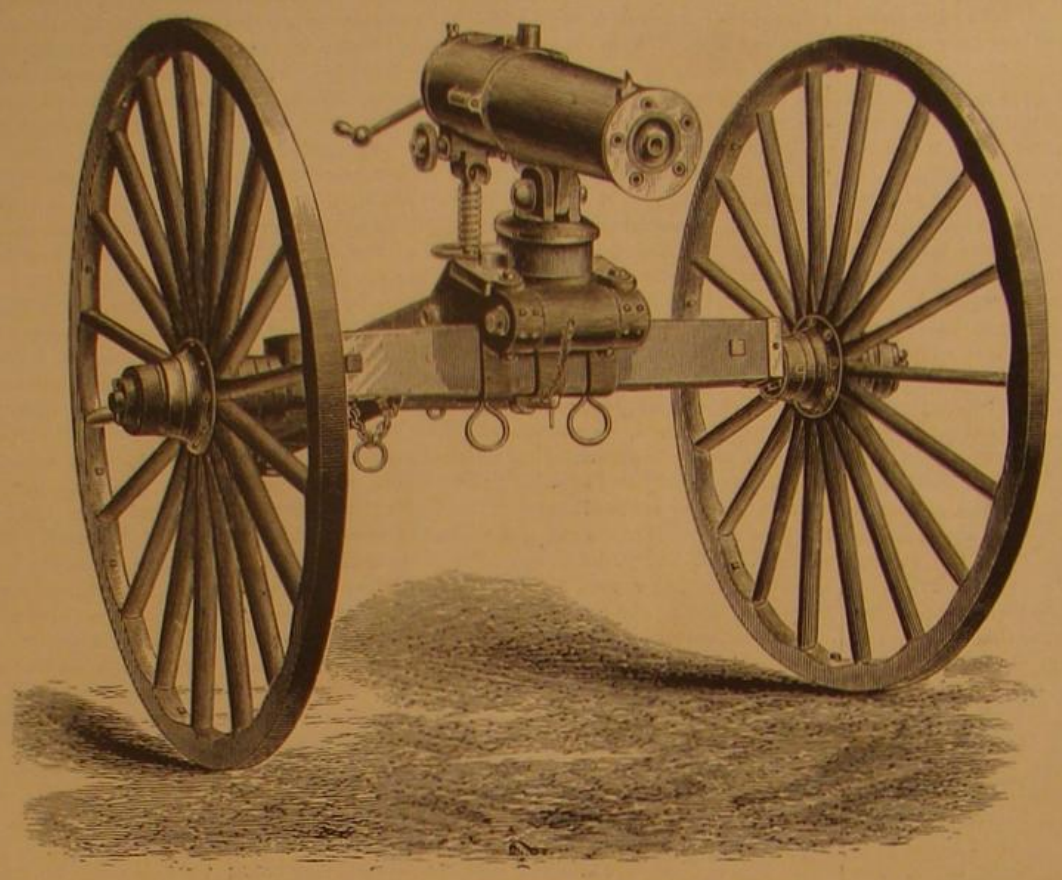
NEW GATLING GUN.

The annexed illustration represents a new and improved five-barreled Gatling gun, which, in lightness and rapidity of fire, excels any gun heretofore made on the Gatling system.

This gun weighs only 97 lbs, and fires one thousand shots per minute. It differs from the previous models in the following particulars: 1. The barrels and working mechanism are enveloped in a metal casing, which supplies the place of the frame formerly used. This casing protects the mechanism from rain, dust, rust, etc. 2. The crank is attached directly to the rear end of the main shaft, superseding the use of gearing to revolve the gun. 3. Improvement in the feed has been made, so that the cartridges are fed directly to the carrier on a central line, vertically, above the axis of the gun. These improvements can be applied to guns of ten barrels.

The manufacture of Gatling guns was commenced at Colt's Armory, Hartford, Conn., in 1866, and has there been continued uninterruptedly since. They are also made at the works of Sir W. G. Armstrong & Co., Newcastle on Tyne, England, and by Ludwig Nobel, at St. Petersburg, Russia, under agreements with the Gatling Gun Company. They have been sold to the following governments: Austria, Argentine Republic, Brazil, Bolivia, Chili, China, Costa Rica, Denmark, Egypt, Ecuador, France, Germany, Baden, Bavaria, Prussia, Great Britain, Guatemala, Hayti, Holland, Italy, Japan, Mexico, Nicaragua, Paraguay, Peru, Russia, Siam, Spain, Sweden, Switzerland, Turkey, Tunis, and the United States.

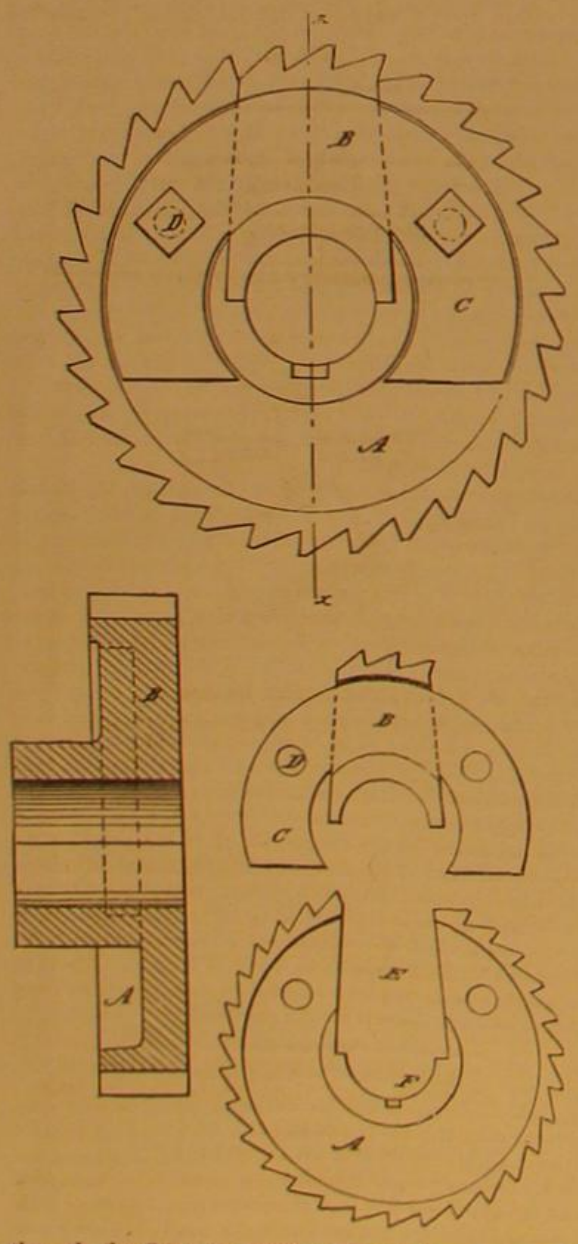
It will be seen from the above that the Gatling gun has met with remarkable success, and is destined to play no inconsiderable part in future wars.



THE LATEST IMPROVED GATLING GUN.

IMPROVED SPLIT WHEEL.

Mr. Benjamin G. Mills, of Fall River, Mass., has patented



through the Scientific American Patent Agency, April 18, 1876, an improved split gear or other wheel, so contrived that flanges on the one side of one part fit upon and are bolted to the side of the other part, to allow of applying to, and removing from, the shaft such wheels in less space than is required when they are fastened by bolting two flanges together at the sides of the wheel. One part of the wheel may also be dovetailed in the other, to sustain the expanding action of the key better than in the common way.

A is one part of the wheel, and B the other. The latter has curved flanges, C, projecting from one side, suitably for fitting against the side of part, A, so as to be secured thereto by bolts, D, when the two parts are fitted together on the shaft. The part, A, comprises nearly the whole of the wheel, being only as much less as is necessary for the notch, E, to admit the shaft to the center, F. Said notch is made in dovetail shape, so that the part, B, will be securely held against the expanding effect of the key, by which the wheel is secured to the shaft.

The Chinese Management of Roses.

It has been stated that the Chinese method of layering roses is sometimes more successful than ours. Late in the summer they select a vigorous shoot of the same year's growth and tongue it in the usual way; then put in a small pebble to keep the slit open, and bind a handful of fresh moss around the tongue, keeping it constantly dampened. In about six weeks it will have struck roots, and can be planted without disturbing the mossy covering. Many of the garden roses can be increased by suckers from the roots, which can be severed with a sharp spade in the autumn and new bushes formed of them. Budding roses is a simple process, by which amateur cultivators often increase their stock. A sharp penknife can do duty for a budding knife, and the handle of a toothbrush, if ground down smoothly, will answer for a spud to aid in lifting the bark. From the last of June to the last of August is the best time for this process, as the bark can then be more easily raised from the wood. Take a smooth stalk and make a horizontal cut across the bark, through to the wood, but not into it. From the center of this cross cut make another cut straight down the stem, an inch or more in length. These two cuts should resemble a T. Slice off the bud you desire to propagate with one cut of the penknife, cutting it close to the main stalk. Now, with the edge of the spud turn back the bark on each side of the straight cut and insert the bud on the wood of the branch to be budded, fitting it tightly to be crossed cut. With a bit of soft yarn bind down the bark, leaving the point of the bud exposed. A handful of dampened moss must then be bound round the stem, taking care to leave the tiny point of the bud exposed to the air. In six weeks the wrappings can be removed, but all other shoots must be kept from growing on the budded branch. By this means a rosebush can be made to bear half a dozen different colored roses.

Gigantic Advertising.

Probably the largest advertisement in the world is that of the *Glasgow News*, which displays its name on the slope of the Ardenlee, Scotland. The length of each letter is 40 feet; the total length of the line is 323 feet, and the area covered is 14,845 feet. The borders of the letters are sown with a pure white flower, the center is set with dwarf beet, the dark purple of which shows well at a distance, and on each side of this there is a row of light purple candytuft.

Dangerous Vails.

Ladies in traveling at this season of the year frequently wear vails of gauze, most commonly light green in color. It appears that the use of these is not wholy safe; as a case has lately been published of a child, in Troy, N. Y., whose face while asleep was covered with a green vail to protect it from flies. The infant managed to get the fabric in its mouth, sucked it, and died shortly afterward, with all the symptoms of poisoning.

IMPROVED MORTISING MACHINE.

We illustrate herewith an improved machine for cutting mortises in all work not too heavy to be raised to the chisel by the table, including sash, doors, blinds, carpentry and joinery work in general, furniture, carriage work, etc.

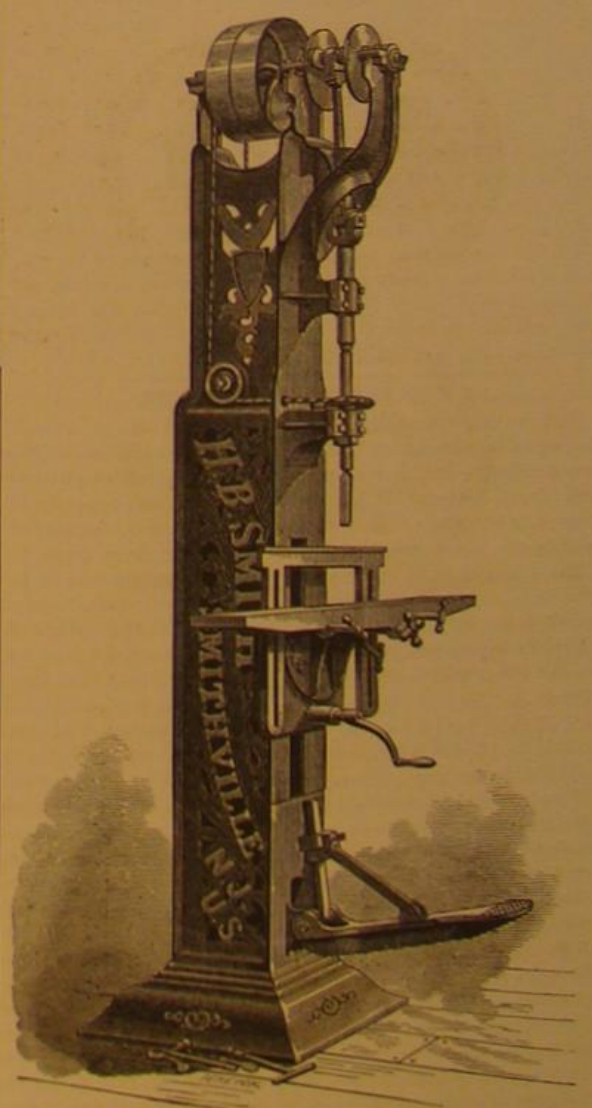
The frame, table, and attached parts are of cast iron, very strong and heavy. The running and reciprocating parts are of the best cast steel, as light as is compatible with strength and durability. The high velocity of 700 to 800 strokes per minute is attained with but little vibration; and as the crank shaft is provided with an outside bearing, the thrust being direct from the crank pin to the mortise, the machine is capable of driving an inch chisel into hard wood without boring. The method of applying this extra bearing prevents injury by careless workmen, both to themselves and to the machine. All boxes are of bell metal, and that in the reversing cylinder is split and made adjustable with screws, to correct any inaccuracy.

A practical trial of over twenty years, we are informed, has proved the efficacy of the device for reversing the chisel. It turns the chisel promptly, by power, with a scarcely perceptible motion of the treadle, and holds it true, regardless of wear or inequalities in the timber being worked.

The destructive effects upon joints in reciprocating parts has been duly considered in the design, and but three joints are employed in the reciprocating parts, it being impossible to have less and to allow the chisel to turn.

The table tips to mortise on any angle required; and when desired, a rack and pinion feed and boring apparatus are attached. To insure accuracy and cheap production, special tools are used in the construction of this machine; and the running parts and boxes are made to gage, and can be duplicated.

Many hundreds of the old style of this mortiser, embodying the same reversing device, we are informed, are now in use. The machine illustrated can be seen in daily operation at the Centennial Exposition. One is in the space of the manufacturer, in Machinery Hall, section B 7, columns 47 and 48, and another in the adjoining wood shop of the Commission, which is fitted up with machinery of the same maker

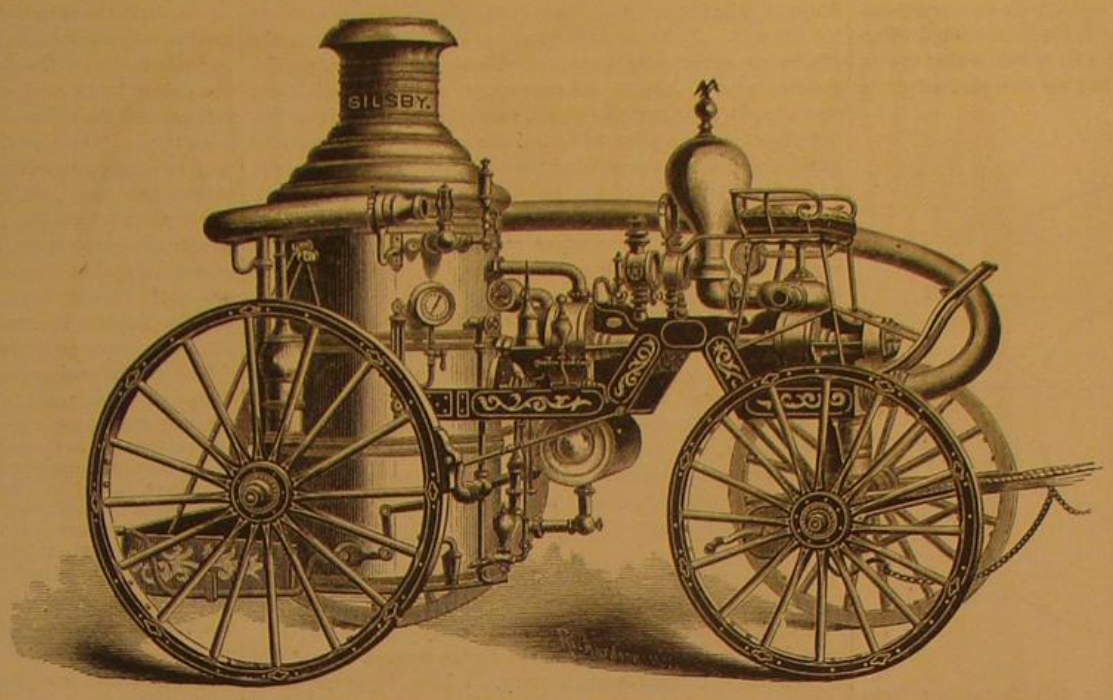


Further particulars can be obtained by addressing H. B. Smith, Smithville, Burlington county, N. J.

ONE pound of coke evaporates 9 lbs. water; 1 lb. of coal, the same; 1 lb. slack, 4 lbs. water; 1 lb. oak (dry) 4½ lbs. water; 1 lb. pine, 2¼ lbs. water.

IMPROVEMENTS IN FIRE ENGINES.

The old controversy as to the merits of rotary pumps is likely to be revived at Philadelphia, when the comparative excellence of the fire engines on exhibition has to be decided by the judges. The Silsby Manufacturing Company, who have constructed the machine shown in Fig. 1, make use of the Holly pump, as shown in Figs. 2 and 3. For the rotary pump, as for the rotary steam engine, many points may be urged to demonstrate the superiority of the rotary over the reciprocating principle, such as continuous action, diminished wear and tear, and the absence of jarring and jerking, which are especially to be avoided in fire engines, as they seriously diminish the effect of the machine. But again, as in the case of the rotary engine, the results attained by the rotary pumps have been exceeded by those of their reciprocating rivals. If, however, practical trials bear out the claim of the Silsby Company for this machine, a considerable step in the improvement of the fire engine will have been made.



SILSBY'S ROTARY STEAM FIRE ENGINE.—Fig. 1.

The construction of the Holly pump is shown in the sectional view, Fig. 2. The steam enters at A, and passes out at B, turning the two revolvers, *c* and *d*, in its passage. The sides of these revolvers are packed, as shown, by blocks of metal inserted in grooves in the long cogs, and kept out by the momentum of the cams, assisted by springs. The ends of the revolvers are ground to the ends of the cylinders in which they turn. The pump is precisely like the engine, the revolvers being carried around by gears on the outside of the cylinder, to save wear. The revolution of the cams draws the water in at A, as shown by the arrows, again converging the advancing streams at the discharge, B.

The improvement on this pump made by the Silsby Company is shown in Fig. 3, three toes being added to each rotator to insure perfect steadiness of the emitted stream.

In Fig. 4 is shown the form of boiler now used in this fire engine. The operation will be clearly understood from the engraving. The boiler, as shown, embodies some slight improvements in details, the water tubes, C, having been shortened, the smoke flues, D, lengthened, and the grate surface

Fig. 2.

