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.

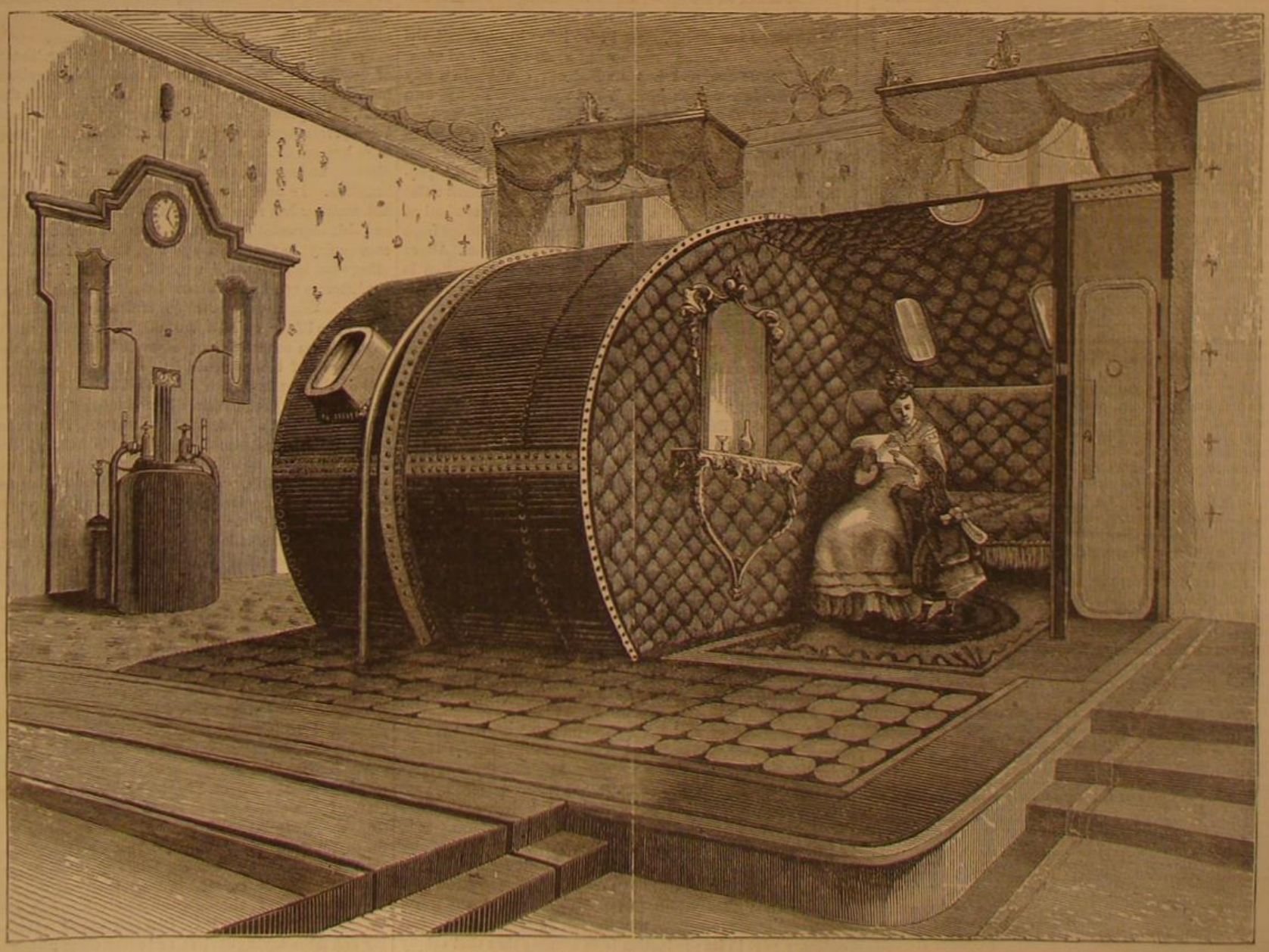
"The potato beetle remains in the ground all winter, emerges from it in the spring in a perfect state, fully grown and ready for procreation. During the day, it remains upon the potato plant and does not fly till night, when it traverses whole fields and whole sections of country, the males in search 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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Contents.

(Illustrated articles are marked with an asterisk.)

THE SCIENTIFIC AMERICAN SUPPLEMENT.

Vol. II., No. 31.

For the Week ending July 29, 1876.

TABLE OF CONTENTS.

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.

