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A NEW GRAIN ELEVATOR.

A new grain elevator in New York city is now in process of construction by the New York Central and Hudson River Railroad Company, which is designed as the beginning of arrangements for the accommodation of a great grain trade which ultimately will tend to direct a large trade, to New York city in this line.

The magnitude of the future facilities for cheaply handling grain in New York can be inferred both from the requirements of the large traffic of the Central and Hudson River Railroad and from the fact that, with that line, other lines will necessarily be brought into active competition, and so led to provide adequate terminal accommodations for their own benefit. The Pennsylvania road has already recognized this, and, it is reported, contemplates the erection of an elevator as large as that of the New York Central Company, and subsequently of building one of double the size, capable of holding 3,000,000 bushels of grain; while the Erie, we learn, proposes to construct a small transfer elevator of 100 000 bushels capacity, and probably in the future a building of much greater size.

At the present time New York suffers from no lack of storage capacity for grain taken from vessels. There is an abundance of floating elevators, and the stationary edifices will, together, accommodate some 12,000,000 bushels. The absence of railroad elevators has, however, rendered the handling of the enormous quantity of grain arriving by rail both costly and difficult, in a degree which may be estimated from the fact that the same has now to be shoveled by hand from the cars of the New York Central and Hudson River road into canal boats, and by the latter transported to storage houses to the lower part of the city.

The opposition to building elevators on the part of the railroad managers has been based on economical motives. The grain-grading system now existing, through the agreement between the Produce Exchange and the roads, has hitherto not been favored; and as a result, under the old plan (it being necessary to deliver the identical grain received for storage) such grain would have to be stored in a separate bin even if it did not nearly fill the latter, so that it was practically impossible to utilize even half the capacity of the accommodations provided. The present system obviates this trouble, and admits of the employment of nearly the full capacity, through proper weighing and inspection, by which the exact amount of the same quality, etc., of grain is returned to the storer: though such is not the identical material, as several consignments may be mingled in one or more bins, in order that the latter may be completely filled. Another obstacle has been found in the fact that the buildings must be erected on the Hudson River, and suitable bottom for laying foundations has hitherto not been reached. This difficulty has, by dint of persevering search, been overcome, and now the Central, Erie, and Pennsylvania roads have, on their respective properties, found solid bottom at a depth of some 75 feet.

The New York Central and Hudson River Railroad Company's elevator, at the time of writing, exists partially in the shape of foundations and partially on paper, in the form of plans. Mr. Charles Hilton is engineer in charge, and through the courtesy of Mr. C. B. Gerard, the assistant engineer, we have obtained the following facts in regard to the edifice, and from the drawings our artist has prepared the accompanying accurate representation of the structure as it will appear when completed one year hence. The building is located between 60th and 62d streets, and on a line with Twelfth avenue. It is 354 feet in length by 100 feet in width, and 160 feet in hight, and contains 264 bins, each 65 feet high, having a capacity of 6,000 bushels each, or an aggregate capacity of over 1,500,000 bushels of grain. The foundation is composed of some seven thousand piles driven into the river bed at intervals of 2 feet 9 inches between centers. These are cut off below low water level, filled in with sand, and transversely capped with heavy timbers. Two diagonal cappings follow above, and a series of granite piers, pyramidal in shape, finally support the ponderous timbers which sustain the bins. The superstructure is of brick outside to the top of the bins, and slate above.

At the north end, four tracks enter, and between the outside pairs twenty-two receiving pits are made, each pit holding one car load of grain, and so located as to come just abreast the car doors. Steam shovels are to be used to remove the grain from the cars; and the grain is then carried by the elevator leg, which enters each pit, to a receiving hopper above the bins. The power for elevating is furnished by a 500 horse power double engine. As soon as the receiving hopper is filled, an attendant on the ground floor opens a valve and allows its contents to run into a weighing hopper placed beneath. The scale rod is also in the lower story, though connected with the hopper far above by suitable devices, so that the weight is easily read off. The weighing hopper may be rotated on a vertical axis, and is provided with an inclined spout. This spout traverses the interior periphery of a ring, into which opens a series of conduits, leading to twenty-four adjacent bins. By means of a wheel and index hand, the attendant can adjust the hopper spout against any desired bin chute, and it only remains to open a valve to deliver the grain into the bin. Meanwhile the receiving hopper valve has been closed, and the hopper is being refilled, so that the raising of the grain is continuously carried on. At the bottom of each bin is a spout, and under every fourth row of bins there is an endless moving belt. Bags, after being filled at the spouts, are thrown upon the belt, and thus transported to the vehicles at the delivery door.