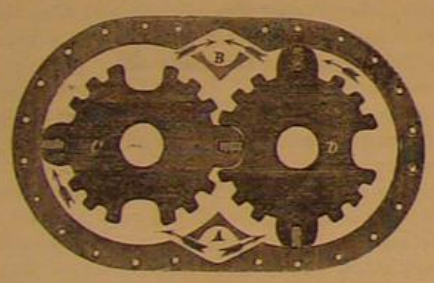
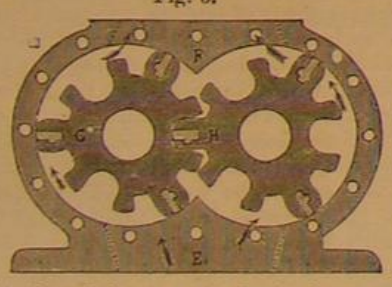


Fig. 3.



increased. One of the water tubes is shown separately at the left of the engraving.

We are indebted to the *Polytechnic Review* for the engravings.

The Nijni-Novgorod Fair.

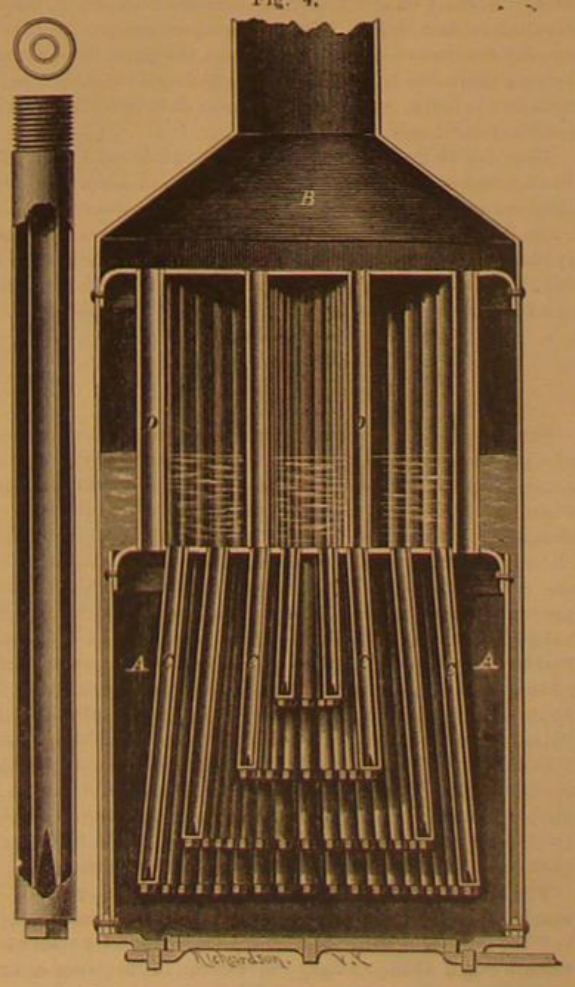
This great Russian fair. opened on June 25 (old style), and will come to a close early in September. The value of the merchandise actually sold at the fair has risen to nearly $10,000,000. Tea was sold last year to the value of upwards of $600,000. Along the banks of the lake enormous pyramids of chests of tea are heaped upon the ground, covered only with matting made from the inner bark of the birch tree. These chests of tea, called "tsibiki," are so packed as to be impervious to rain or damp. Outside the ordinary wooden chest is a covering of wickerwork of cane or bamboo, round which, at Kiakhta, raw bull hides are tightly stretched, with the hair inwards. These chests arrive at Nijni from China, having been received in barter on the Chinese border of Russia, for Russian manufactures of cotton or wool. It is these "tsibiki" which contain that peculiar Kiakhta and Baikhoff tea, whose taste and aroma are unequaled by any other kind of tea imported into Europe from China. But Kiakhta tea now encounters a formidable rival in the tea imported through the Suez Canal and Odessa, as well as from England, and which bears the name of Canton tea. Articles of almost every description are sold, also large sales are made of corn, leather, fruits from Persia, of madder and wine from the Caucasus, and of cotton and skins from Bokhara

The Improved Leclanche Battery.

The Leclanché element, which is now widely used, is, as is well known, composed of a mixture of peroxide of manganese and crushed retort carbon, inclosed in a porous vase around a large carbon plate. The vase is plunged in a solution of sal ammoniac, and a rod of zinc serves as the positive electrode. With this combination the expenditure of zinc occurs when the circuit is closed and is proportional to the work of the battery. Depolarization is effected as in other batteries, by the disoxygenation of the peroxide.

It often happens that this element presents a resistance quite considerable, which it is desirable to diminish. This, M. Leclanché states, he has succeeded in accomplishing, and he has already constructed over 30,000 elements of the improved battery for French railroads. The mixture which has given the best results is formed of 40 per cent peroxide, 55 of retort carbon, and 5 of resin (gum lac). These ingredients being intimately mingled are introduced into a steel mold capable of withstanding a pressure of 300 atmospheres, and are heated to 212° Fah. The whole is then reduced to a solid state by the hydraulic press. The electricity of this mass may be easily collected by a small rod of carbon inclosed therein. The addition of 3 or 4 per cent of bisulphate of potassa in the interior of the agglomerate contributes towards diminishing the resistance in a notable proportion, by acting as a solvent for the oxychlorides which are deposited in the pores, and diminish the conductivity of the mass. This resistance, M. Leclanché states in his communication to the French Academy of Sciences, becomes

Fig. 4.



so weak that a single element is capable of heating platinum wire red hot, and that he has thus been enabled to apply the battery to the electric lighting of gas. The electromotive force of the new pile is about 1·5, the Daniell element being taken as unity.

Wooden Pavements in London.

Some two years ago permission was granted by the city authorities to the patentees of various systems to pave so much of Cannon street as would enable the former to arrive at a definite conclusion as to their respective merits. Accordingly, in May, 1874, a piece of wood pavement, constructed on "Norton's Patent Wood Slab Pavement" system, was laid down. The slabs are 7 feet 6 inches by 3 feet, composed of wooden blocks, which are cemented together by an original watertight substance. When laid down the proprietors asserted that this substance would prove to be wholly impervious to wet, thus obviating the chief objection to other wood pavements, namely, that the surface water percolates through the interstices of the blocks, and by so doing not only rots the wood, but creates a sanitary nuisance which at times might become exceedingly dangerous. A few days ago a slab of the pavement laid down in Cannon street was lifted, in the presence of a number of gentlemen interested in the question, and an engineer informs us that, when taken up, the pavement exhibited a wear of less than one quarter of an inch, and that, when the blocks were split up to ascertain the truth of the assertion that the water would not percolate through the interstices of wood, the timber was perfectly dry, while the earth grit on which it was laid was also found to be in exactly the same condition as on the day it was first put down.—*Builder.*

A NEW SOLDERING MACHINE.

Mr, W. H. Ireland Howe, of North Salem, N. Y., has patented through the Scientific American Patent Agency (June 13) a novel improvement in soldering machines, especially suited for soldering the end seams of cans. A, in the engravings, represents the frame of the machine, to which is attached a track, B, along which the cans are to be rolled. The track is flanged along its side edges to keep the cans, C, in place upon it, and has a side inclination, to cause the

Fig. 1.

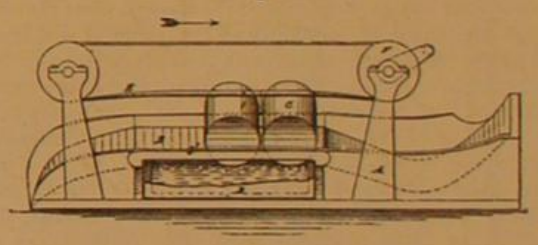
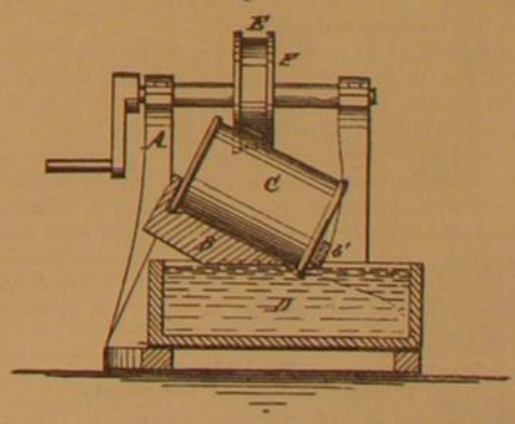


Fig. 2.



ends of said cans to rest upon the lower side flange, *b'*, as they are rolled along said track. The track, B, is slotted in the lower side of its middle part, along the flange, *b'*, to allow the end seam of the cans to project through into a solder bath, D, placed beneath it in the frame, and in which the solder is kept melted by a furnace. The bath, D, is of such a length that the cans may make at least one entire revolution with their end seams in the solder. The track, B, is made with an upward incline at one end, down which the cans are rolled in passing from the machine. The cans, C, are rolled along the track, B, by an endless band, E, which passes around the pulleys pivoted to the frame, and to one of which motion may be given by hand or other convenient power.

An Oyster on Horseback.

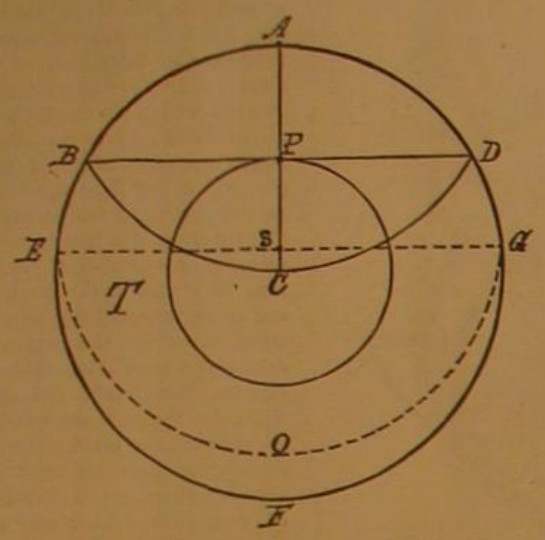
A tortoise was lately brought into Central Park having the shell of a full grown oyster grown upon its back. Frank Buckland recorded a similar instance in England a few years ago, and predicted that if the oyster shell were removed it would be found to have molded itself to all the rugosities of the surface of the tortoise' shell. The Central Park specimen rubbed the shell off its back a few days ago, and the pattern of the scales was found imprinted on the hard shell, showing the truth of the British naturalist's prophecy, that the valve of the oyster, which is attached to the fixed object, takes the precise form of its surface.

Correspondence.

Weight On and In the Earth.

To the Editor of the Scientific American:

Mr. E. B. Whitmore (page 84, current volume) denounces the ordinarily received "body in a hollow sphere doctrine" as unmistakably absurd and false. The doctrine positively declared to be false is the well known and entirely proved theorem that a hollow shell, of equally distributed matter, attracts a body placed inside of it equally in all directions. That is, a body at any depth in the earth is attracted effectively by that part only of the earth that is below that depth, the shell of matter outside of that having an equal effect in all directions, and thus no effect.



In connection with this theorem and following from it is the theorem that "a body lowered towards the center of the earth would lose in weight in proportion to its distance downward." But Mr W. says these two theorems are contradictory to each other, and illustrates by supposing a body to weigh, say, 24 lbs. at the surface of the earth, and to be lowered half way to the center. Then, he says, according to the hollow sphere doctrine, it will weigh only 3 lbs., because only one eighth of the earth's volume is nearer than the body to the earth's center; whereas, according to the other theorem, it must weigh 12 lbs., this being proportionate to the distance. But in this reckoning Mr. W. very carelessly ignores the fact that attraction is always inversely proportional to the squares of the distances from the attracting body. If the body weighing 24 lbs. is carried half way to the center of the earth, it must therefore weigh four times 24 lbs., that is 96 lbs., there, if still attracted by the whole body of the earth towards the center. But, in fact, it is attracted by only one eighth part of the earth's body, and will therefore weigh only one eighth part of 96 lbs., that is 12 lbs. And at all distances, the attraction within the earth's body, assuming the body to be of uniform density, being directly as the cubes of the distances from the center (the result of leaving out the external shell entirely, as ineffectual) and being also inversely as the squares of the distances, in consequence of the mere fact of distance, the result is that the actual effective attraction must be directly as the distances.

Another objection to the hollow sphere theorem, stated by Mr. W., is that it would follow from it that a hollow sphere would balance, as on its center of gravity, if supported at any point inside of it: whereas it will not balance unless supported at the center. Here, again, he ignores the effect of distance on the force of attraction. A hollow sphere does balance around any and every point within it, as far as the mutual attraction of its own parts towards each other is concerned. But the balancing of attraction from some other distant body, as in the case of all weights on the earth's surface, is quite another thing. J. P. PERRY.

New Ipswich, N. H.

Weight On and In the Earth.

To the Editor of the Scientific American:

Your correspondent, Mr. E. B. Whitmore (see page 64, current volume), should be more careful in pronouncing absurd a well established theorem, simply because he cannot look through it at the first glance; and he makes a serious mistake in his own conclusions. He omits to observe that the distance of P from C is equal to ½ that of A from C, and that, in order to get the attraction of the original 24 lbs. when removed to P, he should multiply the 3 lbs. of his calculation by the square of 2, and he would have found no hostilities between the old theories. His considerations, however, show the well known fact that an object at P is attracted equally strongly by the small sphere and by the lenticular mass, BFDC. HUGO BILGRAM.

Philadelphia, Pa.

Electricity and the Radiometer.

To the Editor of the Scientific American:

I have recently observed a phenomenon which is calculated to throw some light on the theory of that mysterious little instrument, Crookes' radiometer; and as, to the best of my knowledge, it has not been noticed before, I hasten to communicate it to the readers of the SCIENTIFIC AMERICAN. The radiometer used was one made by Geissler, of Bonn, and is in all respects similar to that described in the SCIENTIFIC AMERICAN, Vol. XXXII, page 392. The phenomenon and the method of observing it are as follows:

1. The glass globe of the radiometer becomes negatively electrified upon the whole of its outer surface when submitted to the radiation of the sun or any source of light, or even to obscure heat radiations of a certain intensity.

2. The presence of electricity is more sensible upon the hemisphere facing the source of radiation than the farthest removed from it.

The presence of this free electricity was determined by means of a proof plane and a Böhnenberger's electroscope, and is so easily verified that anyone possessing an electroscope of this description can verify the above statements for himself. There is no need of using a condenser, as the effects are sufficiently apparent without it. By placing the radiometer near a luminous or obscure source of radiation, and simply touching the globe, several times and in different places, with a piece of tinfoil supported on an insulated handle, and then approaching the tinfoil to the electroscope, a marked deflection of the gold leaf towards the negative pole is at once observed. If the same experiment be repeated with the radiometer when removed from the radiant source and placed in obscurity, the globe gives no signs whatever of electricity.

This manifestation of electricity cannot be attributed to the friction of the vanes of the radiometer with the rarefied air of the globe. For if the radiometer be inverted so that the vanes cannot rotate, and be then exposed to the radiant source, the same electrical effects will be produced. Several experiments, too simple to be repeated here and which, moreover, each observer will easily imagine for himself, have also convinced me that these effects cannot be attributed to a feeble evaporation on the exterior of the radiometer.

By attaching pieces of tinfoil to the electrodes and applying them to the globe of the radiometer, I have also determined that this instrument is sufficiently delicate to indicate, by a marked fluctuation, the feeble tension of a quart cell of Grenet's bichromate battery. I hope, however, to be able to give more details of this experiment in a future communication.

As your readers will observe, I have not stated to what molecular changes I believe these electrical manifestations are due. Still less do I hazard any opinion in regard to the theory which presents itself quite naturally on the mere statement of the above facts, and which seems to explain all results observed with the radiometer up to the present. This I hope to be able to do in a short time.

JOSEPH DELSAUX, S. J.,
11 Rue des Recollets, Louvain, Belgium. July 14, 1876.

Are Potato Bugs Poisonous?

To the Editor of the Scientific American:

I notice that the last issue of the SCIENTIFIC AMERICAN, in speaking of potato bugs, says that they are not poisonous. This statement ought to be taken with some qualification, I think. We have had ten years of experience with the insects in this State, and the universal impression here is that it is not safe to handle them. I have known of numerous instances wherein people have been made seriously sick by breathing the fumes where potato bugs had been thrown into the fire, or where boiling water had been poured on them to kill them. I also knew the case of a Bohemian woman who killed the bugs with her hands: and as the skin was broken slightly on one finger, an inflammation set in, which resulted in her death. Other instances might be given, equally conclusive in their bearing on the point in question. I think there can be no doubt that there is a poisonous principle in the bugs, which renders them dangerous to life and health if carelessly handled.

They can be destroyed by sifting a mixture, of 1 part pure Paris green and 20 parts of flour or ashes, on the vines when they are damp. But a better way is to put a teaspoonful of Paris green into a pailful of water, mix thoroughly, and sprinkle it on the vines. This can be done at any time of day, and there is no danger of the poison being blown into the face or eyes of the person applying it. WISCONSIN.

"POTATO PEST POISON."

BY CHARLES V. RILEY.

Several persons have recently written to get my opinion of a purported new remedy for the Colorado potato beetle, extensively advertised under the above name by the Kearney Chemical Works, 66 Cortland street, New York city. I should, on general principles, dissuade any one from purchasing a secret remedy, when a cheap, simple, and effective one is well known. Yet as there is always room for improvement, and the inventor and discoverer of something valuable has a right to profit by his discovery if he can, I am just as ready to commend as to condemn any insect remedy offered to the public, according as it merits condemnation or approval, desiring to do justice to the rights of the individual as well as of the public. What, then, is this *new* "Pest Poison," and does it represent some valuable discovery which deserves to be kept a trade secret? Or is it simply one of the many secret nostrums constantly offered to the farmer by schemers who desire to fill their own pockets? Let a candid consideration of the matter decide.

The circular of the firm claims that this "pest poison" is manufactured on "strictly scientific principles," and that it is "the only safe, sure, and cheap destroyer of potato and tomato bugs, chinch bugs, cut worms, wire worms, and army worms, caterpillars, and all insects which prey upon vegetation"! Whenever men are found making the ridiculous claim, for any substance whatever, that it is a universal cure for all noxious insects, it is safe to set them down as ignoramuses or charlatans. The habits and modes of life of insects are so varied that what may prove a perfectly satisfactory remedy against one species is often utterly worthless against another; while for successful warfare, special tactics are required in almost every case. The circular further unqualifiedly claims on one page that the poison "is not injurious to vegetation, while admitting in a special notice on another page that, if used too strong or too frequently, it injures vegetation. The truth is that many tender plants are injured by it even when used as recommended, while even stout-leaved evergreens are seriously injured when the strength of the solution is doubled. In the "directions for use" we find brief accounts of various insects, which show on their face that the authors of the circular and agents for the poison know nothing about the insects they speak of, and recommend their poison for species upon which it has never been tried. The directions under the head "Army Worm" may be taken as a sample. The passage, with the exception of the first and last sentences, is taken almost word for word, without credit, from an article of mine (New York *Tribune*, November 16, 1875); and in the sentences excepted, we are told that the army worm belongs to the "order of *noctua*!" (*noctua* is an old genus of the order *lepidoptera*), and that for this insect the solution must be made of double strength, whereas, thus made, it will injure most grasses.