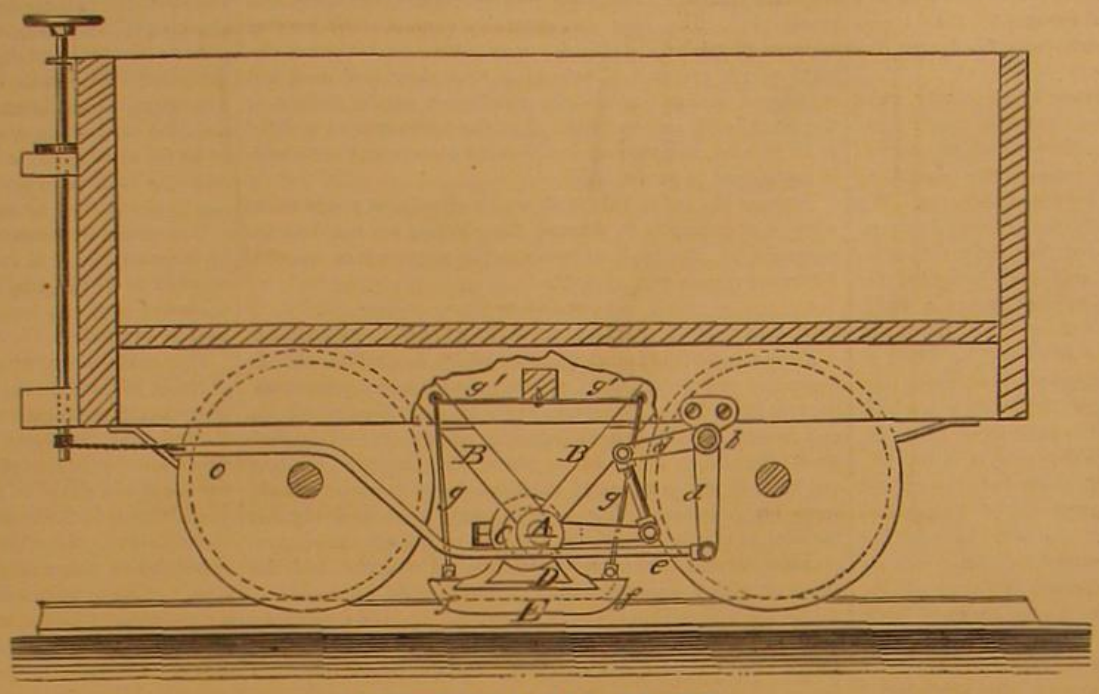
On the evening of July 8, a large meteor passed across the southern heavens, visible in Chicago and vicinity.

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.



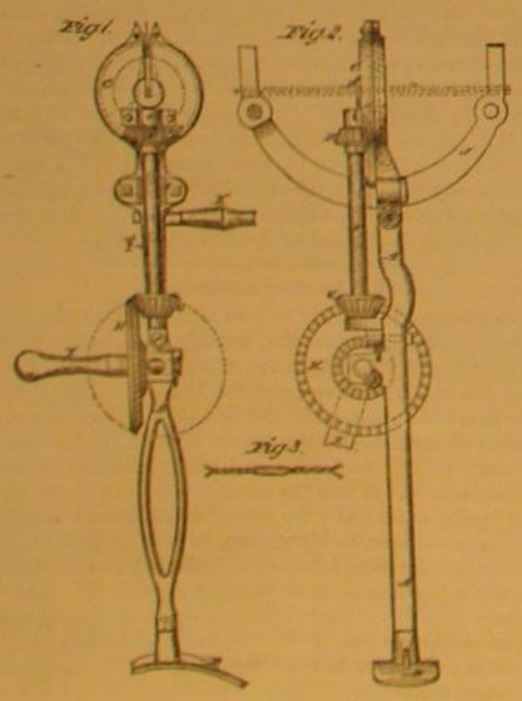
HOFECKER'S CAR BRAKE.

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

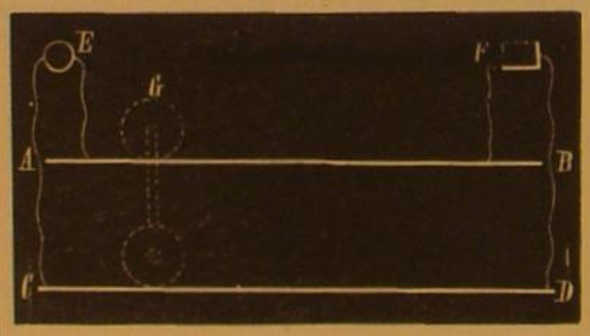


wheel, the side of which passes in through the side of the case, C, and its teeth mesh into the teeth of the gear wheel, D. The gear wheel, E, is attached to the shaft, F, which revolves in bearings attached to the shank, A, and case, C. To the upper part of the shaft, F, is attached a small bevel gear 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

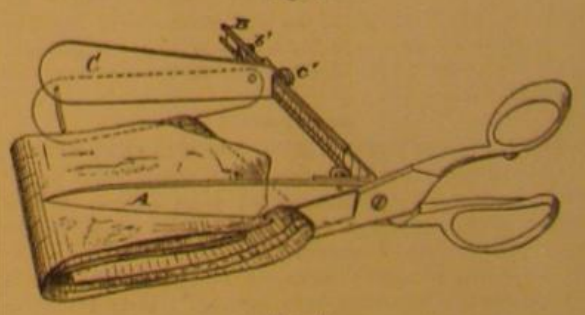
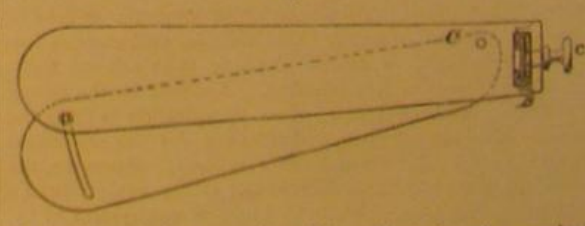


Fig. 2.



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.