In order to accommodate shipping, a separate hopper is provided, and a spout therefrom leads outside the building to the hold of the vessel. Arrangements are also provided for removing grain from boats, the elevator leg for this purpose being 60 feet in length and capable of vertical adjustment over a distance of 20 feet, to suit varying conditions of tide, etc.

Our engraving represents the new elevator, and also affords an idea of another edifice, probably the largest of its kind in the world, and of the extensive yards owned by the New York Central and Hudson River Railroad Company and let to the Union Stock and Market Company as a receiving station for the immense droves of live stock received from the West over the Hudson River road. The sheep and hog house, which very recently has been completed, is shown in the distance. It is a brick structure 370 feet long by 200 feet wide, and is

THE NEW YORK CENTRAL RAILWAY'S GRAIN ELEVATOR AND STOCK YARD

divided into one section 100 feet in length and three stories high, for the reception of hogs, and another occupying the remaining space, but four stories in hight, for beeves, calves, and sheep. The ground floor is utilized for cattle and the upper stories for the sheep, broad inclined planes being the means of ascent. The interior is thoroughly illuminated by a large skylight and innumerable windows, and the ventilation, obtained by flumes and hundreds of apertures in the walls, is thorough; 20,000 hogs, 30,000 sheep, and 2,000 calves can be accommodated at once on the various floors, which aggregate in area nearly seven acres. The yards outside offer quarters for 4,500 head of cattle. The land included in these new improvements, for conducting freighting business by this company, is some 20 acres, nearly all of which is made or filled-in ground, which has heretofore been useless.

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VOLUME XXXIII., No. 25. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, DECEMBER 18, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

PUBLISHERS' CARD.

The present volume of the SCIENTIFIC AMERICAN is drawing rapidly to a close. The next number ends the year. Some eighteen thousand of our subscribers will find, printed on their wrappers covering this week's papers, the announcement that their subscriptions are about to expire, and the request that they will remit for the new volume. To prevent any break in the conti- nuity of their subscriptions, and to enable the publishers to know how large an edition to print at the commencement of the year, subscribers are invited to remit for a renewal as early as possible. Simultaneously with the mailing of this week's paper, an envelope, containing Prospectus for 1876, a beautiful chromo Name List, a Catalogue of our Publications, and an Illustrated Hand Book, useful for inventors and others, will be mailed to all our subscribers; and we hope to receive all the lists back again filled with the names of those who wish in the future to take our paper.

To save our friends all the trouble possible, we also inclose an envelope with our address printed thereon, so that all the subscriber and getter-up of a club has to do, is to place his name or list of subscribers in the envelope, with the postal order, draft, or money, put a 3 cent stamp on the former, and drop it into his post office.

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DIPHTHERIA.