The special notice closes with the following paragraph:

Furthermore, lest a prejudice should be founded on the fears of some people that the vines or crops will absorb the the poison, we have before us detailed experiments for several years past, showing that not a trace of this poison has ever been found in potatoes or grain which have been watered with this solution in much greater quantities than was necessary to destroy worms or insects, and the opinion, also, of eminent chemists, that once in the ground the poison is completely neutralized.

Here again the circular misleads, and I very much doubt whether there is a particle of truth in the statement as to the years of experience or the opinions of eminent chemists. Such language would hold true of the Paris green mixture, but not of the poison advertised. This, upon analysis, proves to be a mixture of arsenate of sodium and common salt, faintly colored with rosaniline; and as opposed to the opinions of the unnamed "eminent chemists" of the circular, I will quote the opinions of Professor Wm. K. Kedzie, of the Kansas State Agricultural College, who says that "the great objection to the use of these compounds is their extreme solubility in water. They are offered to the plant in perfect condition for absorption into its circulation; and while, in the case of Paris green, the minute proportion dissolved is at once rendered inert by the hydrated oxide of iron in the soil, it is by no means certain that the proportion of the latter is in every case sufficient to accomplish this when the arsenic compound is applied in such large quantity and in complete solution."

Last year, in my eighth report, I had something to say of a "Potato Pest Poison," manufactured by the Lodi Chemical Works of Lodi, N. J., showing that it did not work as effectually as the Paris green mixture, and that there could be no advantage to the farmer in its employment. Experiments which I have recently made show that the Kearney pest poison acts very much like its Lodi prototype, the only advantage over which it can claim being the faint coloring. The Lodi company sold a 1 lb. package for $1, which was to be dissolved in 120 gallons of water or more. The Kearney company sell a half pound package for 50 cents, which is to be dissolved in 60 gallons. Of cour e either company could get any number of testimonials as to the efficiency of their compounds. They herewith have mine. To put forth the false claim of the circular I have noticed, is simple humbug. There are plenty of farmers, gentlemen, who, rather than go to the trouble of making their own mixtures, will send for your poison packages, when they once know what your mixture is, where they would not think of ordering a secret remedy. Do not sail under false colors, or claim more than your mixture deserves: let people know that there is just as much danger, if not more, in its use, as there is in the use of Paris green in the wet method. Do this, and put your article up in more secure packages, so that the poison in deliquescing does not soak and drip through in hot weather as it now does; and I believe you will still do a good business, and deserve *not* to be ranked as charlatans.

Burns and Scalds.

The recent fearful explosion on board the British ironclad Thunderer has called out the publication of many recipes and remedies. Among them all, the following, contributed by an old and experienced physician, has the merit of convenience and readiness. The remedy is simply this: The common whiting of commerce (found in nearly every kitchen), reduced by cold water to the consistence of thick cream, is to be spread on a light linen rag, and the whole burnt surface instantly covered, and thus excluded from the action of the air. The ease it affords is instantaneous, and it only requires to be kept moist by subsequent occasional sprinklings of cold water.

Birds' Tracks in Stone.

Professor Marsh, of Yale College, is paying Dr. Field, of Franklin county, Mass., $100 a year for the right of quarrying slabs of stone showing foot prints of birds. A basket full of specimens, worth $200, was recently taken out. The specimnes are well washed, and then coated with shellac.

AMONG the new arrivals at the Central Park menagerie are two little leopards, born a week ago. They are about as large as half grown kittens and twice as clumsy. The hair is bluish gray instead of tawny yellow, as in the adults; but the black spots are well defined. In a few days they will be exposed to view.

Facts and Simple Formulæ for Mechanics, Farmers, and Engineers.

The present is the best time for felling trees. For the purpose of seasoning, timber should be piled under shelter and kept dry: it should have a free circulation of air about it without being exposed to strong currents. The bottom pieces should be placed upon skids, which should be free from decay, and raised not less than two feet from the ground. A space of an inch should intervene between the pieces of the same horizontal layers, and slats or piling strips should be placed between each layer, one near each end of the pile and others at short distances, in order to keep the timber from winding. The strips should be laid one over the other, and in large piles should not be less than 1 inch thick. Each pile should contain but one kind of timber, the heavy sticks being below and the light ones on top: and the piles should be 2½ feet apart.

To cut the best beam from a log, divide the diameter, *ab*, into 3 equal parts, *af*, *fe*, and *eb*; and from *e* and *f*, draw the lines *fc*, *ed*, at right angles to *ab*. Join *ae*, *rd*, *be*, and *bd*; then *abcd* is the cross section of the strongest beam.

To find the weight in pounds of metal objects, measure the number of cubic inches contained in the piece for wrought iron by 0·2816; cast iron 0·2607; copper, 0·32418; lead, 0·41015; brass, 0·3112.

To find the diameter of wrought iron shafting in inches to transmit a given power, multiply the indicated horse power by 65, divide by the number of revolutions per minute, and extract the cube root of the quotient: for crank shafts and prime movers, substitute 83 for 65.

In the drainage of land, the following depths and distances should be observed:

Soil.	Depth of pipes. feet	inches	Distance apart. feet.
Stiff clay	2	6	15
Friable "	2	0	18
Soft "	2	9	21
Loam with clay	3	2	21
" " gravel	3	3	27
Light loam	3	6	33
Sandy "	3	9	40
Light sand with gravel	4	0	50
Coarse gravelly sand	3	6	60

In corn mills, for each pair of stones, with all the necessary dressing machinery, etc., about 4 horse power nominal may be allowed. One pair of 4 feet stones will grind about 5 bushels of wheat per hour. Each bushel of wheat so ground per hour requires 1·11 horse power (indicated), exclusive of dressing and other machinery. Speeds in corn mills are as follows: Stones 4 feet diameter, 140 revolutions per minute; dressing machines 21 inches diameter, 450 to 500 revolutions per minute; creepers with 3½ pitch, 75 revolutions per minute. Elevator with 18 inches diameter, 40 revolutions per minute; wheat screen, 18 inches diameter, 300 to 350 revolutions per minute.

An average of 27 kinds of coal has given about 40½ cubic feet per tun.

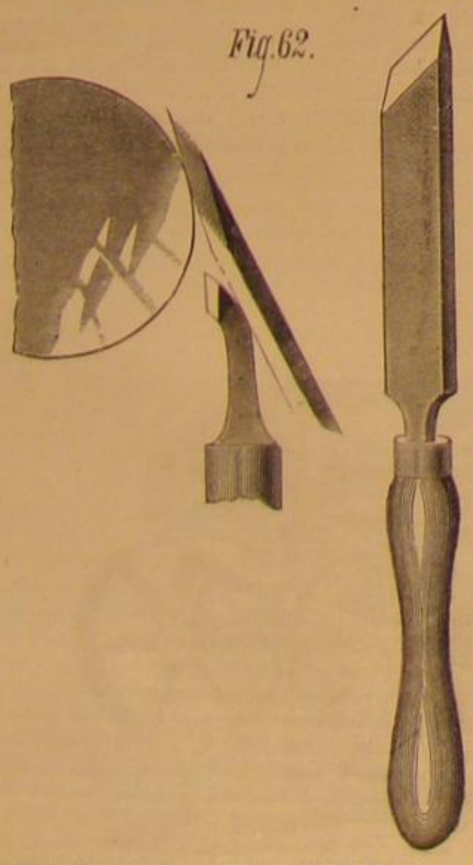
PRACTICAL MECHANISM.

BY JOSHUA ROSE.

SECOND SERIES—Number IX.

PATTERN MAKING—TURNING TOOLS.

For finishing plain work, we have the tool shown in Fig.



62, which is the exception noted previously as being a finishing and, at the same time, a cutting tool. It is called a skew chisel, because its cutting edge is ground at an angle or askew to the center line of its length. Furthermore, it is beveled at the cutting end on both sides (as shown in the edge view), being ground very keen. It is employed for finishing straight or parallel surfaces and for dressing down the ends or down the sides of a collar or shoulder. When used for finishing straight or parallel surfaces, it performs its cutting in the center of the length of its cutting edge only, as shown at A, in Fig. 63, and is held in the position relative to the work shown in Fig. 62. When nicely sharpened it leaves a polish, unlike other finishing tools; but with these advantages, it has a drawback (and a serious one) to learners, as it seems to have a terrible propensity for tearing into the work, whether it is used upon the circumference or facing the shoulders of the work. This difficulty can only be overcome by practice, and the reason lies in the difficulty of learning how to handle the tool with dexterity. It must be held almost flat to the work; and yet, if it should get quite flat against the work, the cutting edge would cut along its whole length, and the pressure of the cut would be sufficient to force the tool edge deeper into the work than is intended, which process would continue, causing the tool to rip in and spoil the work. The face of the chisel nearest to the face of the work being operated upon stands almost parallel, with just sufficient tilt of the tool to let the cutting edge meet the work in advance of the inside face of the tool; or in other words, the amount of the tilt should be about that of the intended depth of the cut; so that, when the cutting edge of the tool has entered the wood to the requisite depth, the flat face will bear against the work and form a guide to the cutting edge. The corner of the chisel which is not cutting must be kept clear of the work. Fig. 63 will convey the idea, the arrows showing the direction in which the chisel is, in each case, supposed to be traveling.

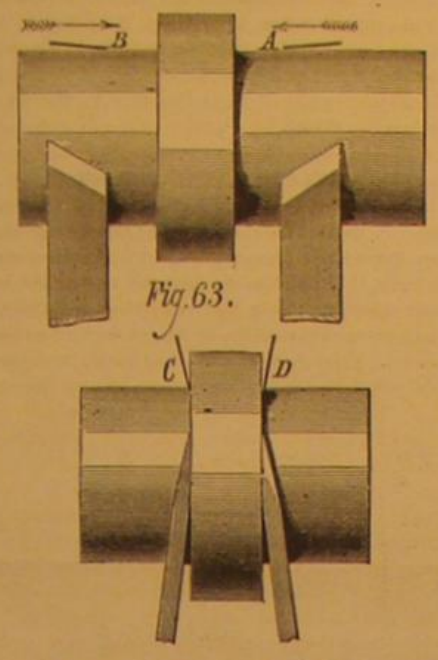
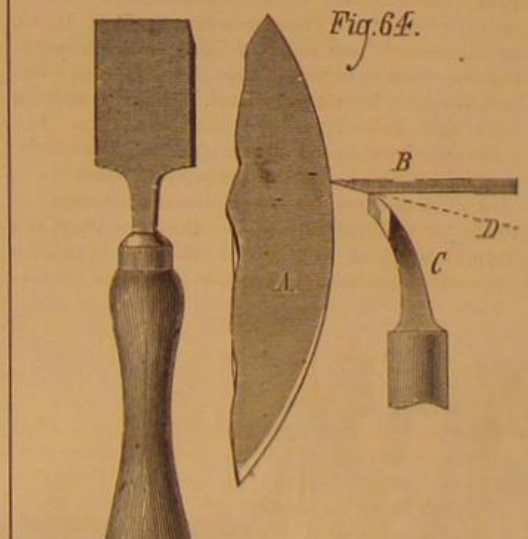


Fig. 63.

The short lines, A and B, under the arrows, and those touching the collar, at C and D, show the tilt or incline of the chisel to the work. In turning the circumference, the obtuse corner of the chisel is the cutting one; while in turning down, a side face it is the acute angle. Most pattern makers, however, do not often use the skew chisel for finishing straight cylindrical work, because it is liable to make the surface of the work more or less wavy. It is, however, almost always used for cutting off and for cutting down shoulders, for which purpose it is highly advantageous. For circumferential work on cylindrical surfaces, an ordinary chisel is mostly employed, the position in which it is held to the work causing it to scrape rather than cut. A worn out paring chisel is as good as any, but in any event it should be a short one. Such a chisel is shown in Fig. 64, the position in which it is held being illustrated by A, which represents a section of a piece of cylindrical work, B representing the chisel, and C the hand rest. Some pattern makers prefer to increase the keenness of this tool by holding it so that the plane of its length lies in the direction denoted by the dotted line, D; this, however, renders it more likely to rip into the work, and the position shown is all that is necessary, providing the cutting edge be kept properly sharpened. This chisel is also used on side faces.



Still another tool, sometimes used for finishing plain cylindrical surfaces and side faces, is that shown in Fig. 65 at A. It is used in the same manner and relative position as the chisel shown above, in Fig. 64.

For finishing hollows, which should first be roughed out with the gouge, the form of tool shown at B, in Fig. 65, should be used. Several of these tools, of various sizes, should be kept; they are used in the same position as the finishing chisel shown in Fig. 64. The tool shown at C, in Fig. 65, is used upon large work, and is advantageous because it presents less surface of cutting edge in proportion to the depth of the cut than does the gouge; and, in consequence, it is less liable to cause the work to jar or tremble It is usually made about 2 feet long, which enables the operator to hold it very firmly and steadily. It is used with its top face lying horizontally, and should be kept keen. D, in the same figure, represents a similar tool, with a round nose; this latter is not, however, made long, and may be used in a handle.

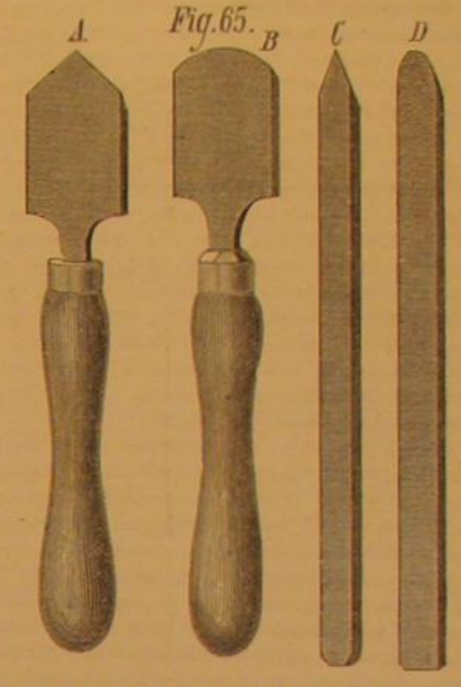


Fig. 65.

For boring purposes, the tools shown in Fig. 66 are employed; those shown at A and B, having their cutting edges at C and D, are therefore right and left hand tools. When, however, the hole is too small to admit of those tools being used, that shown at E may be employed, its cutting edge being on its end, at F.

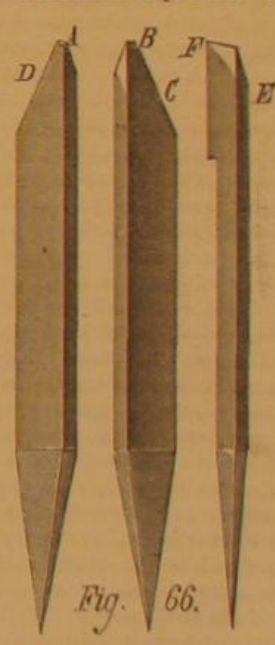


Fig. 66.

The temper of all these tools should be drawn to a light brown color, and the instruction given for grinding bench tools should be rigidly observed in grinding and oilstoning these turning tools.

A Remarkable Dwarf.

Several medical men, including Drs. Alexander Mott, J. L. Little, J. M. Merrill, E. Hudson, and S. Roof, lately visited by invitation the Mexican dwarf, Lucia Zarate, at Tony Pastor's theater in this city. These visitors said she seemed perfect in structure, healthy, and intelligent. She understands and talks Spanish and a few words of English. She is getting her second teeth; and although the doctors could not tell whether or not she was 12 years old, as claimed, they said she had teeth which she could not have under 6 years of age. She ran about, shook hands with, and talked a little to those present. She is now smaller than are many infants at the time of their birth. The following measurements were taken: Hight with shoes on, 21½ inches; length of leg from hip, 10½ inches; around head, 13 inches; circumference of thigh, 4¾ inches; circumference of calf of leg, 4 inches (one inch more than a man's thumb); length of shoe, 3 inches; width of shoe, 1½ inches. The parents of the child are with her, and are of the usual size; the mother is about the medium hight, the father, 5 feet 5 or 6 inches in hight, and quite fleshy.

THE latest improvement in mills for grinding wheat, etc., consists in the use of porcelain rollers for crushing the wheat previous to submitting it to the millstones. The result is an improvement in the quality of the flour, and a larger yield in a given time.

DETECTION OF FUCHSIN ADULTERATION IN WINE.—According to M. Jacquemin, natural red wine does not stain wool, the material regaining its white color after washing. If fuchsin be used to color the wine, however, the wool remains tinged with red.

IMPROVED WOODWORKING MACHINERY.

A growing demand is noticed among manufacturers in wood for machines combining the functions of several different tools in one, thereby economizing space in the factory and capital in investment. These machines are, from the great range of work for which they are adapted, known as universal woodworkers.

In the manufacture of builders' material, sashes, doors, etc., as well as in the production of furniture, agricultural implements, railroad cars, patterns, etc., such machines are almost invaluable. Their true value, however, is based upon the ease with which they can be adjusted, and the facility with which the changes can be made for the different kinds of work.

The apparatus illustrated herewith combines all the features of the variety woodworkers and hand planers of the same manufacturers, with a complete molding and flooring machine. The essential features of the original Climer & Riley patent on woodworkers are all included, together with many novel and important improvements and labor-saving devices, originated by the makers.

The two sides of the machine are driven from one countershaft, which is so arranged as to convey the power to both sides simultaneously or separately, as the operator may desire. The double friction pulley on the countershaft is caused to come in contact with the driving pulleys for the cutterheads by means of two levers, one for each operator, by which he sets in motion or stops his side of the machine as he may desire. This method of obtaining independence of the combination is new and effective, as two operators can perform their work, one on each side, without either interfering with the duties of the other.

Upon the molding side, the moldings can be worked to eight inches in width, also narrow surfacing and flooring to eight inches in width. This side is furnished with a pair of powerfully geared and heavily weighted feed rollers, the motion of which can be instantly started or stopped, or given a quick or slow motion, as may be required. The inside and outside cutterheads can be swung to an angle, and have a vertical adjustment with the table to which they are attached. The under cutterhead is adjustable for different thicknesses of cut, and can be used for forming moldings on the under side of the stuff. This molding side is provided with the same features and adjustments for making accurate moldings as the molding machines of the same manufacturers, and is convenient of adjustment and adapted for simple or complicated moldings up to eight inches wide.

The primary design of the woodworker side is for dressing out of wind, and for trying up and squaring lumber. By the addition of various heads and fixtures necessary to each operation, it is rendered capable of rabbeting, jointing, beveling, gaining, chamfering, plowing, making glue joints, beading, raising panels, ripping, cross-cutting, tenoning, making circular, waved, and serpentine molding, and a great variety of work, practically limited only by the ingenuity of the operator.