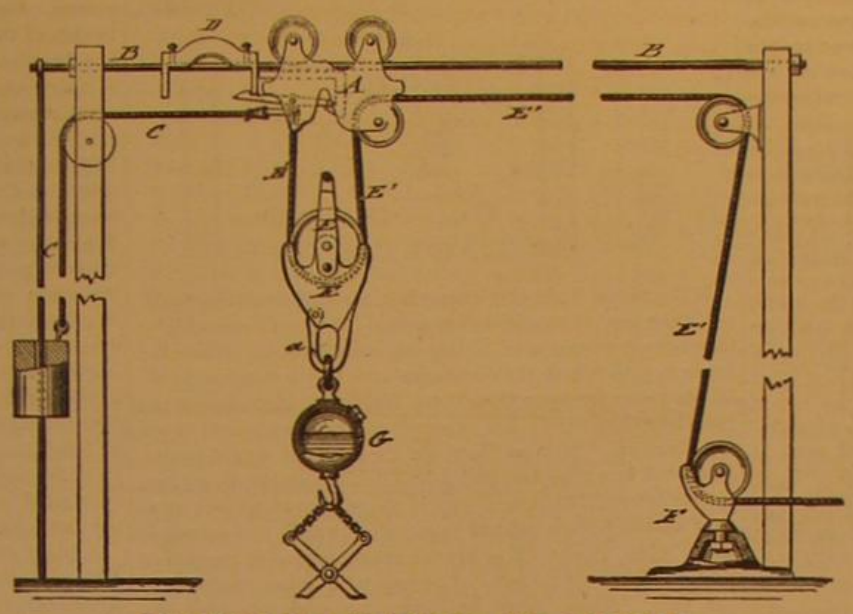
IMPROVED HAY ELEVATOR AND CARRIER.

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.

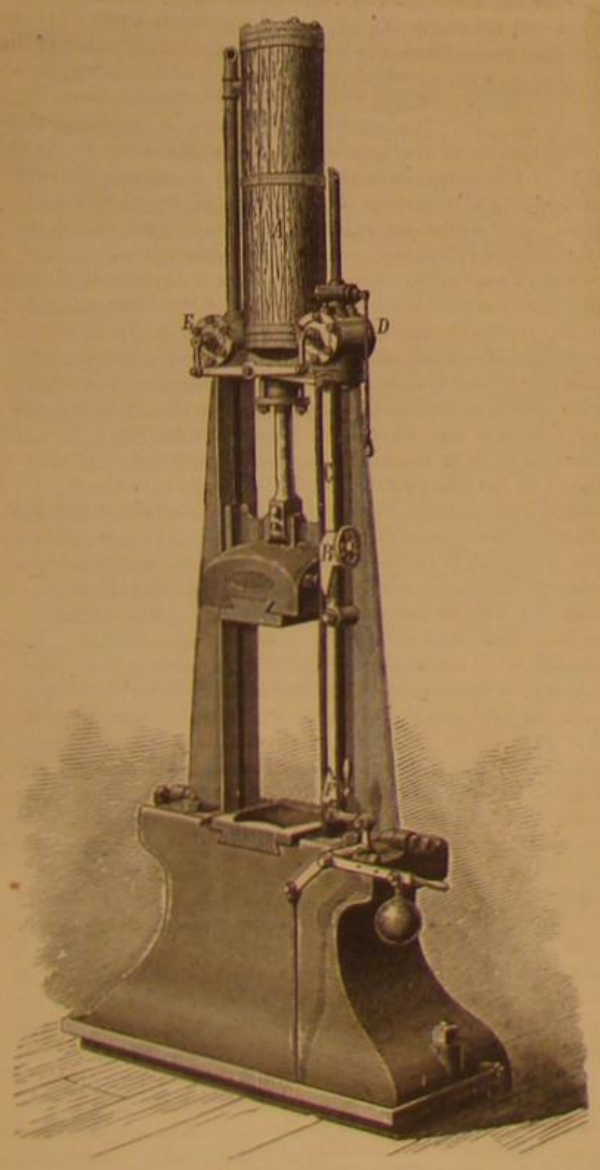
The weight, G, is capable of being adjusted to the varying length of draft rope by being made in the shape of a hollow ball, that is filled with the required quantity of shot. It accelerates the carrying back of the fork pulley on the supporting rod, and of preventing any twisting or entangling of the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

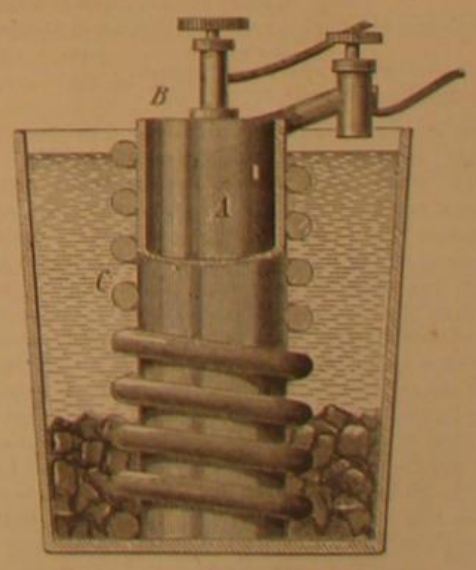
Neither Captain Murray, to whom Mr. Buckland is indebted for the loan of the compass, nor any one to whom he has shown this curiosity at home or abroad, has any idea whatever of the meaning of the star-like bodies in the center, or for what purpose the Japanese used them, but it is quite certain that 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:

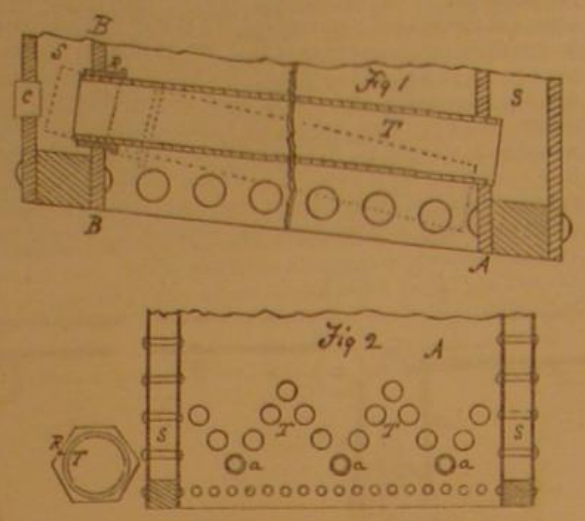
In your issue of June 24, you give us an engraving of fish hooks, etc., found in the stomach of a cod, by Mr. Frank Buckland. Some of our southern streams contain voracious fish. An acquaintance of mine caught a catfish in a lake on the Arkansas River, near Little Rock, some few years since, from the 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."

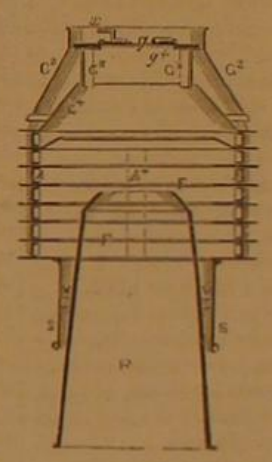
In the next place, the salutatory address was delivered by Edward B. Wall of the graduating class. Then followed abstracts of the theses: "Project for Erection of Two Blast Furnaces," by William Kent; "Transmission of Power by Wire Ropes," by Albert W. Stahl; "Manufacture of Illuminating Gas," by Alfred 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.

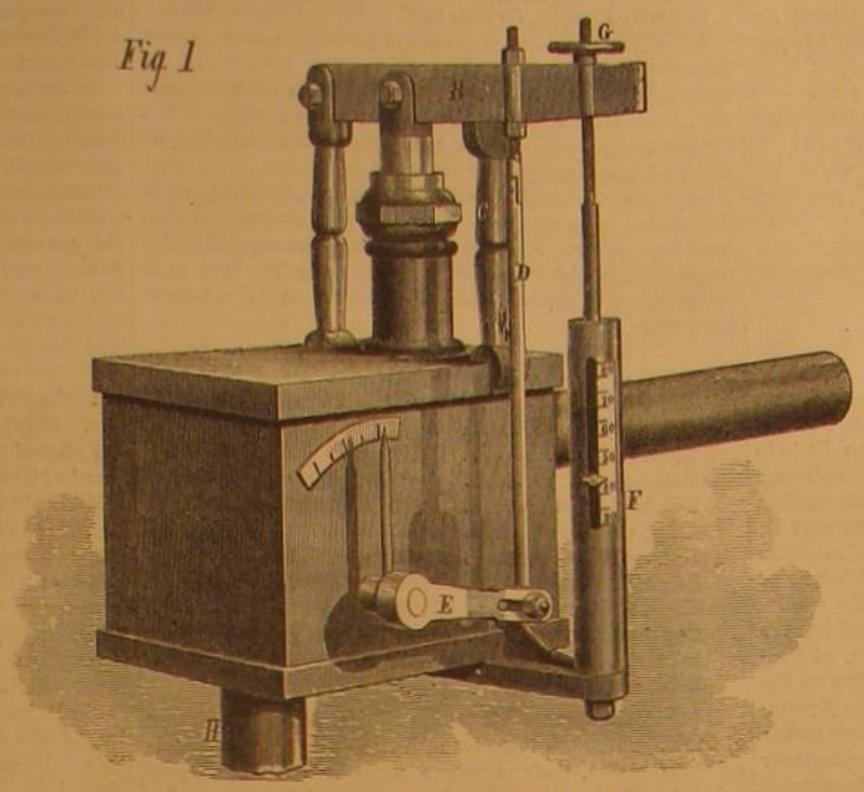
The invention herewith illustrated is a new automatic governor for regulating the influx of steam to the engine, by the steam itself. It is set to allow steam at a given pressure to pass; should that pressure be exceeded, a lever similar to that of a safety valve is lifted, and the steam valve by suitable 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.

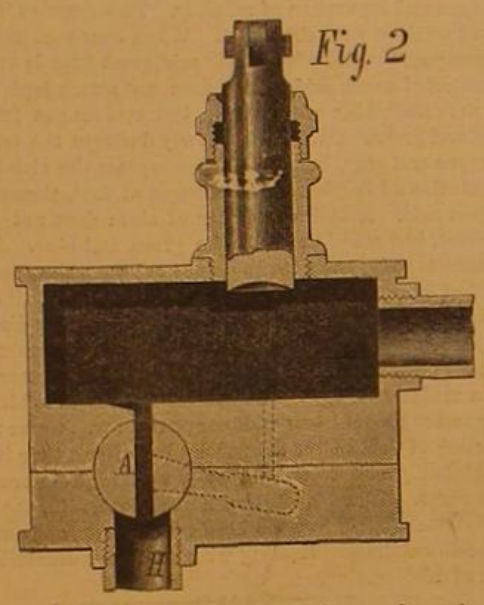
Patented May 23, 1876. For further information regarding sale of rights, etc., address the inventor, Mr. Josiah W. Clark, Iola, Allen county, Kansas.