There has been recently in this city, and throughout the country, quite an alarming spread of diphtheria, amounting almost to an epidemic. The disease is one which fastens on children most readily, although it attacks adults with often fatal effect. Its chief causes are neglect of proper sanitary precautions and the inhalation of foul sewer gas and of the emanations from damp and badly drained ground. We believe that it is not realized, by dwellers in and owners of our city houses, how imminent the danger of such disease is, or else we should see more efforts directed by private individuals toward the closing up of any possible avenue of entrance for mephitic gases into dwellings. It may be laid down, as a general rule, that the merest whiff of sewer gas pervading a hall or room should be considered as a signal of impending peril, and not a moment's delay should intervene before measures are taken to discover its origin. If the drain pipes in a house are properly constructed, there should be no smell whatever; and the first points to look to are whether there is a good trap in the sewer pipe in the cellar, and whether there is a ventilating tube leading from the soil pipe into a chimney, or to a hight at least two feet above the roof. If not, these additions should at once be made. If a tenant be the sufferer by foul odors, and the proprietor neglect the proper safeguards, in this city, the former has only to apply to the Health Board, when an inspector will examine the premises, and the result will be a peremptory summons to the recreant landlord to make the necessary alterations within three days or thereabouts, or in default pay a fine, and also the cost of the work which the Health Board will proceed to perform for him. It is well for tenants to remember this, as we happen to know of cases where many people have all but risked their lives, perhaps through inability to take the precautions themselves, and supposed inability to force their landlords to do so.

About a year ago, Dr. Stephen Smith, of the New York Health Department, published some useful suggestions relative to diphtheria which are well worth remembering. Under the heading of precautions, in addition to the removing of sources of sewer gas escape as mentioned above, he advises the removal of every kind of filth from around the house, the cleaning and white washing of dirty walls, and the disinfection of cellars and ventilation of all apartments, especially those which have been occupied by people suffering with the disease. It is well, in such rooms, not only to lime-wash the ceilings but to paint the woodwork, boil or subject to a high degree of heat every article that can be so treated, and expose the room and its contents to currents of fresh air for at least a week before reoccupation. Children that are well should not be allowed to kiss others affected with sore throat, or sleep in the same room, or use toys or other articles previously handled by the sick. It is safer to isolate ill ones from all the family, except, of course, the necessary attendants. The air in the sick room should be changed at least hourly, and all discharges from the mouth and nose should be received into vessels containing disinfectants, such as solutions of carbolic acid or sulphate of zinc, or upon cloths which are to be immediately burnt or else boiled or soaked in disinfecting fluid.

Diphtheria, like many other serious maladies, is not difficult to check if attended to in time; but it frequently baffles the highest skill if allow to run. Its distinctive feature is the formation of a false membrane in the throat, which shows itself in grayish brown patches. Sometimes the whole membrane forms suddenly; but as a rule, the patches first appear accompanied by fever and prostration. The first symptoms of the disease, sore throat and abnormal heat, are too often considered as premonitory of a simple cold; but there is no necessity of such error if parents will carefully examine the throats of their children as soon as soreness is complained of. The patches can almost always be well recognized, and a competent physician should be instantly summoned. Home-made remedies and gargles should not be depended upon; and the only treatment worth practising before the doctor arrives is to administer pounded ice, the use of which was found very effectual during the ravages of the disease in the Oneida community in this State. The prevailing dampness peculiar to the winter months may lead to increased numbers of cases of the malady. It is well therefore to keep in mind that there are but three safeguards: first, cut off the foul air; second, watch all sore throats in the family; and thirdly, summon the doctor immediately.

A VALUABLE GIFT BY CHEMISTRY TO THE WORLD.

A celebrated physician, the late Dr. Valentine Mott, used to say that iodine was the greatest gift which medicine had ever received from chemistry; and it may now be said that one of the most remarkable and important services rendered by chemical investigators to the arts and sciences is the discovery of bromine, by Balard in France, just 50 years ago. Berzelius, while describing it in his "Chemistry," mentions that no use had been found for it, but he cautiously adds the words "thus far," showing that he confidently expected that a use would ultimately be found. The discovery was fruitless for a period of 15 years, when daguerreotypy was invented; and bromine soon took an important place as one of the most valuable ingredients in the necessary materials, and now bromine compounds are indispensable to the photographer. Another 15 years elapsed; and then physicians commenced to experiment with the new element, and they soon ascertained its great value as a remedial agent, and the salts of bromine now form a series of the most important substances in the materia medica. Lately it has been found that bromine and some of its compounds are the very best etching materials for engraving metals, surpassing all acids and other agents, as described on page 369 of our current volume. But there is no reason to believe that this will close the list of the uses of this remarkable elementary substance, which is found in sufficient abundance in the waters of the sea and of many saline springs to make it comparatively cheap. A short account of the manner in which it is produced will undoubtedly interest many readers.