The whole machine has for its support a heavy iron column, upon which all the tables are planed and gibbed to move vertically, each having a separate adjustment. The woodworker tables have a horizontal adjustment for the accommodation of different sizes of heads and cutters, the vertical adjustment being used to graduate the depth of cut for grooving, gaining, panel raising, surfacing, etc.

One of the spindle bearings on the woodworker side is cast solidly to the column, the other being movable in a planed seat, and retained in its place by a screw. This outside bearing is readily removable to allow interchange of cutterheads on the spindle, and gives the spindle a steadiness not to be acquired where the head overhangs the framing of the machine.

The tables are furnished with grooves for receiving the gaining frame slide and other attachments, and for making a continuous table by fitting in slides of the proper form. The fence is attached to and moves with the forward table, can be adjusted to an angle of 45°, and is arranged to receive stud springs for holding down the lumber, and for bolting the panel-raising attachment.

The machine is very complete in all particulars, and the desirability of the combination can hardly be called in question. This machine can be seen in daily operation at the space of J. A. Fay & Co., Machinery Hall, Centennial Buildings, section B, 8, columns 61, 62, 63. Any desired information will be furnished on application to the manufacturers, Cincinnati, Ohio

LELAND'S PIPE COUPLER.

We took occasion some time ago to bring to the notice of our readers a remarkable case of bad plumbing which came under our immediate observation. The instance was that of a wiped joint of the ordinary type used to connect lead water pipes, but through which, by blundering workmanship, the solder had been squeezed so as nearly to fill the bore of the tubes joined. The result was that great trouble was incurred in overhauling all the water pipes of the building to find why the water refused to run in the upper stories, and finally, only after large expense was incurred, the source of the difficulty was discovered. We have repeatedly expressed our opinion that wiped joints are at best badly contrived affairs, and that there is a good opportunity for inventors to devise a new method of connection for pipes which will not require fire, and solder, and skill combined to render it available. There are so many uses for such a coupling that, for one that is really cheap, simple, and capable of easy application by any one, without the aid of a plumber, a wide demand is a reasonable certainty.

Fig. 1

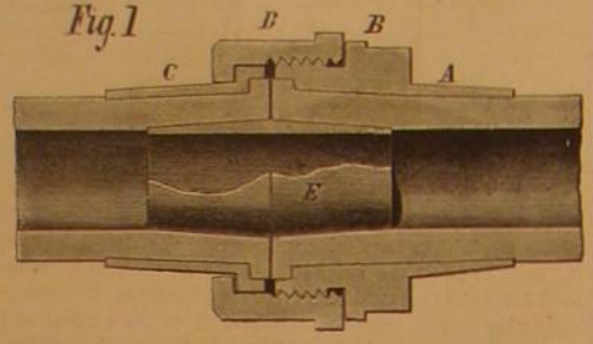
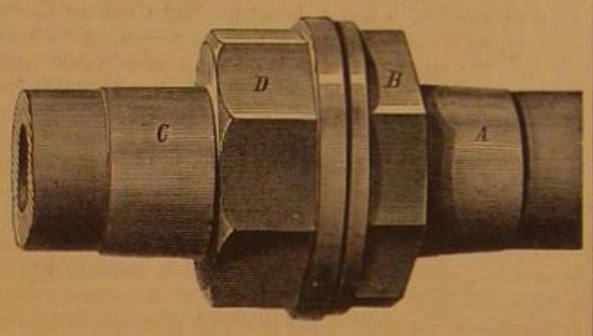


Fig. 2



In the annexed engraving is represented a device which seems to meet all the requirements as above stated, and which we can commend very highly to our readers. Its construction will be understood from the sectional view, Fig. 1, its exterior appearance from Fig. 2. It is applied as follows: A is a ferrule of brass or other suitable metal, tapered within and also having an interior shoulder. There is also an exterior collar at B, and a threaded portion adjoining. The ferrule is slipped over the end of the pipe, into the mouth of which a steel or iron shouldered tamp pin is inserted. A few blows of a hammer on the latter distends the metal of the pipe to the taper of the ferrule, and the shoulder of the tamp pin forms a facing of the pipe on the shoulder of the ferrule. On the other extremity of the pipe is applied, in precisely the same way, the ferrule, C, retained by a shoulder on which is the female union, D. A double thimble, E, of brass or iron, is then inserted in the mouth of one part of the pipe; the other end is brought over it, and the thread of the union engages with the threaded portion on the ferrule, A. By a few turns of the wrench the parts are drawn tightly together, the distended metal of the pipe itself meeting and forming the joint. The thimble simply fills up the enlargement of the bore produced by tapering the ends, and of course aids in strengthening the connection.

We have seen this coupler attached to lead pipe and secured inside of a minute and a half, and we are assured that it may be applied with nearly equal facility to the connecting of lead to iron and copper to copper, and parts of hose. It is excellently suited for use on plumbing work in houses, especially at points where both strength and a neat appearance are required. It will be found valuable in proximity to ranges or furnaces, where the heat frequently melts the solder, and will probably find an extended application on locomotives. It also is well suited to supersede the somewhat clumsy wire binding used in connecting Westinghouse brake tubes. It may be applied to attach pipes to corporation mains, without turning off the flow of water. It is extremely strong, and has been tested under the severest pressures.

Patented by E. A. Leland, February 8, 1876. For further information address the Leland Coupler Company, 36 John street, New York city.

Eating Bread and Milk with Lime Water.

Milk and lime water are now frequently prescribed by physicians in cases of dyspepsia and weakness of the stomach, and in some cases, to our knowledge, the diet has proved very beneficial. Many persons who think good bread and milk a great luxury frequently hesitate to eat it, for the reason that the milk will not digest readily. Sourness of the stomach will often follow. But the experience of many will testify that lime water and milk is not only food and medicine at an early period of life, but also at a later, when, as in the case of infants, the functions of digestion and assimilation have been seriously impaired. A stomach taxed by gluttony, irritated by improper food, inflamed by alcohol, enfeebled by disease, or otherwise unfitted for its duties, as is shown by the various symptoms attendant upon indigestion, dyspepsia, diarrhœa, dysentery, and fever, will resume its work and do it energetically on an exclusive diet of bread and milk and lime water. A goblet of cow's milk, to which four tablespoonfuls of lime water have been added, will agree with almost any person, will be agreeable to the stomach when other food is oppressive, and will be digested when all else fails to afford nourishment.

The way to make lime water is to procure a few lumps of unslaked lime, put the lime in a stone jar, add water until the lime is slaked and is about the consistence of thin cream. The lime will soon settle and leave a clear and pure liquid at the top, which is lime water. As the water is taken out more should be added, and the lime should be frequently stirred up and allowed to settle.

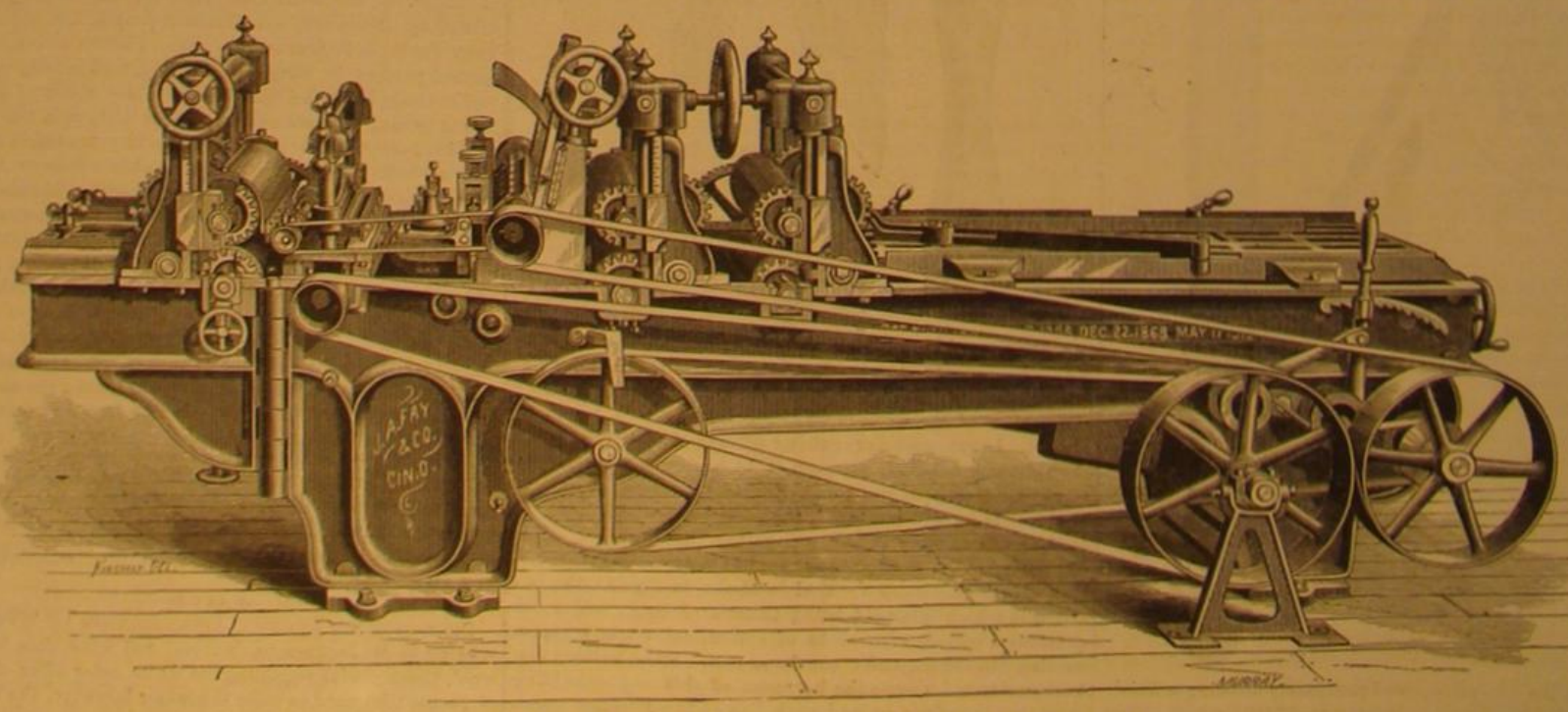
Colors for Confectionery and Food.

The police of Paris have directed that the following substances be employed for coloring articles of food or confectionery: Blue: Indigo and its derivatives, Prussian blue. Red: Cochineal, carmine, Brazil wood lake, orchil. Yellow Saffron, Avignon yellow berry, quercitron, fustic, turmeric. Green: Mixture of Prussian blue and logwood (Campeachy wood). Violet: Mixture of carmine and Prussian blue.

The use of the following pigments is prohibited: Oxide of copper, blue copper salts, red lead, vermilion, chrome yellow, gamboge, white lead, Schweinfurt and Scheele's green (Paris green).

For coloring drinks they recommend Curaçoa logwood; for absinthe, soluble indigo blue with saffron; for blue liquids, soluble indigo blue, Prussian blue, and ultramarine.

We notice that, singularly enough, aniline colors are omitted from the list of prohibited colors.



J. A. FAY & CO.'S UNIVERSAL WOOD WORKER.

TWO BEAUTIFUL PALMS.

Although the palm tribe, as a whole, is indigenous to the tropics, some wandering members of the family may be found as far from the equator as the south of France; and one is a native of Asia, and grows wild in the region north of the Himalayas, up to latitude 44° N. The latter, of which we give an engraving, is the hardy palm (*chamærops excelsa*); and the palmetta, of which four species are native to this country, is nearly related to it, as will be seen on an inspection of its foliage. The pure dark hue of its leaves, and the sturdy vigor of its general appearance, make it a highly ornamental tree in the shrubbery and plantation. Heat and abundant moisture are needed for its growth, and, like most other palms, it is capable of extensive utilization; its growth in tropical regions is enormous, and some fine specimens may be found in conservatories in our northern homes.

Another exquisite specimen of the palm genus is the *Pritchardia filifera*, of which we also give a representation; it is one of the most beautiful of the handsome family to which it belongs. All who have seen it will remember its remarkably fine appearance and the admiration which it excites. It is a native of this country, and grows farther north than any other of the palm tribe, its native habitat being the banks of the Colorado, in Arizona and New Mexico, where it bears the winter frosts without injury. It is excessively graceful in appearance, long white filaments falling from its palmate leaves, giving them the appearance of being furnished with plumes.

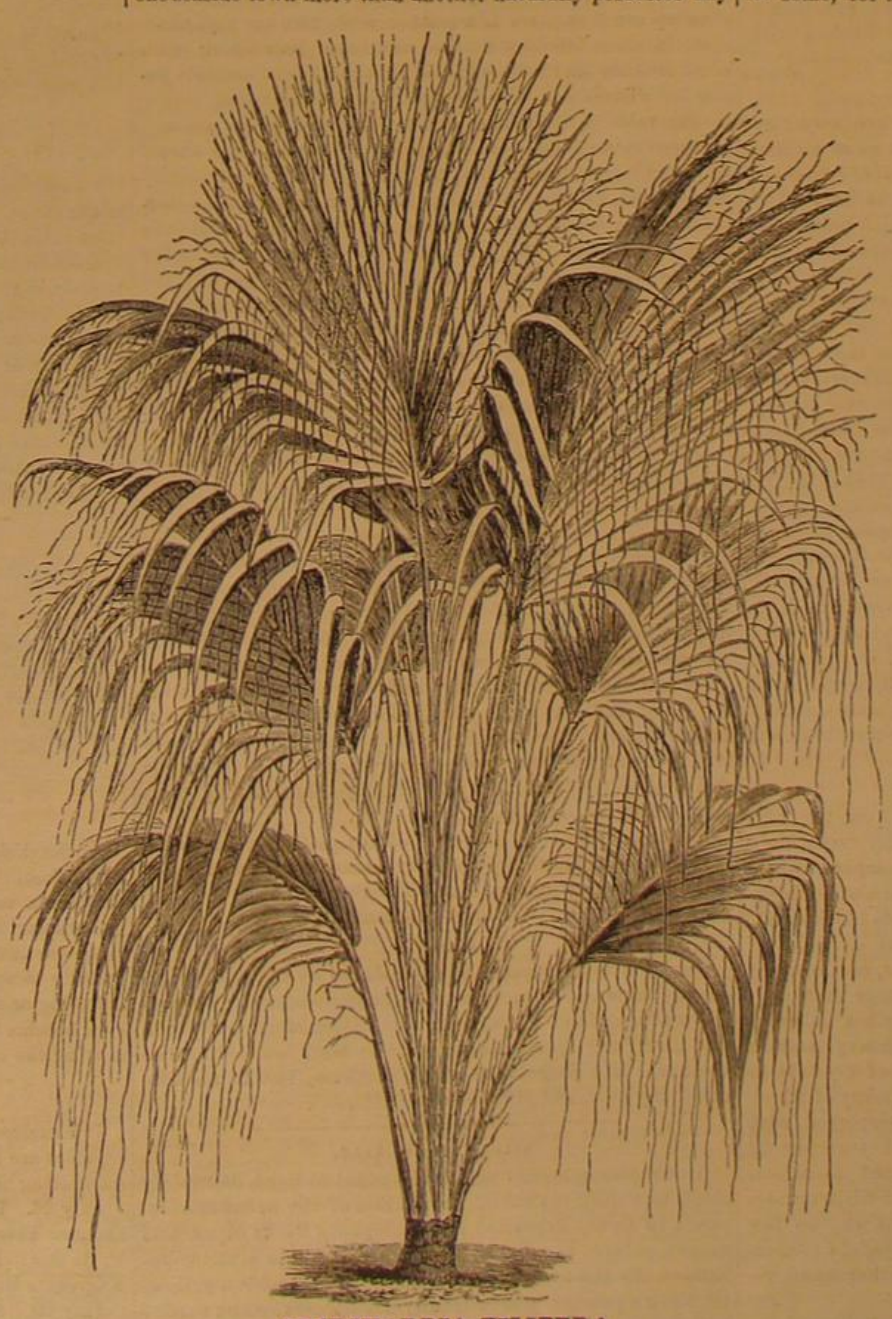
This beautiful variety of palm ought to occupy a conspicuous position, not only in private collections but also in those of public gardens. It will be found to form a good substitute for latanias, phœnixes, and similar palms, of which amateurs are rapidly beginning to get tired. In the south of Europe, says a correspondent of the English *Garden*, from the pages of which we select the engraving, it is perfectly hardy; but in more northerly climates it will succeed best under the protection of an ordinary conservatory or greenhouse.

The palm family is perhaps the most widely diversified of any botanical tribe that has distinct family characteristics; and the useful products obtainable from its members are very numerous. Houses are built of the wood, and roofed with the leaves; the fibers are used for all textile purposes; very many edible fruits are yielded by the trees; oil is extracted in prodigious quantities from one palm tree, and wine from another; and a tanning material resembling catechu is extracted from palm nuts. A common kind of sugar, called jaggery in the East Indies, is the product of a palm; and the betel nut, chewed by the natives of the Indian archipelago and elsewhere, is the fruit of a palm tree.

THE HARDY PALM (CHAMÆROPS EXCELSA).

New Treatment for Cholera.

Asiatic cholera is so well known to be such a terribly fatal disease that any plan of treatment that gives promise of success must excite general interest. A method has lately been introduced by Surgeon Major A. R. Hall, of the British Army Medical Department, which, it is hoped, will lessen the mortality caused by this fearful maladay. It consists in putting sedatives under the skin, by means of a small syringe (hypodermic injection), instead of giving stimulants by the stomach. Surgeon Major Hall has served nearly twelve years in Bengal, and has suffered from the disease himself. In most accounts of the state of the patient in the cold stage, or collapse of cholera, the heart is described as being very weak, and the whole nervous system very much exhausted. Stimulants have, therefore, almost always been administered; but experience has shown that they do more harm than good. Surgeon Major Hall observed, in his own case, while his skin was blue and cold, and when he could not feel the pulse at his wrist, that his heart was beating more forcibly than usual! He therefore concluded that the want of pulse at the wrist could not depend upon want of power in the heart. A study of the works of a distinguished physiologist, Dr. Brown-Séquard, with some observations of his own, suggested the idea that the whole nervous system is intensely irritated, instead of being exhausted; and that the heart and all the arteries in the body are in a state of spasmodic contraction. The muscular walls of the heart, therefore, work violently, and squeeze the cavities, so that the whole organ is smaller than it ought to be; but it cannot dilate as usual, and so cannot receive much blood to pump to the wrist. Surgeon Major Hall looks upon the vomiting and purging as of secondary importance, but directs special attention to the spasmodic condition of the heart and lungs. The frequent vomiting causes anything that is given by the mouth to be immediately rejected; so it occurred to him, as the nervous system appeared to want soothing instead of stimulating, that powerful sedatives, put under the skin, would prove beneficial. A solution of chloral hydrate (which has a very depressing action on the heart) was employed in twenty cases where the patients were either in collapse or approaching it, and eighteen of these recovered. They were natives of Bengal. It is probable that, among Europeans, in severe cases, more powerful depressents may be required; and Surgeon Major Hall recommends the employment of solutions of prussic acid, Calabar bean, bromide of potassium, and other sedatives. Opium (which is not really a sedative, but a stimulating narcotic) and all alcoholic stimulants are to be avoided, and nothing given to the patient to drink, in collapse, except cold water, of which he may have as much as he likes. It is to be hoped that this sedative treatment may have an extended trial, and that before long we may have further favorable reports concerning it.—*Chambers' Journal.*



PRITCHARDIA FILIFERA.