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.

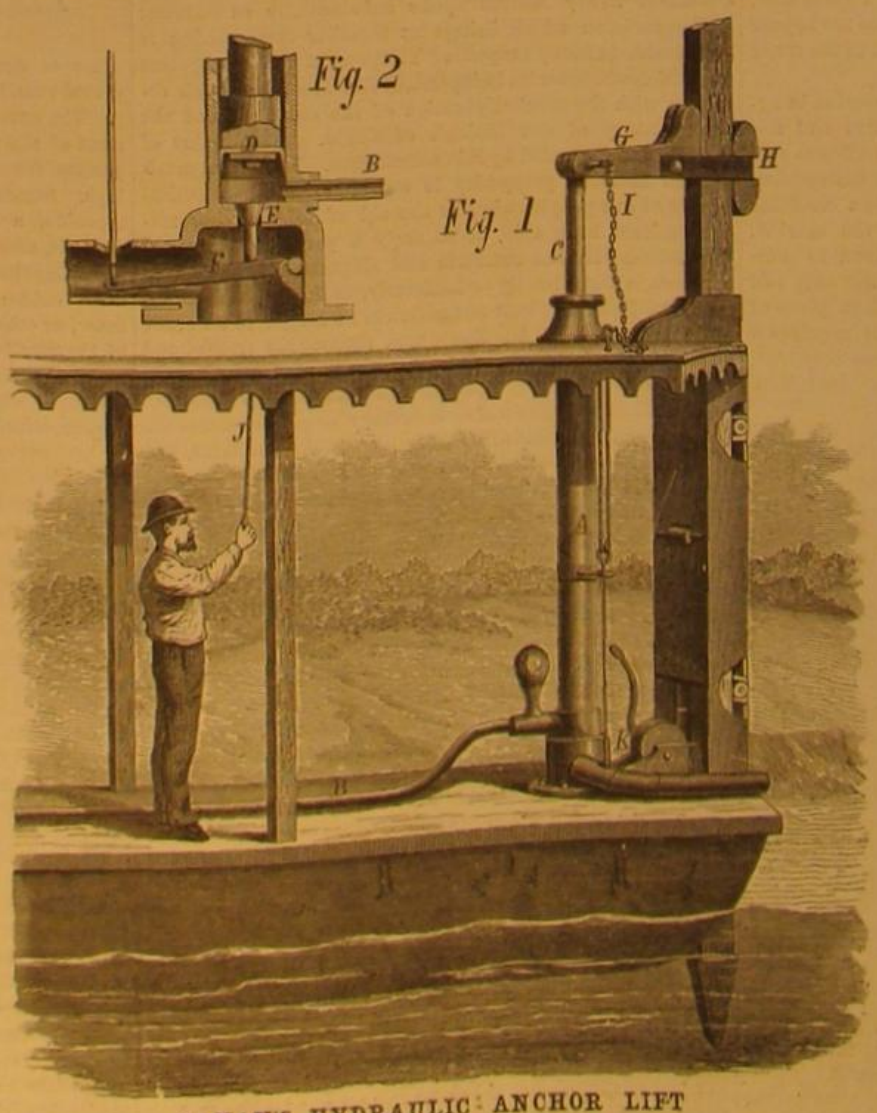
A is the vertical cylinder which receives its water supply from, the donkey or other pump by the pipe, B. Inside the cylinder is the plunger, C, the head of which, with cup-shaped packing, which the water pressure it self serves to keep tight, is represented at D, Fig. 2. The same figure shows, at E, 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.*

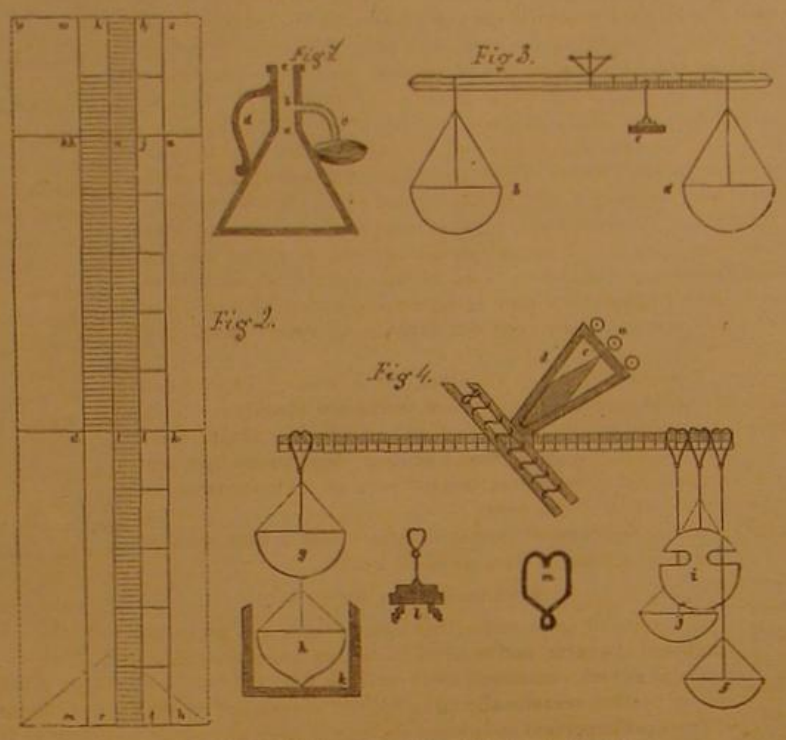
NEW YORK ACADEMY OF SCIENCES.