Bromine is commonly obtained from the mother liquor or bittern of salt works, which is rich in bromine compounds, the latter being retained in the liquor, as they do not crystallize out as easily as the chlorine compounds, of which common salt is the principal. The old method is to pass chlorine gas through the liquor, which, as the chlorine has greater affinity to the bases than bromine, sets the bromine free. The latter is then absorbed by shaking portions of the thus chlorinated liquid with ether, which dissolves out the bromine, and is darkly colored by it. Then the ether is shaken with caustic potash or soda, which combines with the bromine, and so a bromide of potassium or sodium is obtained, out of which the bromine may be set free again in the same way as chlorine is disengaged from common salt, namely, by mixing it with sulphuric acid and black oxide of manganese, and heating, when the bromine distils over.

According to an improved method, the bromine is obtained directly from the mother lye or bittern, by heating the latter with the sulphuric acid and black oxide of manganese, which decomposes the chlorides and yields chlorine gas; this in its turn sets the bromine free from the bromides, and the vapors, with that of water, pass over to a cool receiver, where they condense; while the pure bromine at last floats over a layer of saturated solution, containing 1 part bromine to 40 of water. We ought to add that pure bromine is a virulent corrosive poison. When a small piece of phosphorus is thrown on a few drops of bromine in a tall beaker glass, it is at once violently projected upward with an explosive noise, and in an ignited condition; this forms a striking lecture room experiment, illustrating the effects of very active chemical affinity.

Bromine is a very disagreeably smelling brown liquid, freezing at —8° Fah., and boiling at 150°, when it changes into a deep red vapor, nearly 6 times heavier than the air. According to Wagner's last *Jahresbericht des chemischen Technologie*, the total production of bromine at present equals 245,000 lbs., of which the United States and Germany produce the greatest part, namely, 100,000 lbs. each. Scotland produces 30,000 lbs., and France 10,000 lbs.

MAKING EXCUSES.

It has been said that a person who is good at making excuses is good for nothing else. Nature never accepts an excuse, the law seldom does, and yet in ordinary affairs of life excuses play a large and pernicious part. There are some people who spend half their time in inventing excuses for what they do in the other half of the time. What a pity this inventive power could not be directed into a useful channel, and made to benefit instead of injuring their fellow men! The habit of making excuses grows on what it feeds upon. If excuses were never accepted they would be seldom offered; but on the contrary, our whole primary school system is built on a plan that fosters the fabrication of excuses, many of which are little better than lies. There is a story of a schoolmaster who called up one of his favorite scholars and asked him why he was late. "Oh," said the little excuse maker, "I dreamt I was going to California, and when I heard the school bell I thought it was the steamboat bell." Glad to avoid punishing his favorite, this absurd excuse was accepted and the delinquent pardoned. We fear there are too many parents and teachers so willing to accept excuses that they greatly encourage excuse making, and indirectly encourage lying. As these pupils grow older and begin to feel a personal responsibility for their actions, they naturally fall into the habit of making excuses to their own consciences and of deceiving themselves. How quickly an ingenious excuse heals the prick of conscience!

We do not mean to assert that, frail and imperfect mortals as we are, we should require perfection of our fellows, nor, like Shylock, demand that the letter of the bond be fulfilled. Justice must be tempered with mercy, but sometimes we must be cruel in order to be kind. Nature's laws are inflexible; there is no escape from the severities of her just penalties. If we breathe infected air through ignorance, we suffer as much as if we had entered it with full knowledge; ignorance of the law does not relieve us from its penalties. Our statute and other laws distinguish between murder committed with premeditation and malice from that committed without forethought. The insane escape punishment for their crimes, however heinous. The man who shoots his sister by accident is at once acquitted. But does the bullet discharged by accident, or by a lunatic, or by any one in the heat of passion, prove less fatal than it would had murder been intended? The severed artery, the pierced lung, the congested brain listen to no excuses. To him that is murdered it is all one whether it was premeditated or not.