Ozone.—What Is It?

A certain seaside town has been considerably puffed into notoriety as a suitable resort for persons seeking health, on account of the quantity of ozone in the atmosphere. We will not dispute the fact, but it may be doubted whether one seaside town more than another naturally possesses any specially large amount of ozone. What, however, is ozone? That is a question more easily asked than answered. It appears to be a highly concentrated condition of the oxygen which forms the peculiarly vital part of the atmosphere, and is produced through electrical agency. The mechanical action of pure air over vegetation is productive of ozone, but still more manifestly is this subtle quality produced by the dashing of waves and spray against the air. These lashings of air and sea mixed are, electrically speaking, in the nature of one substance rubbing on another. They evoke ozone, which, being inhaled in breathing, gives a stimulus to the constitution. Hence the benefit to health from a sea voyage, or a residence at a pleasant sea side resort. Mr. Binney stated, at a recent meeting of the Manchester (England) Literary and Philosophical Society, that the atmosphere of towns may be sensibly ozonized, and of course improved in quality by the action of public fountains. He says: "A water fountain may be regarded as a hydro-electric machine, the friction of the water issuing through the jets developing electric action, materially assisted by the conversion of the spray into aqueous vapor. I would suggest that this fact should be prominently brought before municipal bodies, to induce them to erect fountains in all available places in large cities, as sanitary agents. They might prove highly beneficial in crowded localities." It need only be added that the delicate and wholesome freshness of the air after a rattling thunder shower in summer is very much due to the development of ozone. The subject of ozone, in its various phases, is at present engaging the attention of scientific inquirers, and we may soon hear more about it.

METEORITES.

BY PROFESSOR C. A. YOUNG.

In the present article we propose to consider the so-called detonating meteors, or *bolides*, which from time to time fall upon the earth as masses of stone or metal. It may indeed be a question whether these bodies really differ from the ordinary meteors in any thing but size; many of the highest authorities think they do not. Still the fact that even during the most remarkable meteoric showers no sound has been heard, and not a single fragment has been known to reach the ground, seems to warrant us in classing the bodies by themselves, at least provisionally. They appear to bear much the same relation to the shooting stars which planets do towards comets.

As late as 1800 men of science in general were disposed to be very skeptical as to accounts of stones and iron falling from the sky, and those who admitted the fact had recourse to most curious and absurd hypotheses to account for it: some, for instance, thought the stones were formed in the air by lightning, while others maintained that they came from volcanoes on the earth or moon. Chladni, however, in 1794 published a paper upon the origin of a remarkable mass of native iron found by Pallas, the Russian explorer in Siberia, maintaining it to be meteoric, as is now universally admitted; and to strengthen his position, he went into a careful criticism of various accounts of the fall of such bodies, compiling a catalogue of some 300, and affirming their credibility. His reasoning made an impression, but still failed to enforce general assent, until in 1803 an event occurred which put an end to all skepticism. On the 26th of April in that year, a meteor exploded over the village of L'Aigle in Normandy, within 85 miles of Paris; and more than 2,000 fragments, of weights ranging from 20 pounds to a fraction of an ounce, were scattered over a region of several miles. The Academy of Sciences sent a special committee to investigate the matter. They collected specimens, took the sworn depositions of those who had witnessed the phenomena, and in their report put the reality of the occurrence beyond all possible doubt.

The phenomena which accompany the fall of these bodies are much the same as those of the shooting stars, except that they are ordinarily far more brilliant; and observers who are near the path of the meteor usually hear a rushing roar, like that of a heavy railroad train, accentuated by several cannon-like reports which are sometimes heard at a distance of a hundred miles. At each of these explosions, whose cause is only doubtfully explained the meteor changes its course or breaks into fragments. In a few instances, when the fall took place in the daytime, no luminous phenomena were seen, and in one or two cases the fall of very small aerolites has been unaccompanied by noise. Thus, in March 1859, there was a shower of little stones in Harrison county, Indiana, one of which, about as large as a marble, fell within a few feet of a man and his wife who were standing in their cabin, with no other warning than the tearing of

the missile through the leaves of the trees. The character of the stone, and of several others which fell at the same time, removes all doubt as to their meteoric origin.

There are several instances on record of mischief done by meteors. In 1511 a monk was killed by one at Crema; in 1650 another monk at Milan; and in 1674 two sailors on a ship in the Baltic. One of the aerolites which fell at Barbotan in 1790 broke through the roof of a house and killed a peasant and a bullock.

When these bodies have fallen among the ignorant and superstitious, they have usually been regarded with great reverence, and become objects of worship. The Palladium of ancient Troy, which by some writers is described as a shapeless mass, is supposed to have been an aerolite; so also the image of Diana of Ephesus that fell down from Jupiter; and the mysterious black stone of the Kaaba at Mecca. The stone which fell at Parnallee in Southern India, in 1857, was for some time worshipped by the natives.

The number of meteoric falls is very considerable, our cabinets now containing specimens derived from nearly 300 different localities; and if we added the specimens which are supposed to be of meteoric origin, though the date of their fall is unknown, we must at least double the number. Recalling now how small a portion of all that reach the earth would ever be found, because so much of her surface is covered with water, or forest, or desert, it becomes evident that the total number of such events is to be counted by the thousand in every century. In fact, the scientific journals usually contain the notices of some five or six on the average every year.

Meteorites differ greatly in size. They seldom fall singly; but the mass which enters the atmosphere, chilled to the temperature of interplanetary space, breaks up, under the action of the sudden and intense heat generated by the resistance of the air, into fragments which, as a rule, seldom exceed 150 lbs. in weight, while the majority are much smaller, say from 20 lbs. to a few ounces. Since, however, the number of fragments is often very great, the total weight of a single meteoric mass sometimes amounts to tuns. This seems to have been the case with the shower of stones which fell at Weston, Conn., in 1807, and the more recent fall at New Concord, Ohio, in 1860.

The different specimens from the same fall of course always closely resemble each other, being merely fragments of a single mass; but aerolites from different falls differ widely in almost every respect, with however a few marked features of resemblance. They are always coated with a thin, black, highly magnetic crust formed by superficial fusion, and they invariably contain a considerable amount of iron, ranging from 20 or 25 per cent to more than 90. They may, according to Maskelyne, be broadly classified into three divisions: The iron meteorites or siderites; the stony meteorites, or aerolites (air stones); and an intermediate class, represented by exceedingly rare specimens, which consist of a honeycombed mass of iron filled in with stony matter, and are known as siderolites (steel stones.)

SIDERITES.

Compared with the aerolites, the siderites are very rare. As yet only five cases are on record in which meteoric iron has been seen to fall: at Agram in Bohemia, 1751; Dickson county, North Carolina, 1835; Braunau, Austria, 1847; Victoria, South Africa, 1862; and Maysville, California, 1873. A recent fall in Nevada is reported to have consisted of meteoric iron, but the report needs confirmation. While, however, the instances are so few in which the actual fall of iron masses has been observed, we have in our cabinets some 200 specimens of native iron, which from the circumstances under which they were found, and their resemblance to the Agram meteorite in chemical constitution and crystal structure, are pretty certainly concluded to be of meteoric origin. Such are the great masses from Orange river in the British Museum, the Red River iron from Texas in the Cabinet of Yale College, and the Ainsa iron in the Smithsonian rooms at Washington. A marked peculiarity of all meteoric iron is its alloy with a considerable quantity of nickel, varying from 5 to 15 per cent. A second characteristic consists in a peculiar crystaline structure, which is best brought out by polishing a cut surface and acting upon it with a weak acid. Quite recently, also, Graham and others have found that a large quantity of hydrogen, and smaller amounts of carbon oxide and other gases, chiefly hydrocarbons, are occluded in the pores of meteoric iron, and can be liberated by heat.

AEROLITES.

The aerolites, or stony meteorites, which form the vast majority of all that have been seen to fall, differ very widely among themselves. Some are hard and compact, while others are as friable as rottenstone. The aerolite of Bishopsville, S. C., though covered with the invariable black crust, is internally almost as white as chalk, and as light as pumice; that of Kold Bokkeveld, South Africa, on the other hand, resembles a piece of anthracite coal more than anything else; and that of Orgueil, a mass of rather coherent garden soil. The majority, however, are heavy grayish rocks, something like sandstone, made up of crystals or minute spheres of various peculiar minerals (many of which are never found in terrestrial rocks), interspersed with nodules of nickeliferous iron and cemented together by compounds of the oxides of iron. If exposed to atmospheric influence for a few years only, the mass disintegrates and falls to pieces, and this probably explains why so few aerolites have ever been found except in immediate connection with their fall. The siderites, on the other hand, remain for centuries but slightly altered.

According to Maskelyne the following 24 elements have been detected in aerolites, namely, *hydrogen, lithium, sodium, potassium, magnesium, calcium, aluminum, titanium, chromium, manganese, iron, nickel, cobalt, copper*, tin, antimony, arsenic, vanadium, phosphorus, *sulphur*, oxygen, silicon, carbon, and chlorine. Those italicized are also shown by the spectroscope to exist in the sun, together with zinc, strontium, and cadmium, which thus far have not been found in meteorites.

ORIGIN OF METEORITES.

The origin of these bodies is as yet a matter of speculation. They enter our atmosphere, however, with a velocity so great (often exceeding 20 miles per second) as to make it certain that they do not come from any terrestrial source, or even from the moon. And for the same reason, they cannot well be, as some have thought, "the minute outriders of the great family of the asteroids," for then the velocity with which they would reach us would be only the difference between their velocity and ours. It seems impossible to avoid the conclusion that their orbits must be unplanetary, not approximately circular, but very eccentric, like those of comets and the ordinary shooting stars. It may be, as Mr. Proctor has suggested, that some of them, the siderites especially, have been ejected from our own or some other sun, by some of those tremendous outbursts of solar energy which we occasionally observe with our spectroscopes; or they may have originated, as Moigno argues, in the cracking to pieces of some old and used-up world.

At present, all we know is that they come to us from the outer darkness of interstellar space. As Humboldt has said: "They present to us the solitary instance of a material connection with something which is foreign to our planet. We are astonished at being able to touch, weigh, and chemically decompose metallic and earthy masses which belong to the outer world—to celestial space—and to find in them the elements of our native earth, making it probable, as the great Newton conjectured, that the materials which belong to our group of cosmical bodies are, for the most part, the same."—*Boston Journal of Chemistry.*

Disinfectants.

A report of the medical officers of the British Privy Council and Local Government Board throws discredit upon popular notions of disinfection. The conclusion reached is that aerial disinfection, as commonly practised in the sick room, "is either useless or positively objectionable, owing to the false sense of security it is calculated to produce. To make the air of a room smell strongly of carbolic acid by scattering carbolic powder about the floor, or of chlorine by placing a tray of chloride of lime in a corner, is, so far as the destruction of specific contagia is concerned, an utterly futile proceeding. The practical result of experiments goes to prove that dry heat, when it can be applied, is the most efficient of all disinfectants; that the old plan of stopping up crevices, and fumigating with sulphur and charcoal, is more efficacious than any other proceeding with more modern disinfectants; and that the use of carbolic vavor for disinfecting purposes should be abandoned, owing to the relative feebleness and uncertainty of its action." To these medical conclusions the experience of wise nurses adds the suggestions: That no patient, who can possibly be removed, should spend night and day in the same apartment. One room may be thoroughly ventilated while the other is occupied. Many napkins, handkerchiefs, and other articles which are sent to the wash tub should go into the fire. Every particle of foul matter should be instantly removed from the sick room. All scraps of food should be at once taken away, when the patient has finished his meal. The nurses and attendants should take especial care of their own health, and strength, and cheerfulness; and above all, no fussiness should annoy the patient. Simply let the room be kept neat and comfortable, and in that mode infection is guarded against before it becomes dangerous.

Varnish for Glass.

Terquem prepares a varnish for glass on which drawings can be made, either with India ink or with ordinary ink. Four parts of gum mastic and 8 parts sandarac are placed in a well closed bottle with 8 parts of 95 per cent alcohol, and warmed on a water bath, then filtered. When used, the glass is heated to 122° to 140° and the varnish flowed over it. After the drawing is done, it is flowed with a weak solution of gum. The varnish is very hard, and on warm glass it is brilliant and transparent; but when cold it is opaque and absorbs the ink. It can be employed for putting labels on glass bottles, etc

A thin solution of gelatin applied to a plate of glass, which is supported horizontally until dry, makes a good surface for pen and ink drawings for transparencies.

Kaolin.

Kaolin is now supposed to be produced by the mechanical decomposition of mica, some recent microscopical and chemical examinations having afforded evidence all tending in that direction. Several samples also were washed and so separated into large and small particles, but in no case could any chemical difference be discerned.

Nitro-Cumic Acid.

A new photographic agent. Exposed to light, it rapidly alters to a deep red color. A solution of the substance exposed to light, deposited red amorphous flocks of an acid nature, soluble to a beautiful rich red liquid in alkaline solutions. By the action of reducing agents it yields a yellowish brown powder, which readily decomposes, while oxidising agents convert the red acid into a yellow powder.

The Probabilities of Sickness.

The business of life insurance is largely based on purely mathematical calculation, involving the laws of probabilities, the object of which is to determine, by careful comparison of extended statistical returns, and like information, the probable duration of a person's life at every year of his existence. On the tabulated results is founded the scale of premium charges, proportionate to the risk assumed. While everyone is, of course, interested in knowing how long he is likely to live, he has a more immediate and vital interest in learning how often he is likely to be sick, and for how many days per year he will probably, by ill health, be incapacitated for work.

Dr. Reginald Southey has recently been delivering a course of valuable lectures on "Individual Hygiene" in London, and in one he introduced a table of "Expectation of Sickness," which he had prepared, and which is as follows:

At 20 years of age, calculate on 4 sick days yearly.
At 20 to 30, 5 or 6 days.
At 45, 7 days.
At 50, 9 or 10 days.
At 55, 12 or 13 days.
At 60, 16 days.
At 65, 31 days.
At 70, 74 days.

Of course this refers to people of average good health, and not to those who may be afflicted with any ineradicable or chronic ailment.

The Most Useful Drugs.

According to the London *Medical Times and Gazette*, a party of ten medical men were dining together not long since, and one of them, during dessert, started the question that, supposing all present were limited in their practice to a selection of six pharmacopœial remedies, which would be chosen as being most useful, compound drugs to be excepted. Each of the party wrote the names of the six drugs he should select, and handed them to the doctor who started the enquiry. On examining the lists it was found a majority of votes were given in favor of opium, quinine, and iron; between mercury and iodide of potassium the votes were equally divided, as as they were also between ammonia and chloroform.

New Method of Testing Milk.

The *Country Gentleman* advises its readers to test their milk by pouring a given quantity into a small cup, arranged to be heated in a water bath. When the temperature of 96° is reached, the smell of garlic, putridity, fever, or udder disease will unmistakably manifest itself. If the milk is suspected of being diluted or skimmed, the sample in the cup is coagulated by rennet, the curd is compressed to expel the whey, and the curd is then weighed. By knowing the standard weight of the curd of a given quantity of milk and comparing it with the sample tested, the variation shows the amount of water that has been added, or to what extent it has been skimmed.

The Cause of Coughs.

An Italian (according to *Les Mondes*) attributes cough to the presence of a parasitic fungus in the air passages. In grave cases, this parasite multiplies, and reaches into the lung cells. Quinine has the property of stopping the development of microscopic fungi, and is therefore adapted as a remedy in the present case. Dr. L. has used with success the following powder: Chlorhydrate of quinine, 1 part; bicarbonate of soda, 1 part; gum arabic, 20 parts. The bicarbonate of soda is meant to dissolve the mucus, the gum arabic to increase the adherence of the powder on the bronchial passages. The insufflation (blowing in) of the powder should take place during a deep inspiration of the patient, so as to facilitate its penetration into the windpipe, which is the principal seat of the microscopic fungus.

A Gigantic Kitchen.

The German government has recently built a kitchen, a thousand feet long and wholly of stone and iron. It is to be used to supply food to the army during war. Its machinery is driven by two 1,800 horse power engines, and is capable of boiling down and condensing 170 oxen, grinding 350 tuns of flour, and making 300,000 loaves of bread daily. It is also able to supply enough preserved oats for a day's feeding of the horses belonging to an army corps of 280,000 men.

Arsenic from Curtains.

An English physician discovered in a lady symptoms of arsenicism. His attention was drawn to the calico lining of the chintz bed curtains. This material was of a delicate green color, and, on examination, proved to contain a very large quantity of arsenic. This lady's husband used frequently to wake in the morning suffering from nausea, with a feeling of weight and oppression about the chest and his eyes became inflamed. These symptoms all subsided on removing the curtains.

Naval Items.

It is understood that, to reduce expenses, all officers whose services are not absolutely required on duty will be placed on waiting orders.

July 26. The following officers were ordered to the U. S. steamer Essex, now fitting out at Boston: Chief Engineer P. A. Rearick, Assistant Engineer G. B. Ransom, and Cadet Engineers Reid, Dunning, and Stivers.

July 29. Assistant Engineer J. Diamond was dismissed the service, in pursuance of the sentence of a court martial

[For the Scientific American.]

EXHIBITS OF FOREIGN TECHNICAL SCHOOLS AT THE CENTENNIAL.

Although technical education in Europe is far more general than in the United States, the importance of presenting its methods, for study at the exhibition, seems to have been overlooked by most of the countries represented. The exhibits from foreign technical schools, however, although quite limited in extent, possess many interesting features, and are worthy of at least a brief record. The schools represented may be classed as those for artisans, which are designed to supply, as far as possible, the place of the old apprenticeship, which now exists only in name, and the schools for engineers, in which a higher grade of education is attempted, combined with extensive practice in the details of the profession which the student proposes to adopt. It is not improbable that the directors of our own technical schools can derive many valuable hints from a study of the methods adopted abroad.

RUSSIA.

The elegant manner in which Russia displays her exhibits at the Centennial is suggestive of an imperial exhibitor, and will go far to atone for the delay in opening them to the inspection of visitors. Those persons, however, who have been accustomed to look upon Russia as the abode of barbarians will find that civilization has much to learn from her display. But at present attention must be given to the technical exhibits, which occupy a prominent place in the Russian section in Machinery Hall.