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
Bag for grain, etc., self-closing, M. J. Walsh 179,236
Bag holder, B. B. Gurley 179,301
Bag holder, S. C. Pyles 179,343
Bag, traveling, T. A. Dennis 179,279
Base ball target, J. O. Belknap 179,150
Bath tub attachment, W. C. & A. H. Kidney 179,321
Bed bottom, L. Birk 179,257
Bed bottom, spring, W. D. Hatch 179,190
Belaying pin, J. W. Norcross 179,129
Bird cage, A. B. Hendryx 179,192
Block frame, J. W. Norcross 179,126
Boat hook, J. W. Norcross 179,127
Boiler, steam, D. Sullivan (r) 7,196
Boilers, furnace for steam, J. L. Heald 179,191
Boot horn tip, Prusha & Cook 179,219
Boot shank burnisher, W. A. Mack 179,130
Boring machine, metal, J. W. Wilbraham 179,381
Bottle-capping machine, W. Pitt 179,218
Bottle mold, glass, Pease & Tester 179,340
Box-nailing machine, F. Rochow 179,135
Brick for walling wells, A. Moore 179,215
Brick machine, J. Dalzell 179,164
Brush, J. E. & C. E. Howard 179,196
Brush, H. Rosenthal 179,223
Brush, A. Wattles 179,376
Bucket car, J. F. Donkin 179,284
Bucket car, M. Saulson 179,333
Buckwheat cleaner, H. R. Ward 179,374
Burial case, Colby & Drew 179,098
Butter package or tub, C. W. Grannis 179,197
Button fastening, D. Heaton (r) 7,139
Button-hole machine attachment, J. J. Sullivan 179,232
Can for packing meat, G. Brougham 179,154
Can nozzle, G. H. Chinnock 179,267
Can spouts, die for, J. Gilbert 179,295
Canal boats, propelling, H. I. Chapman 179,266
Car axle box, T. L. Buckley 179,157
Car brake, P. Hughes 179,312
Car brake, I. Robbins 179,350
Car brake shoe, G. F. Eckert 179,170
Car coupling, G. J. Crikelair 179,101
Car coupling, Hiltz & Provost 179,194
Car coupling, J. W. Buckingham 179,156
Car coupling, M. B. Ogden 179,216
Car coupling, W. N. Hutchinson 179,116
Car mover, J. W. Raynor 179,347
Car replacer, Hosier & Watkins 179,311
Car spring, E. Cliff 179,397
Cars, compressed air holder for, J. Griscom 179,300
Cars, ventilation of, Hall et al. 179,303
Carpet lining, J. L. Kendall 179,117
Carriage axle, W. H. Ward 179,237
Carriage, child's, F. W. Whitney 179,244
Chains, stretching, C. Hall (r) 7,192
Chair, convertible, W. McGregor (r) 7,194
Chair, convertible, C. Vandyeck 179,234
Chair, folding, P. Born 179,259
Chair, folding, B. E. Wetherbee 179,242
Chair, shearing, J. A. Boals 179,256
Chimney cap, J. E. Auld 179,147
Cigar mold, F. C. Miller 179,125
Clasp, S. Wales 179,143
Clevis, spring, L. C. Eaton 179,285
Clew thimble, J. Dunn 179,168
Clipping machine, A. N. Gavit 179,105
Clothes dryer, H. F. Green 179,298
Clothes dryer, G. A. Wright, Sr 179,247
Clothes pin, G. C. Eastman 179,169
Coal hod, W. S. Potwin 179,132
Coal-mining machine, A. Crombie 179,102
Coffee pot, W. H. Sherwood 179,359
Coffee roaster, N. Ljungberg 179,325
Cooker, steam, H. E. Fuller 179,292
Cooler, beer, W. Woerle (r) 7,197
Cooler, milk, Eaton & Randall 179,286
Cooler, milk, T. King 179,323
Corkscrew, J. Barnes 179,099
Corn sheller, J. Q. Adams 179,250
Corset spring, C. F. York 179,146
Cotton opener, beater, etc., R. Kitson 179,118
Cradle, T. B. Way 179,144
Crape, laces, etc., restoring, A. J. Schriver 179,361
Culinary vessel, F. Schifferle 179,354
Cultivator, D. C. Baker 179,089
Cultivator, S. Purdy 179,133
Cultivator, G. W. Rhodes 179,220
Curry comb, C. E. L. Holmes 179,195
Curtain cord tightener, A. Burbank 179,158
Dental plugger, C. King 179,201
Dental tools, making, Bonaventura et al 179,153
Desk, G. Range 179,345
Desk, wall, T. Cogswell (r) 7,189
Dish and bottle washer, W. N. Cosgrove 179,274
Door check, W. J. Clarke 179,269
Door check, T. Hill 179,308
Double tree hook, J. Parker 179,339
Drain hopper, J. D. Pierce 179,217
Drain or sewer trap, W. D. Stewart 179,138
Drying house, S. W. Craven 179,275
Electric machine, magneto-, J. B. Fuller 179,184
Elevator and carrier, H. W. Foutz 179,181
Enameling wrought iron, J. C. Whiting 179,38
Engines, link for steam, W. H. Gilman 179,107
Engine valve, direct-acting, Goose et al 179,188