1.—*The Imperial Technical School of Moscow.*—This school, under the direct patronage of the government, is richly endowed, and is provided with ample resources for both practical and theoretical instructions. There are school workshops, in which students are instructed until they are prepared to enter the general shops, in which skilled workmen are employed and machinery is regularly manufactured for sale. The course is 3 years, and the annual expenses are $225 for students who board in the school, and $75 for day scholars. The methods adopted for practical instruction are worthy of careful study. The professors recognize the fact that practical manipulation can best be taught by proceeding in a regular system of graded steps. If, for instance, a student is to acquire a knowledge of the art of filing, he first is shown the peculiarities of different kinds of files, as illustrated by models 24 times the size of the originals. He then passes to cleaning and chipping castings, is taught to file thin edges to given lines, and is advanced, as he becomes proficient, to filing plane surfaces, two rectangular planes, planes making acute and obtuse angles with each other, cubes, and so on, through a variety of steps, the full enumeration of which must be omitted for want of space. The same system, which is briefly described above, is pursued for the course of instruction in forging, in turning in wood and metal, in fitting up machinery, and the like. The results of such a system, carefully followed, cannot fail to be most gratifying. Not the least among its meritorious features is the plan of representing cutting tools on a very large scale, so that their peculiarities can readily be recognized by the students. The cases of tools and models on a large scale, as exhibited at the Centennial, are made at this institution for sale. They would be a useful addition to any of our technical schools; and the present exhibits at least should be secured, if possible, for some one of our industrial workshops.

2.—*The Practical Technological Institute of St. Petersburgh.*—The exhibit of this school admirably supplements the one described above, the results of the methods, which are essentially the same as at the Moscow school, being practically illustrated. Thus, the consecutive tasks in finishing cast iron, wrought iron, turning, and fitting, are all displayed, the last being represented by a good assortment of machine tools, consisting of planers, lathes, slotters, drill presses, and vises. A careful examination of these tools will show that they compare quite favorably with the average work turned out from regular establishments in this country.

The course at the St. Petersburgh school covers five years, and has two departments, mechanical and chemical. In the mechanical department, 648 hours of the course are devoted to labor in the workshops. The other technical schools represented at the exhibition, of which brief mention will be made, are designed for the sons of artisans, and give instruction which is chiefly practical, with courses in elementary mathematics, physics, and drawing, such as will be of substantial service to the workman who desires to rise in his profession.

SWITZERLAND.

The Free School of St. Gall, for Merchants' and Artisans' Apprentices.—The students of this school are instructed in drawing, modern languages, book keeping, woodworking, and modeling. Specimens of their work, in wood, plaster of Paris, and clay, with drawings made by them, are exhibited.

HOLLAND.

The Artisans' School, Rotterdam.—This school is supported by subscriptions, and grants from the government. It was founded in 1869, in order to instruct boys in the rudiments of the trades which they proposed to follow. The tuition fee is merely nominal, being about ten dollars a year. The course covers a period of 3 years, and students on entering must be between the ages of 12 and 15. After they leave the school, the authorities endeavor to find places for them as workmen, and exercise a general supervision over them for five years longer. During the time they are at school, the boys are made to work at their several trades, the brazier manufacturing kettles, basins, etc.; the smith, nails, locks, etc., and so on; and each is instructed in drawing, with reference to his special profession. Numerous articles constructed by students are exhibited. A few hours every day are devoted to the study of arithmetic, algebra, geometry, and mechanics. The results of this course of instruction are stated to be most gratifying, the boys being eagerly sought after by manufacturers on leaving school, and receiving much higher wages than other boys of the same age who have not been to a practical school.

Philadelphia, Pa. R. H. B.

Incendiary Telegraph Wires.

The building of the Western Union Telegraph Company in Philadelphia recently caught fire in a curious manner. The flames broke out in the receiving box—a large cupola-like structure on the roof, into which over three hundred telegraph wires pass in their way from the operators' room to the poles in the street. The fire was quickly subdued, without material damage other than the destruction of the wires and the drenching of the building with water. Subsequent investigation into the cause gives rise to the belief that a short line wire must have touched the earth and made a return circuit, possibly communicating with a sixty-five cell Grove battery of great intensity, which speedily rendered the wire white hot, and thus ignited the adjoining woodwork.

A New Use for Iron.

One of the most incomprehensible discoveries—if it be true, which is questionable—that we have ever encountered is announced in a recent French journal by M. Massie. He says that the mere introduction of an iron bar, in the box in which barley, rice, bran, biscuit, and like farinaceous materials are stored, is sufficient to prevent either the ravages of decay or the attacks of insects. Full details of the experimental investigation are given. An iron bar 3 lbs. in weight is reputed to have protected 40 gallons of grain; and certain biscuits were preserved for seven months in excellent condition, while others, under like circumstances but without the iron, were totally destroyed by weevils.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From June 27 to July 13, 1876, inclusive.

AUTOMATIC TELEGRAPH.—R. E. House, Binghamton, N. Y.
BINDING GRAIN.—Johnson Harvester Company, Brockport, N. Y.
CHAIN SWIVEL, ETC.—V. Draper, North Attleborough, Mass.
COUPLING, ETC.—S. Poole, Boston, Mass.
FASTENING BOOT SOLES, ETC.—G. V. Sheffield *et al.*, Brooklyn, N. Y.
FLOURING PROCESS, ETC.—V. B. Ryerson, New York city.
HAMES, ETC.—W. Robinson, Newburgh, Minn.
HARVESTER.—W. E. Kelly, New Brunswick, N. J.
HORSESHOE MACHINE.—H. J. Batchelder, Fitchburg, Mass.
KNITTING MACHINERY.—M. Marshall, Lowell, Mass.
LAMP BURNER, ETC.—H. A. Chapin *et al.*, New York city.
OIL TANK, ETC.—C. A. Munger, New York city.
PREPARING FLAX, ETC.—J. Good (of Brooklyn, N. Y.), Leeds, Eng., *et al.*
RAILWAY COUPLING.—J. C. Mitchell *et al.*, Lancaster, N. H.
RAILWAY WHEEL.—W. A. Miles, Copake, N. Y.
REAPER AND MOWER.—G. Pye, Hyde Park, Mass.
REAPER COMPRESSER, ETC.—S. Johnston, Brockport, N. Y.
REDUCING IRON ORES.—T. S. Blair, Pittsburgh, Pa.
REFINING IRON, ETC.—W. Sellers, Philadelphia, Pa.
REVOLVING PISTOL.—O. Jones, Philadelphia, Pa.
SAW FILE GUIDE.—E. Roth, New Oxford, Pa.
SEAMING KNIT GOODS.—C. J. Appleton, Elizabeth, N. J.
SEWING MACHINE.—F. D. Ballou, Marlboro', Mass.
SEWING MACHINE CUTTER.—L. L. Barber, Boston, Mass.
SIGNAL, ETC.—J. Gordon, Cal.
SMELTING ZINC.—F. L. Clerc, Bethlehem, Pa.
STEAM ENGINE.—H. S. Maxim, New York city.
TRAVELLER.—S. Poole, Boston, Mass.
UMBRELLA FRAME.—R. G. Radway *et al.*, New York city.

Recent American and Foreign Patents.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WAGON STANDARD.

Jacob Metz, Vernon, Ill.—This is an improved standard for the bolsters of wagons, so constructed that it may be readily and quickly attached and detached. It also enables a pair of bolsters to be ironed with less labor. It consists in castings bolted to the bolster and the base of the standard, connected with the said castings by tongues and grooves, and with the bolster by a spring bolt.

IMPROVED CHIMNEY AND VENTILATING FLUE.

Amos H. Bourne, Fort Scott, Kan.—This invention consists of a chimney and ventilating flue constructed of plastic material, the smoke flue being a clay pipe, which is placed in the center of the ventilator, the last being a cement case surrounding the pipe. There are four ventilating passages between, and at two opposite sides are ribs fitting in grooves of the pipe to secure it in place. The exterior case with passages is also for protecting the building from the heat of the smoke pipe.

IMPROVED SAW CLAMP.

Joseph Shelly, Mariposa, Cal.—This consists of clamping jaws, that are adjusted by stationary and sliding clamp pieces, screw bolts, and nuts, to the saw, in connection with a central spring pin, and grinding and locking bars for holding and turning circular saws in the clamp.

IMPROVED SAW MILL.

William E. Hill, Erie, Pa.—The logs are fed against the saws, and cut by the downstroke of the same, producing, by the slight inclination during the downstroke, the equal cutting of all the teeth, until at the lower part of the downstroke the saws are carried back far enough to give the sawdust a chance to drop or fall out before the saws get any perceptible upward motion. This prevents the teeth from carrying the sawdust back up into the cuts, and avoids thereby the choking or clogging of the saw teeth while coming down for the next cut. The receding of the saws from the cuts admits the regular forward feed of the logs during the rearward oscillation of the saws, and brings the saw teeth, at the completion of the upward stroke, forward again, to meet the cleared cuts and cause the cutting of the logs exactly at the commencement of the downstroke. The cutting is thus accomplished in the shortest time compatible with the clearing of the cuts. The feed rollers are geared to prevent the cant or log from rising or lowering when it feeds up.

IMPROVED FENDER FOR CAR WINDOWS.

Raphael P. Proctor, Edinburg, Va.—This improvement is in the form of a hood or funnel converging to a cylindrical tube at its lower extremity, and pivoted to a bracket beneath the car window, to adapt it to be turned to either side thereof, and then secured by a catch, which is likewise pivoted to said bracket.

NEW HOUSEHOLD INVENTIONS.

IMPROVED WELL AND CISTERN TOP.

John M. Bull, Sidney, O.—This invention consists of a platform with hinged door and recess and pump arranged at the top part of a sediment-collecting pot at the bottom of the cistern or well.

IMPROVED LAMP BRACKET FOR SEWING MACHINE TABLES

Frank T. Knauss, Scranton, Pa.—This is a folding lamp stand, arranged so as to be vertically adjustable on a bracket, which is to be attached to the sewing machine table by screwing to the under side. The object of folding the stand is to dispose of it compactly when not in use.

IMPROVED SASH FASTENER.

Gustavus H. Reck, Bethlehem, Pa.—This consists of a bolt for locking the sash, and a spring presser for holding the sash up by friction, so combined that the locking bolt is thrown out of action by the act of unlocking it and raising the sash. It does not interfere with the function of the presser, nor act upon the jamb so as to injure it, and is put in action again by the closing of the sash down. The invention also consists of a novel contrivance of the spring presser and the handle for working it, to apply the pressure and release.

IMPROVED CHAIR.

William T. Doremus, New York city.—The back frame of this chair is so constructed as to hide the springs and the devices by which the seat is connected with the pedestal.

IMPROVED WASHING MACHINE.

William H. McFarlen, Dysart, Iowa, assignor to himself and G. Aschenbrenner, of same place.—This is an improvement in that class of washing machines in which an endless carrier, formed of slats placed side by side and attached to belts, or otherwise flexibly connected, is arranged to travel in contact with one side of a rotating drum, and thus rub and cleanse the clothes by their combined action. The improvement relates to so arranging the endless carrier that it nearly encircles the drum, space only being left for the introduction and removal of the clothes.

IMPROVED LAMP REFLECTOR.

Martin P. Warner and Jabez F. Warner, Morrison, Ill.—This is a reflector covered at the reflecting surface with a thin layer of mica. The device is applied to the lamp by spring clamps at the lower end, which are bent of one piece of wire and attached by forward extending arms to the lamp at the juncture of burner and bowl.

IMPROVED OSCILLATING CHAIR.

Stephen C. Osgood, Georgetown, Mass.—In this device there is a combination of the knife-edged pivots of the seat frame with the spring-cushioned bearings of standards, to produce the giving of the seat when sitting down.

IMPROVED WASHING MACHINE.

Joseph Klein, Allentown, Pa.—This consists of a revolving endless belt made of hinged, grooved, or corrugated sections set into a wash tub, and of a reciprocating rubber with elastic ribs working thereon.

IMPROVED MOSQUITO NETS AND CANOPIES.

Mrs. C. Ballou, Watervliet, and G. G. Lee, Paw Paw, Mich.—This invention is an improvement in that class of nets or canopies which are applied to beds and other articles of household furnitur, to exclude mosquitoes, flies, and other insects, and consists of a series of folding frames having their respective arms or end bars pivoted to common centers to adapt the frames to open and close like the leaves of a fan, and in a clamping device for adjusting and holding the pivoted frames in the desired position, also in the construction of the longitudinal main bars of the frame, also in other features.

IMPROVED STOVE POLISH.

Charles H. Curfew and Alfred Hall, Fiskedale, Mass.—This is a compound of plumbago, nitrate of silver, salt, and cream of tartar, said to produce a brilliant polish with little labor.

IMPROVED MEAT TENDERER.

John Roemer, Champion, Mich.—This consists of a handle and corrugated squeezing plate, pivoted to a stationary corrugated plate by means of a vertically sliding pivot block. Over the latter is a strong spring, to allow the pivot block to rise in case the steak is thick and hard, and an adjusting stop screw to limit the rise of the pivot block, as required for steaks of different thicknesses. Under the block is a light spring, to prevent the block from dropping down too low when the steak is removed.

IMPROVED CLOTHES LINE SUPPORTER.

Smith M. Knapp, Hoboken, N. J.—This is a crank for clothes lines, so constructed that the clothes may be put upon the line within the room, so as to avoid all danger of falling out of the window while putting out or taking in the clothes, and which will allow the window to be closed while the clothes are upon the line.

IMPROVED AUTOMATIC FAN.

Mrs. Laura E. Haack, St. Louis, Mo.—This invention consists of a spring with a gearing of spur wheels, contained in a suitable box or suitable frame, and operating a suitable fan, the said box being located in a convenient position above the bed, and supports in a detachable and peculiarly constructed frame, which consists of legs, having at the bottom forked feet, which fit upon the head and foot boards, and have in the top tenons, which fit into sockets attached to the box.

IMPROVED COOKING RANGE.

Thomas A. Carrington, Baltimore, Md.—This invention relates to an improved double cooking range, and it consists in the particular construction and arrangement of the ovens and furnaces, so arranged with respect to a common flue, and controlled by dampers, that the heat may be variously applied, at the top or bottom of the ovens, and either side of the range, with its oven and furnace operated and controlled as to its heat, independently of the other.

IMPROVED PETROLEUM COOKING STOVE.

Fredrick Hildebrandt, New York city.—The invention consists of a perforated sheet metal body resting directly on the lamp, and supporting an interior chimney that is connected at the top by an inverted conical diaphragm with the body. It is provided at the base with a burner-encircling cone inside of the chimney, to conduct the air both at the inside and outside of the cone to the flame of the burner.

IMPROVED LAMP WICK ATTACHMENT.

Henry Rauschousan, Cornwall, Canada.—This consists of a clamp formed of the two plates, hinged to each other at one end, and provided with teeth on their alternate side edges, to adapt it to connect and hold the adjacent ends of two wicks.

IMPROVED LAMP CHIMNEY.

Emil Honerjaeger, Watertown, Wis.—This chimney is formed of a brass frame, having the inner edges of its top, bottom, and side strips scalloped, to hold a sheet of mica. There is besides a metal top piece. With this construction the sheet of mica will be held securely in place, and may be readily cleaned or replaced.

IMPROVED DOOR CHECK.

William J. Clarke, Trenton, Canada.—By this device the door may be readily retained in any position. It consists of a toothed latch bar, raised in any suitable manner, and locked by a slide with a stop pin applied to the end of a swinging lever hinged to the door casing.

IMPROVED BASIN FAUCET.

Edwin S. Rich, New York city.—The compression valve is placed at the end of the pipe to prevent leaking, as the drip water is conveyed directly into the basin, instead of running down the pipe, or between the slab and basin. The nozzle may be unscrewed at any moment from the sleeve when the valve commences to leak, and a new rubber or other packing placed into the seat of the valve.

IMPROVED PRESS BOARD

Charles H. T. Kruse, Fishkill Landing, N. Y.—An ordinary press board is supported upon blocks or pedestals having a recess in which, when not required for use, a smaller board is deposited. The latter has one side or edge curved to adapt it for use in ironing curved seams of garments. The main feature of the invention, however, consists in forming a slot in one end of said press board, and providing a detachable ironing block adapted to fit in the seat. This block may be adjusted to project above the press board, or beneath it. In the former position it is used in ironing shoulder seams of coat sleeves, etc., and in the latter position, it simply forms part of the smooth surface of the press board proper.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED PADDLE WHEEL.

Richard D. Cauthorn, Waverly, Mo., assignor to himself and William P. Milnor, of same place.—This is a paddle stern wheel, made of two sections with separately revolving shafts, and buckets placed at an angle of inclination symmetrical to the axis of the vessel, to produce, by the separate working of the sections, the turning about of the vessel without the rudder.

IMPROVED FEED WATER REGULATOR.

John Slade, Bay City, Mich.—This is an improvement in the class of feed water regulators in which the pump is continuously operated, and means are provided by which, when a sufficient quantity of water has been at any time supplied to the boiler, the current may be shut off and caused to return to the pump. The invention relates to devices for indicating the hight of water in the boiler. There is also an adjustable connection between the arm of the rock shaft, which is operated by the float, and the arm of the valve by which the entrance of the water into the boiler and return of the same to the tank or immediate source of supply are regulated.

IMPROVED CONSTRUCTION OF SHIPS.

Jules A. D'Hémécourt, New Orleans, La.—The planking is tongued and grooved, and secured by wires running through widthwise in the case of small boats. The wires are pulled taut, and soldered to metal plates fitted to the rim, and the flat bars are flanged or bent over at the top, and secured in any approved way.

IMPROVED STEERING APPARATUS.

Charles R. Suter, St. Louis, Mo. assignor to himself and Elliott E. Furney, of same place.—This consists of one or two winding drums, revolved by suitable power, around which the tiller ropes are wound, when slack merely is taken up by the steering wheel and barrel in steering. The power drums are provided with ratchet wheel and pawl, to admit the use of the apparatus directly from the steering wheel when the driving wheel is not in working order.

IMPROVED MIDDLINGS SEPARATOR.

James Stewart, Atlanta, Ga.—This invention is based upon the fact that under the impulsive force of a current of air the middlings will have greater momentum than the dust or fiber from which they are to be separated, and consists, mainly, in using a fan, so as to move the middlings in one direction, while the dust will be driven out in another at a tangent to the fan.

IMPROVED RAILROAD FROG.

David Y. Payne, Corning, N. Y.—This invention is an improvement upon the combination frog, forming the subject of letters patent No. 138,835, and relates to a certain construction and arrangement of parts, whereby a frog is produced which has advantages in respect to cheapness, durability, and facility of handling and repair.

IMPROVED CARBURETER.

James M. Pollard, New Orleans, La., and Wallace R. Barton, Galveston, Texas.—The chief objects of the invention are, first, to cause the gas to take up, or absorb, the heavier or least volatile portion of the hydrocarbon liquid, and thus avoid leaving a residuum; second, to render the volatilization of the hydrocarbon, and the quantity taken up as vapor by a given amount of gas, more uniform; and, third, to render the carbureter safer in use than those heretofore employed. To these ends, the invention consists in an improved process of feeding or supplying the gas to the carbureting vessel, at or near the point of exit of the hydrocarbon, so that they (the gas and hydrocarbon liquid) will flow through said vessel in opposite directions; in completely surrounding or submerging the said vessel, the reservoir of carbureting liquid, and the gas supply and discharge pipes, with a body of water; and lastly, in combining a liquid seal with the said reservoir.

IMPROVED CRUSHER FOR COKE, ETC.

George R. Root, Indianapolis, Ind.—This consists of a couple of hollow roller drums, having strong bars parallel to the axis, attached at suitable intervals apart for the bars of one drum to mesh into the spaces of the other without quite touching. The coke is fed into the crusher between the drums, which are geared together and revolved by power. The bars are tapered from the outside inward, so that any pieces entering between the outer edges of them will be free to escape to the inside, and thus prevent clogging the bars. The invention also consists of cone-shaped cores within the drums, to cause the crushed coke to escape from one end.

IMPROVED SPIKE DRAWER.

Andrew J. Conway, Salina, O., assignor to himself and Edgar Michael, of same place. This consists of a griping tongs suspended from a toothed bar, which gears with a toothed segment of a lever pivoted to a stand. On the latter is a slideway for the toothed bar. The whole is so arranged that the gripe of the tongs on the spike is increased as the power applied to the lever increases.

IMPROVED PLUMBER'S GRAPPLE.

William H. Dewar, New York city.—This consists in the combination of suitable jaws with rods or tubes in such a way that the jaws may be operated in pipes or other narrow places for removing obstructions.

IMPROVED MACHINE FOR REDUCING RAILROAD RAILS TO THE FORM OF PLATES.

James N. Whitman, Pembroke, Me.—The object of this invention is to change T and double-headed rails into flat plates by spreading out or flattening them transversely, without crimping or doubling over their external surface, producing plates homogeneous in texture, and suitable for shovel plates, nail plates, etc.

IMPROVED PADDLE PROPELLER.

William Davenport, Philadelphia, Pa.—This consists of two or more paddle cranks, from which the paddles are suspended and braced by a simple contrivance of stays, supported by one crank and connected to the paddle of another, and the paddles are fluted to enable them to hold the water better than flat ones do.

IMPROVED KEY BOARD FOR TYPE WRITERS.

Philander Deming, Albany, N. Y.—This inventor has lately been giving considerable attention to the improvement of the type writer. His latest device is intended so to improve the key boards of type writers that the sound of the keys is perfectly deadened and the type writer worked without noise, so as to be employed in court and other places, for stenotypic purposes, without annoyance. The invention consists of the key board, provided with a number of layers of cloth, rubber, and similar fabrics, and intermediate washers, fitted to the stems of the keys.

IMPROVED BELL-RINGING APPARATUS.

James W. Coffey, Ellettsville, Ind.—This consists of a double bell hammer, suspended on an axis over the bell. A hammer is placed on each of the two sides, so that when one is pulled down to strike the bell the other rises, preparatory to striking its blow; and each is balanced by the other, so that but very little power is required.

IMPROVED MAIL BAG CRANE.

James A. Boals, Dinsmore, Pa.—This consists of a crane for holding mail bags for the catcher of a running train, contrived so that the arms which hold the bag will drop out of the way of other passing trains and hang by the post as soon as the bag is taken off by the catcher.

IMPROVED PUMP.

Henry Durre, New York city.—This consists of a revolving shaft that imparts rotary motion to two sliding pistons, which are simultaneously reciprocated, so as to move alternately toward or away from each other, and produce thereby a compound action of the valves.

IMPROVED HYDRANT.

William Todd, Portland, Me.—This relates to an improved service pipe and gate for post hydrants, by which the water may be readily shut off from the main pipe and entirely drained off, so as to leave no water in the connecting pipes. It thus prevents the freezing and bursting of the latter. The invention consists of a sliding gate of the main pipe, and of a drain valve of the connecting pipe, that are jointly operated from the top of the hydrant, so that the gate is closed simultaneously with the opening with the drain valve and *vice versa*.

IMPROVED SCREW-CUTTING DIE CHUCK..

John G. Born and George J. Born, Pittsburgh, Pa.—This invention consists of the two parts of a divided screw-cutting die, fixed on slides, which are fitted in a supporting plate and combined with an eccentric and shaft in such manner that the die is opened and closed readily by the eccentric.

IMPROVEMENT IN TIRE TIGHTENERS.

Ensley Martin, Edward N. Davie, and Charles E. Thornton, Rockford, Mich.—This device is composed of adjustable arms and screw blocks, for pressing against the felly, and a post, which is applied to the hub, and provided with guide plates attached thereto, in which said arms are secured and adjusted.

IMPROVED GRAIN SCOURER.

Frederick E. Klopfleisch, Milwaukee, Wis.—This is a mill in which the grain is scoured between the periphery of a horizontal stone and the shell of a surrounding case or curb, so that the grain enters between the stone and the case at the bottom, and is worked upward in the process of scouring, and delivered through a spout which shifts up and down to vary the hight. By this means, the grain is scoured more or less, as may be demanded by grains of different qualities and conditions.

IMPROVED SLIDING CAR FOR RAILWAYS.

John Westcott, Tocoi, Fla.—The object is to cheapen transportation and reduce the first cost of stock. To this end, the invention consists in dispensing with the wheels and trucks of cars, and substituting for them swiveling pedals, which move in channeled rails with a sliding friction from the draft of the locomotive driver upon a separate rail. The rails are channeled for the purpose of containing and guiding the pedals and holding lubricant with which the rails are charged. Dispensing with the wheels and trucks of the cars lessens the first cost, and the easy gliding movement of the pedals in the lubricated channels lessens the wear and tear and cost of maintaining the stock. The invention is designed for elevated railways, but is applicable also to the railways of ordinary gage.

IMPROVED NUT LOCK.

A. J. Potter, Omaha, Neb.—This invention relates to the construction of a staple and provision of elongated coincident slats in the fish plate and out-locking plate of a rail joint, by which said staple is adapted to be inserted in and removed from the slats, and thus, by the operation of gravity, to hold said plates locked together.

IMPROVED SEAL LOCK.

Sylvester J. Tucker, Richmond, Va.—This invention is an improvement in that class of fastenings for freight car doors in which a glass plate or seal requires to be broken, both when the fastening is tampered with or properly opened. The fastening consists of a pivoted hasp bar, which engages with a lug on one of the doors whenever its loop or hasp proper engages the spring catch, or lock, on the other door. The bar may be secured to the lug (which is perforated for the purpose) by means of a padlock.

IMPROVED CAR COUPLING.

John Q. Johnston, Yankton, Dakota Ter.—This consists of two linked-shaped drawbars, folding one within the other, that are fulcrumed to a lateral cross pin, and operated by a fulcrumed front lever. The lever is carried back by the entering of the coupling link bars, so as to close the spread link bars by a longitudinal rod, operating a double elbow lever, fulcrumed to the rear part of the interior link. The inner link bar has a pendent locking pin at the front end, that couples the entering link of the opposite drawbar. The uncoupling is obtained by a cord attached to the lower end of the swinging front lever, while a second cord attached to the lower end of the double elbow lever closes the link bars for coupling.

IMPROVED DIE FOR CAN SPOUTS.

John Gilbert, Newark, N. J.—These are dies for forming curved spouts for oil cans and other uses, which will enable the said spouts to be formed rapidly and neatly, requiring only soldering for their completion.

NEW AGRICULTURAL INVENTIONS.

IMPROVED BEE HIVE.

Orson A. Davis, Sacramento, Cal.—This invention consists, first, of an adjustable entrance gage to regulate the size of the passage to suit the wants of the colony, having perforations to admit air for ventilation when the passages are closed, and so contrived that it can be readily taken away to clean; second, of the construction of the boxes for surplus honey in sections, adapted to be separated with the divisions of the comb, and arranged so that the upper joints serve for comb guides, by which the divisions of the comb will coincide with the divisions of the boxes.

IMPROVED BAG HOLDER.

Gideon Marsh, Steamburg, N. Y.—This consists of two separate main standards, with backwardly inclined upper parts, which are adjusted at suitable distance, according to the width of the bag. The standards are firmly attached to a suitable support by fastening strips and clamping screws, and arranged with top and side hooks for hanging the bag thereon.

IMPROVED HAWK TRAP.

Joseph White, Anderson, Tex.—This trap is so constructed as to adapt it to be attached to a pole or a post set in the ground. The construction is quite simple, and is based on an ingenious arrangement for tripping the jaws.

IMPROVED GRAIN BINDER.

John O. Schuster, Long Prairie, Ill.—This invention relates to a novel construction of a grain binder, and it consists in a set of devices adapted to be placed upon the harvester table in a position to receive the cut grain from the elevator apron, which devices are so constructed as to hold back the accumulating grain until a sufficient gavel has been obtained, when it is admitted to a trough, and then by a series of consecutive movements it is clamped and tied with a wisp of its own straw and the bundle thrown out, the binder being then ready to receive another gavel.

IMPROVED PORTABLE LINT ROOM.

Fielding L. Ellis, Greenville, Ala.—The object of this invention is to provide a portable fireproof lint room, in the form of a car, for carrying the lint from the gin house to the cotton press, and it consists in the construction and arrangement of the car, which is provided with an air vent and a flooding water tank to obviate danger and loss in case of fire, the said car being mounted upon an inclined tramway or track, and connect with the side of the gin house.

IMPROVED SHEEP COLLAR.

James A. Armentrout, Staunton, Va.—This collar is composed of two perforated leather bands or plates, armed with projecting spikes. The perforations allow proper ventilation, and the spikes prevent dogs seizing or holding sheep by the neck, which is the most vulnerable as well as most common point of attack.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED UNDERSKIRT.

Edwin D. Smith, New York city.—This consists of the employment of ruffle, flounce, and binding bands, which are produced by specially weaving them in the breadths required, and in the style and character corresponding to the goods, and without raw edges, and in sewing them on without hemming and binding. A machine with two needles is used, and thus the band is sewn on along both edges at the same time.

IMPROVED COMBINED PORTMANTEAU AND SHAWL STRAP.

Mrs. Diana S. Mathews, Adrian, Mich.—Two or more shawl straps are attached by buckles to the bottom of the portmanteau, to be detachable therefrom or riveted thereto at one side, or to be stationary, as desired; the opposite ends of the straps are secured by buckles at the opposite side, to strap a shawl, overcoat, or any other article of wearing apparel, to the portmanteau, and admit the storage of smaller articles in the case.

IMPROVED FIRE ESCAPE.

Arthur W. Crockett, New York city.—In using this escape a holding rope is secured inside the building, and bars, with the ladder and chute folded upon them, are turned out through the window, the lower end of the ladder and chute dropping to the ground, and the brace bar resting against the wall of the building beneath the window sill. The brace thus holds the ladder and chute out from the wall, so as to clear the blinds, awnings, etc., that may be attached to the side of the building.

IMPROVED POCKET BOOK FASTENING.

Franz F. Weiss, Jersey City Hights, N. J.—This is an ingenious lock consisting of three parts only, and forming a reliable closing device that is adjustable to the expansion or contraction of the pocket book.

IMPROVED SHOE.

Jakob Zwicker, New York city.—This consists of a shoe or gaiter made of a vamp of one continuous piece, with front or back stays attached to a quarter of one piece, provided with a front extension or flap. This gives a shoe without side or back seams.

IMPROVED UNIVERSAL STENCIL PLATE.

Joseph A. David, New York city.—This consists of a stencil plate on which all the letters of the alphabet and numerals are so combined that any combination of them may be made. The stencil plate is provided with space sections at the sides, and top and bottom guide pieces.

IMPROVED PICTURE FRAME FOR FLORISTS.

Diedrich Wilhelmi, New York city.—This consists of the outer base part of a picture frame, with a raised wire or other frame, that forms a space around the frame for arranging and holding flowers therein.

IMPROVED SATCHEL.

Mrs. Euphemia Vale Blake, Brooklyn, N. Y.—The ends are constructed of suitable flexible material, to fold or double inward above the bottom portion, in which they are secured. The sides and ends are constructed with flap pieces of leather, contrived to button together, for the large bag, and to fold down inside to close the bag up in small form. The satchel is provided with a hand strap having a sliding loop, which is made to slide, to provide for variations in the size of the satchel, as when filled, partly filled, or empty.

IMPROVED SPRING BOARD FOR PANTS.

Charles H. T. Kruse, Fishkill Landing, N. Y.—This invention is an improvement in devices for stretching the bottom of pantaloon legs, and imparting to them a certain desired shape. The device is composed of three parts, a sliding wedge, and two formers or forming pieces attached to the wedge in such manner that by adjusting the latter the width of the board is increased or lessened accordingly.

Notes & Queries

J. J. will find a recipe for artificial meerschaum on p. 307, vol. 34.—L. M. G. will find a formula for the proportions of a safety valve on p. 363, vol. 29.—G. F. S. will find a formula for the flow of water through pipes on p. 48, vol. 29.—B. will find directions for preparing canvas for painting on p. 267, vol. 25.—C. and W. H. I. will find a recipe for a silver-plating solution, for use without a battery, on p. 408, vol. 32.—G. F. B. can fasten emery to leather, and leather to wood, with good glue.—B. L. F. can dissolve glass with hydrofluoric acid. See p. 264, vol. 30.—E. A. S. will find directions for bronzing castings on p. 283, vol. 31.—G, W. C. will find a recipe for Babbitt metal on p. 122, vol. 28.—P. M. S. can solve his cone pulley problem by the formula given on p. 180, vol. 26.—F. E. B. will find directions for scouring brass on p. 54, vol. 32.—B. C. B. will find an explanation of the effect of the moon on the tides on p. 64, vol. 28. The belief that the moon affects the condition of meat is a vulgar superstition.—A. M. is informed that gas retort carbon can be cut with an ordinary saw.—Y. R. will find directions for soldering of all kinds on p. 251, vol. 28.—G. E. B. will find directions for preparing canvas for painting on p. 267, vol. 25.—A. P. R., Jr., will find directions for stereotyping by the paper process on p. 363, vol. 30.—W. T. S. should make a rubber stamp for marking cloth. See p. 156, vol. 31.—N. N. will find directions for getting rid of flesh worms, etc., on p. 233, vol. 31.—F. A. F. will find directions for promoting the growth of the beard on p. 363, vol. 31.—J. S. will find a recipe for the hop yeast cake on p. 234, vol. 30.—G. C. McC. is referred to the Naval Academy for answers to his questions.—H. H. L. will find a recipe for indelible ink on p. 129, vol. 28.—J. M. F. will find directions for extracting impurities on p. 89, vol. 26.—J. S. P. will find directions for galvanizing iron wire on p. 346, vol. 31.—W. H. W. will find a recipe for a fusible alloy on p. 27, vol. 30.—F. W. F. will find directions for removing paint from clothing on p. 75, vol. 30.—P. will find on p. 282, vol. 31, a good recipe for gun cotton. As to nitro-glycerin, see p. 341, vol. 34.—H. E. G. can make white ink for writing on colored paper by following the directions on p. 75, vol. 31.—S. N. C. will find directions for tempering taps, etc., on p. 75, vol. 28. For tempering millpicks, see p. 314, vol. 27.—A. R. H. will find a description of an egg hatching apparatus on p. 273, vol. 33.—A. H. will find directions for making marine glue on p. 42, vol. 32.—E. N. will find a good recipe for whitewash for outdoor use on p. 133, vol. 34.—W. M. M. will find a recipe for a stove cement on p. 183, vol. 34.

(1) R. A. R. asks: What is the variation of the magnetic needle at this point, about latitude 32° and longitude 91°? A. The best way is to determine it experimentally. See Loomis' "Trigonometry and Logarithms."

(2) B. B. says: Where can I find tabulated variation of magnetic needle courses from the true meridian, for the last century, in Central New Jersey? A. We understand that the most complete statement of the results of American observations on the magnetic elements has been published by Dr. Bache, in *American Journal of Sciences*, (2) XXIV., p. 1, where all the earlier observations are collated, with the more extended result of the coast survey, with maps.

(3) L. P. D. says: 1. What size of box will it require to enclose the steel band or spring by which Mr. Leveaux has succeeded in getting a draft of 3,000 lbs.? A. The boxes used by Mr. Leveaux are each 14 inches in diameter. 2. What is meant by a draft of 3,000 lbs.? A. The draft of the spring is the force in lbs. which it exerts in unwinding. Mr. Leveaux proposes to wind up his springs with steam engines. By using several springs, he expects to be able to propel as large a car as is required.

(4) L. H. P. says: 1. I am making an electric engine, as described on p. 301 of the SCIENTIFIC AMERICAN SUPPLEMENT, by Mr. Sawyer. The magnet is made of 1 x ⅜ inch Ulster iron. How many feet and what size of wire will I need to wind on it? A. About 20 feet of No. 16, or a couple of hundred feet of No. 20. 2. Does it make any difference which way I wind it? A. No, provided the connections are made in such a way that the upper ends of the magnet are of opposite polarity. 3. What kind of battery is the best? A. One cell of Grove if the large wire is used, or two of Daniell's battery if the small wire is preferred. See any schoolbook on natural philosophy. 4. Are all the parts to be insulated from the table on which it rests? Would a stand made of plate glass be the best? A. Convolutions of wire should be insulated from each other; this is best effected by using silk or cotton covered wire. A wooden base will answer. 5. Would light brass springs answer in place of mercury cups? A. Yes.

(5) C. N. M. says: You state that Dr. Joule's powerful magnets were wound in the direction of their length. Please explain how this was done. A. The wire was wound around the iron in the direction of its longest dimension, from end to end, instead of around it laterally, as is usually done for small magnets.

(6) R. & Co. ask: What is the difference in the method of galvanizing wrought and gray or cast iron? A. The iron is cleaned by diluted acid and friction, is heated and plunged into a bath of melted zinc covered with sal ammoniac, and is stirred about until the surface becomes alloyed with zinc. Mallett recommends an amalgam of zinc, 2,292, mercury, 202, and about 1 of sodium or potassium; this melts at 680° Fah. The cleansed iron is dipped in this and removed as soon as it reaches the temperature of the alloy. Wrought and cast iron may both be treated in this manner.

(7) A. W. T. says: If 1 cubic foot of gas, at 100 lbs. to the square inch pressure, be liberated into a receiver capable of holding 3 cubic feet, would the pressure of the gas be 50 lbs. to the square inch? In other words, does the elastic pressure of a certain weight or quantity of gas vary uniformly as its volume? A. This law is as you state it, if the temperature of the gas is kept constant.