Engine valve, direct-acting, J. Hare 179,304
Envelope, J. Rogers 179,351
Evaporating pan, T. McQuiston 179,124
Eyelet-setting instrument, H. Dinning 179,281
Fan, automatic, A. Mattox 179,211
Faucet, Booth & Hall 179,092
Feather renovator, Biggar & Murwin 179,151
Feed rack, A. W. Humphrey 179,314
Fence wire, barbed, N. Clark 179,268
Fire-arm feeder, L. W. Broadwell (r) 7,188
Fire pot lining, J. Ziegler 179,249
Flambeau, English & Lasse 179,177
Flour, manufacture of, J. Mills 179,214
Food for stock, steaming, R. Dailey 179,162
Fruit dryer, H. G. Hulburd 179,313
Fruit jar, D. E. Stevens 179,231
Furnace and steam boiler, Ash & Walker 179,148
Furnace blast, C. Piagge 179,342
Furnace for steam boilers, J. L. Heald 179,191
Furnace grate, Dodge & Coles 179,283
Furnace grate, J. Reynolds 179,348
Furnace, heating, P. Martin 179,210
Gas apparatus, W. & R. H. Smith 179,364
Gas manufacturing, M. H. Strong 179,369
Gas purifying tray, T. P. McGarvie 179,213
Gas retort lid, etc., J. Ricketts 179,221
Gas-saving attachment, T. McKee 179,220
Gate, automatic, P. Sames 179,225
Gate, farm, A. Brinkerhoff (r) 8,187
Girder, compound, A. Hay 179,114
Grain binder, J. Garrard 179,294
Grain cleaner, W. W. Ingraham 179,198
Grain register, M. Shawver 179,126
Grindstones, hanging, D. E. Hall 179,189
Hammer, hydraulic power, W. B. Leachman 179,206
Harness, D. S. Carrick 179,265
Harness, G. H. Van Sice 179,143
Harness hame, L. P. Brown 179,261
Harrow and pulverizer, T. A. Kershner 179,320
Harvester, R. Emerson 179,287
Harvester, E. H. Gammon 179,104
Harvester, B. Shoup 179,228
Harvester, Steward & Coddington 179,140
Harvester reel support, J. F. Steward 179,139
Hinge, table, F. H. Cutler 179,278
Hook, snap, G. D. Mosher 179,335
Hose pipes, making, G. M. Fuller 179,183
Ice-shaving apparatus, W. C. Salmon 179,224
Indicator and speed recorder, J. F. Kettell 179,200
Ingots and plates, making, H. McDonald 179,212
Ironing apparatus, C. Mackh 179,121
Ironing apparatus, Sternberger & Pfautz 179,367
Jelly glass top, J. Dalzell 179,163
Journal bearing, C. C. Hoyt 179,115
Knife-scouring machine, R. G. Spaulding 179,365
Knitting machine needle bar, etc., W. H. Abel 179,088
Ladder extension, H. Buestrin 179,362
Lamp chimney, E. Honerjaeger 179,310
Lamp extinguisher, M. Wagner 179,373
Lamp wick attachment, H. Rauschousan 179,346
Lamp match box, J. Dalzell 179,165
Lathe, double reversible, J. H. Wilson 179,245
Liniment for rheumatism, Shane et al 179,358
Lock, seal, J. Sweeney 179,370
Locomotive draft regulator, J. M. Foss 179,182
Log track, J. N. Russell 179,352
Loom, H. D. Davis 179,166
Loom, A. H. Miller 179,334
Lubricating compound, H. W. Billington 179,256
Lubricator, D. Jenkins 179,199
Lubricator, N. Seibert 179,226
Mail bag, F. J. Feinthel 179,288
Marking implement, J. Perkins 179,341
Match safe, H. Kinsley 179,319
Measure and pump, fluid, W. H. & W. J. Clark 179,096
Measure, graduated, E. L. Witte 179,382
Mechanical movement, A. Warth 179,375
Mechanical movement, W. D. Westman 179,241
Milestones, laying out furrows in, G. T. Smith 179,229
Mold for pillars, Gibby & Goldsmith 179,106
Molding machine, H. Buchter 179,098
Music stand, J. A. Bland 179,154
Musical instrument valve, W. A. Tischendorf 179,372
Nail and spike, E. Bless 179,152
Nails, making, Cerf et al 179,098
Nursing bottle valve, A. M. & H. Knapp 179,204
Nuts, machine for tapping, C. H. Robinson 179,222
Oaten grits, machine for making, G. H. Cormack 179,100
Overalls, G. R. Eager 179,170, 179,171, 179,172, 179,173, 179,174
Overalls, etc., G. R. Eager 179,174
Paddle wheel, feathering, T. Walsh 179,143
Padlock, combination, H. Clarke 179,270
Paint, oil, W. E. Vary 179,235
Paper board, drying, B. F. Field 179,289
Paper pulp, wood, H. H. Furbish 179,108
Paper, reel for, W. Conquest 179,161
Passengers, recording, P. B. & C. Mathiason 179,328
Pencil protector and knife, F. A. Coombs 179,273
Photograph burnisher, L. D. B. Shaw 179,227
Photographs on glass, B. T. Irish 179,316

Pipe-bending mandrel, M. L. Orum	179,130
Planing machine, R. B. Norment, Jr.	179,397
Planing machine, wood, Landon & Titus	179,264
Plow and cultivator, combined, C. Frank	179,291
Plow, gang, Button & Lundy	179,094
Plow shield and cleaner, A. T. Martin, Jr.	179,122
Plow, sulky, L. Wertenberger	179,378
Polishing machine, H. M. Dubois	179,167
Portmanteau and strap, D. S. Mathews	179,329
Potato crulls, making, A. Herring	179,193
Press, G. B. Boomer	179,091
Press, hydraulic cotton, S. Hughes	179,197
Press, power, B. G. Martin	179,309
Propelling wheel, W. S. Wootton	179,395
Pulley block, J. Weir	179,389
Pump, R. E. Mills	179,314
Pump, force, T. Gardner	179,293
Radiator, steam, W. P. & R. P. Thompson	179,371
Rail joint, J. D. Smith	179,363
Railway rails to plates, reducing, J. N. Whitman	179,379
Razor, C. Beck	179,255
Reaping self-rake, E. H. Clinton	179,271
Rendering apparatus, G. Upton	179,233
Rolling sheet or plate metal, J. Q. Everson	179,178
Roofing, plastic, L. Pierce	179,151
Rowlock, J. W. Norcross	179,328
Sash cord fastener, A. J. Chase	179,160
Sash fastener, W. G. Brown	179,153
Sash fastener, T. Hill	179,339
Sash holder, J. Gallaher	179,185
Saw handle, crosscut, H. Disston	179,282
Saw mill, W. A. Stoltz	179,368
Saw mill, circular, O. L. Jenks	179,318
Screen, D. G. and J. B. Smith	179,229
Seal, metallic, E. J. Brooks	179,260
Seal, metallic, M. W. DeWolf	179,280
Seeding machine, W. G. Barnes	179,149
Seeding machine, M. L. Gorham (r)	7,191
Separator, grain, W. H. Asbury	179,252
Separator, grain, H. A. Barnard	179,254
Ships' bottoms, fouling of, W. D. Folger	179,180
Ships, etc., constructing, J. A. D. Hémécourt	179,306
Shoes, manufacture of, J. E. Wheeler	179,145
Skate, C. G. C. Simpson	179,137
Skate, J. A. Whelpley	179,243
Slate, drawing, C. L. Slade	179,362
Soap compound, T. H. Starizman	179,366
Solder wire machine, E. M. Lang	179,119
Spike drawer, A. J. Conway	179,272
Stalk cutter, Page & Hoffman	179,338
Stamping, die for, H. Martyn	179,208
Stove cover, J. A. Marvin	179,327
Stove leg fastener J. Ziegler	179,248
Stove pipe elbow, A. Greenleaf	179,299
Stove polish, Curfew & Hall	179,277
Straw cutter, A. Anderson	179,251
Streets, substructure of, M. A. Burnham	179,159
Suspender end, Schirmer & Betts	179,355
Switch and signal locking, Finch & Moore	179,290
Table, C. Schmid	179,356
Table, ironing, R. N. Herring	179,307
Tag fastener, W. B. Mills	179,331
Tank, oil, S. Webster	179,238
Teeth, artificial, T. Williams	179,382
Thill coupling, Gillespie & Springer	179,296
Tobacco, liquids in, Smith & Messenger (r)	7,195
Tobacco extract, S. Krackowizer	179,323
Tobacco plants, treating, Harris & Beverly	179,305
Tongs, pipe, A. H. Jarecki	179,317
Tool handles, Hardy & Stayner	179,110, 179,111
Toy, bandlure, C. Weber	179,377
Toy money bank, W. M. Kirchner	179,203
Trap, animal, Kramer & Loeble	179,205
Trap, hawk, J. White	179,380
Tree protector, G. W. Grader	179,297
Trunk corner clamp, J. W. C. Haskell	179,113
Twine cutter, W. Haddenhorst	179,302
Valve, ball, Carlton & Jones	179,262
Wagon body, B. Rankin	179,344
Washing machine, E. Cooper	179,099
Washing machine, T. Muir	179,336
Washing machine, J. H. Shaut	179,357
Watch case spring, C. O. Farciot	179,179
Watch chain swivels, making, J. F. Harris	179,112
Water cut off, C. O. Wilson	179,246
Well borer, artesian, J. A. Woodhouse	179,384
Well tubes etc., inserting, J. T. Sherfey	179,360
Wells, brick for walling, A. Moore	179,215
Wells, stirrup for oil, W. J. Lewis	179,207
Wheel tyre, W. H. Bailey	179,253
Wheelbarrow, J. A. Garver (r)	7,190
Windmills, D. Halladay	179,108, 179,109
Windmill, T. J. & M. F. Ingels	179,315
Windmill, C. H. Miller	179,333
Window screen, H. W. Yates	179,386
Window shade roller, E. S. Johnston	179,319
Window shade, sectional, G. W. McGill	179,123
Wrench, pipe, G. H. Crosby	179,276

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