(8) J. V. R. says: I have made an induction coil mostly from instructions gained from the SCIENTIFIC AMERICAN; it is capable of throwing a spark 6 inches. From reading No. 17 of your SUPPLEMENT, I proceeded to lengthen and strengthen the spark from instructions therein contained, and failed. I made the attachments as you recommend in your article this week; but it would not work. What was the cause of the failure? A. Your previous question was not fully understood. We think a better plan is to attach the secondary wires to the inside and outside castings of a Leyden jar of considerable capacity. This will increase the volume of the spark, but it is not likely to lengthen it much. The plan is used in studies with the spectroscope.

(9) C. B., of Holaa Hauai, Sandwich Islands, asks: Can you give me a plan by which, in plowing with 4 horses abreast, the tension will be equal and the plow in its proper place, and yet 3 of the animals will travel on the unplowed land and one in the furrow? A. Some of the farmers who take our paper can perhaps answer this correspondent. If so, we would be glad to hear from them.

(10) A. B. J. says: In your paper of March 25, 1876, you give a recipe for a new nickel-plating solution, which you say gives beautiful results. This recipe seems to be indefinite, and I would be very much obliged for a lucid explanation of it. There are two solutions mentioned. The first of these is easily understood, but I cannot understand how to make the second solution, as I do not see how ½ oz nickel can be dissolved in 2 ozs. cyanide of potassium in 1 lb. of water. And again, after the solutions are mixed, is there to be any water added? If so, what quantity? A. The half ounce of metal for the second solution is dissolved in aqua regia, the same as for the first. The acid is then driven off by heat and the pasty mass redissolved in a solution of cyanide of potassium and water (2 ozs. cyanide to 1 lb. water). No more water need be added.

(11) W. A. W. asks: I wish to evaporate liquids by steam heat. How much pipe surface will it take to evaporate 1 cubic foot of water per hour after the temperature of the water has been raised to the boiling point, the steam pressure being maintained at 60 lbs. to the square inch? A. We think that from 10 to 12 square feet will be sufficient.

(12) J. F. A. says: I heard a man say that a pump would work easier if the bottom of the suction pipe was only just covered with water than it would if it were at the bottom of a great depth of water. I differ with him, and I can prove that it will not, if the suction pipe and discharge pipes are of the proper area for the cylinder. Take, for example, a quantity of water 20 feet in depth, with the surface of the water 15 feet above the vacuuum in the pump. I claim that the water will find its way into that vacuum at every stroke, if there were no atmospheric pressure acting on the water, showing that a pump will work as easily with the bottom of the pipe at the bottom of the water, as it would if it was only just covered with it. A. We think there would be a slight difference in favor of the arrangement proposed by your disputant, principally because, the water passing through a shorter length of pipe, there would be less friction.

(13) J. W. P. asks: Does a propeller wheel, submerged, do its work of propelling the boat during its entire revolution, or only for half of it? A. Throughout the whole revolution. Its action is somewhat like that of a screw advancing into a nut, as it is turned.

(14) W. H. B. asks: 1. What is commonly understood by the expression "press equally in all directions," when using it in speaking of the action of steam or other fluids? Is it so much pressure to the square inch of surface acted upon? A. Yes. 2. If so, in what does the evidence consist of the truth of it? A. It is most simply proved by experiment. 3. When we say that a man can raise so much weight, do we mean to say that his force (or weight) applied at the end of one arm of a lever (or its equivalent) will balance the weight raised? A. Yes. 4. Does weight alone give water its downward pressure? A. Yes. 5. What natural law does water follow in seeking its level? A. It moves under the action of force until this force is balanced. 6. Is what is termed the hydrostatic paradox easily explained by known natural law? A. Yes. 7. What is the law? A. That the pressure of a column of water is equal to the weight of a prism of water having the same base and altitude as the given column.

(15) M. M. says: Please find sample of a crust that forms in my boiler. Can you tell me what will prevent it? I use well water, and it tastes strongly of sulphur. A. It is a lime deposit. We doubt whether you can entirely prevent the formation if you continue to use the present feed water; but the use of a good heater will be advantageous.

(16) M. M. asks: Would borax make a good addition to a dentine? A. No.

How is precipitate of lime made? Precipitate any soluble salt of lime by addition of an alkaline carbonate.

(17) D. B. T. asks: What force would be necessary to support a body in mid air, so that it would neither fall nor rise, but be supported in equilibrium? A. A force equal in intensity to the weight of the body.

(18) E. H. says: There is a cast iron cannon in our town made in 1822, which will shoot a 9 lbs. ball. It used to sound well, and make a loud report; but for the last year or two, it seems to have lost its ring or clear loud report. It sounds dead, when the same amount of powder is used as formerly. A. If you have correctly stated the particulars, we do not feel able to explain the matter. In general, we should imagine that in such a case the quality of the powder rather than the gun had deteriorated. Possibly, however, there may be other reasons; and perhaps some of our readers can furnish them.

(19) C. A. asks: What pressure of steam per square inch will be necessary in a double kettle to keep sugar sirup boiling at 350° Fah. A. About 125 lbs. per square inch, by gage.

(20) J. R. P. asks: 1. What is the strength of a good Manilla rope 1 inch in diameter, and also of one 1¼ inches in diameter? A. One inch rope, about 3,000 lbs.; 1¼ inch, about 4,500 lbs. 2. What is a four fall tackle block? A. We believe the term has no precise definition, but commonly refers to a tackle with two blocks, each having 2 sheaves. 3. How much weight can be safely raised with an inch rope in a good tackle block, say with 3 pulleys in one and 2 in the other, and how much with a rope 1¼ inches diameter in a like block? A. It will depend somewhat on the rigidity of the cordage and friction of sheaves but the maximum safe weights will be about 7,500 lbs. for the 1 inch rope, and 11,000 lbs. for the 1¼.

(21) C. M. says: There have been lately many storms and tornadoes in this and in foreign countries. Does our present mode of telegraphing help to create these storms? A. No. On the contrary, so far as the telegraph lines have any effect, it is to lessen the violence of electric storms by carrying the fluid to the earth and thus tending to bring about an equilibrium.

(22) J. L. W. says: We have a siphon of 2 inch pipe from a canal to a tank about 100 feet distant. The top of the tank is a few inches above the water in the canal, and the pipe enters the tank near the bottom, which gives it a fall of about 5 feet (the tank being 6 feet deep) at the start, and is intended to keep the water in the tank on a level with the water in the canal. Sometimes it stops and has to be started again with a pump. Will you explain the cause of this? A Observe the hight in the tank when the siphon stops working, and insert a waste pipe just below this level. There should be a valve at the highest point of the siphon, to let out the air that accumulates from time to time.

(23) A. D. B. asks: What substance can I use to make a watertight flooring over a plank floor? The floor is of two inch yellow pine plank and very stiff; it is in the second story of a building, and so exposed to the air beneath, it is soaked with water two or three times a day. There is no wheeling or rolling of heavy articles over it, only persons walking. Would a concrete 2 inches thick of cement and coarse sand do, or would it crack? I would prefer a slightly elastic flooring. A. If there is not much wear upon it, why not take sheet lead?

(24) P. G. asks: Is there any known way to purify the gas made by gasoline machines, so as to obtain a steady light, equal or nearly so to coal gas? A. If the machines are properly constructed, they should give a good steady light fully equal to that of coal gas. The gas (or vapor) does not require purification.

(25) E. T. D asks: Would a battery made of an iron cylinder 10 inches deep and 3 feet in circumference, and a lead one 10 inches deep and 15 inches in circumference, charged with common salt, give enough current to heat a small platinum wire to white heat? A. You had better use zinc and copper instead of lead and iron. Salt will answer to charge the batteries with.

(26) O. R. M. asks: 1. On what principle is an electric engine constructed? A. Various forms are made, but they depend upon the alternate magnetization and demagnetization of soft iron cores and the consequent attraction of other soft iron pieces placed within their influence. The moving piece or parts are provided with attachments called commutators, by means of which the battery connection is made and broken at the proper moment. 2. Is it possible to store electricity up in any manner so that an engine can be run without the batteries being present? A. No, not in the sense you mean. Magnetic machines are made to run by steam power and give powerful currents, but it would be a great waste of power to use them as motors. 3. Is it possible to construct an electric engine of any large power, say 1 horse power? A. Yes. 4. Is the power of the engine dependent only (within limits) on the strength of the current? A. The strength of the current is only one of the factors on which the power of the machine depends. 5. In that case, could not a powerful engine be constructed within a small space? A. Motors capable of running sewing machines can be made to occupy but little space, but for much power their proportions become more considerable.

(27) O. K. says: If of two pulleys, one be 20 inches in diameter, making 190 revolutions per minute, the other being 6 inches in diameter, what is the rule for finding number of revolutions of smaller pulley? A. Divide the speed of belts in feet per minute by the circumference of the pulley in feet.

(28) J. J. says: 1. A great many people, contemplating building concrete houses from your directions, would have many things to learn yet. In preparing the sand and gravel, would not two screens, one above the other, do, first putting the earth as it comes out of the bank, containing gravel, sand, and loam, on the upper screen, that which remains after shaking being gravel, the balance passing down to the lower screen which, on being shaken, would pass the finer dirt or sand through it, and that which remains being sand? Would this mode be sufficient to prepare the sand and gravel? A. There are sand beds where the sand is found of a very even grade of fineness and purity, and it would be better if possible to take it from these beds; and the same is true in reference to the gravel. If these beds are not to be found within a convenient distance, the sand may be screened from a gravel bed as you suggest. 2. How fine should the screens be? A. For the sand $\frac{1}{16}$ of an inch, but what is left in front of the screen may be taken for the gravel without further sifting. If not entirely free from loam

the sand, and also the gravel, should be washed. 3. Dr. Youmans says: "Beach sand will attract dampness." How is this? A. Because of the salt with which it is more or less impregnated. 4. In the absence of broken stone and the like, will gravel and sand do? A. Yes, if the gravel is of good size. 5. Will such a wall be damp? If so, would it need furring, or should it be hollow, as recommended by Gilmore, in his work on "Mortar and Cements"? A. Yes, it would need to be protected on the inside in some way against the condensation of water from the air in winter. 6. How are the parts proportioned, by weight or measure? A. By measure. 7. Drs. Chase and Youmans recommend freshly burnt lime; you recommend cement. If lime, being cheaper, will do, no one will use cement or water lime (which, I think, is the same). Suppose we take ⅔ freshly burnt lime and ⅓ water lime, how will that do? A. Pure cement of the best quality should be used. We presume that this is what you mean by "water lime." No common lime should be mixed with it if you want a permanent wall. 8. In using cement lime, are the proportions taken before slaking or after? A. Before. 9. How are sills, caps, and cornices made? A. These may be cast in molds.

(29) S. A. & S. ask: What will prevent the forming of vitriol crystals on the outside of telegraph battery jars? We use stone jars, which become entirely coated on the outside in a short space of time. A. A good way to prevent the fluid from creeping over the tops of the jars and crystalizing on the surface is to paint the top of the jars for half an inch.

(30) R. S. asks: What is the solution used by sugar refiners in the centrifugals to give to sugar the bright yellow straw color? A. This color, we believe, is obtained during the bleaching process, and sometimes by the addition of small quantities of dye stuffs, such as turmeric, etc.

(31) W. R. says: I. In a Holtz induction machine, where the revolving plate is supported by a thick glass plate, held horizontally between two insulated plates, of what material is it best to make the axle of the revolving plate? A. Wood and glass are frequently used. Perhaps an ebonite axle would answer best. 2. If ebonite be substituted for this horizontal glass plate, can as good electrical results be obtained? A. We believe some experimenters give ebonite the preference. 3. If coatings of paper or foil be attached to the sector plate, and these have projecting rows of pin points, and the edges that hold these pin points are opposite collecting combs of conductor, is it necessary to have windows or holes cut in sector plate to relieve the bound electricity? A. In the improved Holtz machine neither windows nor armatures are used. Two plates are mounted horizontally and both revolve, the direction of one being opposite that of the other. Four collecting arms are placed, at equal distance apart, around the plates, two above the upper and two below the under plate, and the order alternating, so that if the first is an upper arm the next is under, and so on. The first upper and under arms are connected metallically, as are also the third and last. Sometimes also an extra arm is used, which brings an upper and under arm together in one place. This arrangement appears to improve the action of the machine. 4. To steady the revolving plate, should its edge or circumference rest or turn in grooved pulleys, fastened on the small wooden pillars or posts that support the sector plate, these posts passing from horizontal supporting plates to sector? A. Grooved pulleys are best, unless, as is often done with the old style machines, the fixed plate is perforated at the center, and the revolving plate mounted on an axis passing through it.

(32) D. W. W. asks: What substance can I use to illuminate the dial of a watch sufficiently to show the hour in the dark? Will the small glass tube with phosphorus and oil do? A. We do not consider it practicable nor advisable to attempt the application of the phosphor lamp in the way you mention.

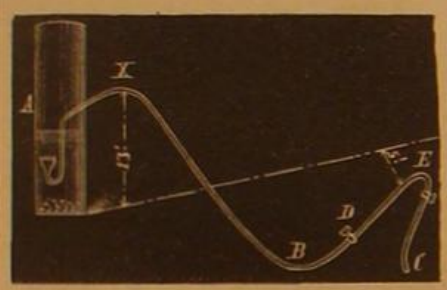
(33) N. S. W. asks. Is the first six months (vol. I) of the SCIENTIFIC AMERICAN SUPPLEMENT furnished bound? If so, price? A. We furnish the first volume of SCIENTIFIC AMERICAN SUPPLEMENT, stitched in paper covers, for $2.50. In boards, $3.50. Probably few persons appreciate the great scope and remarkable cheapness of the work we are carrying on under the title of our SUPPLEMENT. The first volume, lately completed, is illustrated by over 1,000 engravings and figures, covering all the most recent and interesting scientific information of the day. It includes the history and progress of the Great Exhibition. The contents of the SUPPLEMENT are arranged in such compact form, and embrace such an enormous variety of subjects, that if printed in ordinary book form they would occupy 3,000 pages, or 7 volumes of 500 pages each. In the domain of Science, nothing comparable to the SCIENTIFIC AMERICAN and SUPPLEMENT, in the matter of economy of price, has heretofore been given to the public.

(34) P. F. asks: How can I dissolve soda in oil? A. You do not state what kind of oil. Except in the fatty oils, containing free glycerin or acids, it is nearly insoluble. In any case, an elevated temperature increases solubility.

(35) W. E. H. says: A friend of mine recently bought me a piece of glass tubing of ⅝ inch internal and ¾ inch external diameter, about 1 foot in length. He stated that it formed part of a gage tube to show the hight of water in a mill flume, and that, getting dirty, the engineer in charge took it down to clean it, which he accomplished by wiping with waste and emery flour on the end of a pine stick. The tube, which had been in use for years, was then laid down in the engine room temporarily, when in a few hours it broke spontaneously into a dozen pieces. The fractures are nearly all alike, running a short distance lengthwise and then directly around the tube, cutting it off. I took the piece he gave me; and after cleaning with water and drying it, I laid it on a bench with a piece of iron wire and another of brass wire laid loosely through the tube. In a few hours it broke into three pieces, and in the course of the next night into half a dozen pieces, all the fractures having the direction as stated above, and some of the pieces being interchangeable on account of the striking similarity of the ends. To ascertain whether imperfect annealing had to do with the breaking, I took a piece two inches long under the blowpipe and heated it so hot that it flattened by its own weight, without any tendency to fly to pieces. A. These tubes are usually made of the hardest glass, and carefully annealed; but from the fact of your ability to soften the tube as you represent, it appears to have been otherwise in this particular case. There may have been flaws in the glass, which were further aggravated by the careless use of emery or otherwise, but we think it probable that there were some facts connected with this peculiar breakage which you have failed to discover or mention.

(36) J. I. asks: What is the best cheap solvent for ordinary tar? A. Benzine.

(37) R. M. says: I take water by siphon from a well distant from my house about 950 feet. I first laid ½ inch lead pipe, through which the water flowed nicely for a year or more, when the pipe was burst by frost. After repairing it I could never get it to work satisfactorily. With a view to improving it, I substituted a ¾ inch pipe from the well, A, to the lowest part of the siphon, B, the ½ inch pipe from that point to the house being in good condition. I now find that, by filling the pipe by either force or suction, the water will continue running for from ½ an hour to 12 hours, when it stops. I sometimes imagine that it runs only long enough to allow what water there may be in the pipe from upper part of siphon to the outlet to flow out. I wish to ascertain if you can suggest where the defect is, and give the remedy. The pipe is perfectly airtight. I have thought that by using a ½ inch pipe from well to the highest point of the siphon, X, the difficulty might be overcome. The water has to rise from bottom of well to this point about 13 feet. I have a fall of 5 feet from bottom of well to the highest point of discharge, E. I have experimented and thoroughly exhausted all the local hydraulic knowledge, and now apply to you. Can you tell me what further means I can try with it? A. The end of the pipe at the strainer in the well may be stopped up with dirt, or there may be some obstruction in the end at the house. If this is not so, it would seem to imply that the pipe is not airtight; this point should be tested thoroughly. Sometimes air bubbles from the water will collect at the highest point of the siphon, and trap it there, but this is not likely to occur in so short a time; the probability is that the pipe either leaks or is stopped up.



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

E. C.—No. 1 is a piece of slate with chalcopyrite, sulphide of copper, and protoxide of copper. No. 2 is coal.—G. V. H.—It is iron pyrites in clay.

J. C. M. says: I have seen a musical instrument in which the sound was produced by a crank in the end of the instrument, the notes being produced on keys along the side. How is the inside of the instrument arranged?—J. G. W. asks: What is the construction of the Langstroth beehive?

COMMUNICATIONS RECEIVED.

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

On Ornamental Machinery. By E.
On a Theory of Electricity. By J. N. L.
On a New Electric Battery. By W. R. H.

Also inquiries and answers from the following: W. B. A.—G. B.—E. B.—A. L. F.—W. G.—C. H. C.—C. H. B.—E. B.—G. W. D.—F. S. D.—H. S.—G. H.—R. R.—L. F.—A. T.—H. P.—W. S. V.—G. W. D.—E. —T. H. L.—W. E. F.—W. S.—H. S. W.—B. R. H.—H. C. R.—G. B. T.—J. M. N.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who makes carbons for batteries? Who sells gutta percha? Who sells incubators? Whose are the best leather belts? Who makes the cheapest photographic apparatus?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL]

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A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

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9,397.—CARPETS.—J. Hamer, Dutchess county, N. Y.
9,398 to 9,400.—TYPE.—H. Ihlenburg, Philadelphia, Pa.
9,401.—TYPE.—A. Little, New York city.
9,402.—CARPET.—T. J. Stearns, Boston, Mass.
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