The infraction of any and all of Nature's laws brings as certain punishment as does Recorder Hackett's court, nay, more certain, if less speedy. The tight shoe, whether of satin or cowhide, worn voluntarily or involuntarily, by a city belle or a rustic clown, is sure to produce the well known corn. Undue exposure leads to consumption; over study and

excitement produce brain diseases as frequently in the pulpit as in Wall street. How often are people engaged in charitable work stricken down by disease incurred in the fulfilment of a holy mission! Most undeserving of such a fate, we are inclined to exclaim; but Nature accepts no excuses. Violate her laws, and ye die!

But what is the great harm in excuses? we think our reader begins to inquire. First, it encourages story telling, untruth, prevarication, and white lies. Second, it makes people careless. Railway trains are our best examples of punctuality; if you reach the depôt but 15 seconds too late, you are left and must wait, perhaps for hours. It is of no avail to tell the doorkeeper that your delay was unavoidable, that the omnibus broke down, or the street was blockaded, or the car ran off the track. People know that the rule is as inflexible as the law of the Medes; they do not flatter themselves, as does the tardy school boy, that their excuse is a good one, and thus loiter along at a convenient gait. One of the blessings of railway travel is that it makes people more prompt and more diligent. The banks are another class of institutions that will not accept excuses; if your note is not paid by three o'clock, it goes to protest. It matters not that the money promised you fails to come to hand in time, the train bringing your draft was delayed by snow drifts, or the telegraphic remittance was stopped by a broken wire, or the messenger on his way to the bank fell into an open coal hole and is maimed for life: the bank asks none of these questions, it listens to none of these excuses; the law is carried out.

The publishers of the SCIENTIFIC AMERICAN discontinue sending it to a subscriber as soon as he stops paying. The forgetful subscriber, who would continue forgetful if his paper kept on coming, arouses from his lethargy, and the next year he does not forget to renew it in time to avoid any loss.

The poorest of all excuses is forgetfulness, and the best method of cultivating the memory is to resolve never to accept this excuse from yourself nor make it to others. "I forgot" and "I didn't think" have caused untold misery, and should be stricken from the vocabulary of every ambitious youth. Conductors and switchmen sometimes forget that a certain train is due, and the next morning we read in heavy head lines: "Fearful Railroad Accident! Dreadful Loss of Life." The innocent (?) conductor is acquitted of the murder because he renders an acceptable excuse, and history goes on repeating itself. In some eastern countries, it is said, when a house burns down, the owner, instead of getting paid for it, loses his head. Fires are not of frequent occurrence there.

The old saw, that where there is a will there is a way, is true more frequently than is generally supposed. Let a man know that no excuse will avail for the omission of duty, and nine times out of ten he will contrive to accomplish what he had supposed to be impossible.

WEAK SPARKS.

Poggendorff's *Annalen* for February, 1875, contains an interesting account of many experiments by the celebrated German electrician, Professor Reiss, concerning a new form of electric spark, which he discovered several years ago, and which he denominates "weak sparks." He states that they differ from the ordinary strong electric sparks, not only in form, light, and sound, but in other and very various properties. For example, the length of the conductor makes no difference in the production of the weak sparks; in reference to length, light, and sound, they are independent of the composition of the circuit in which they occur; they produce no marked indication of heating in the circuit, and no magnetization. So far as we have examined the accounts of M. Reiss's results, he appears to have experimented chiefly with the Holtz frictional machine; but doubtless he has tried other apparatus. We however do not observe that he anywhere suggests any form of apparatus for telegraphy or other practical uses of the weak sparks.

It would naturally follow, from what we know of electricity and from the extensive series of experiments and the careful investigations of the nature of the weak sparks by the author, that they might be produced by any of the various known forms of electrical apparatus; and this would appear to be confirmed by certain recent experiments of Mr. T. A. Edison, the well known telegraph engineer and inventor, of Newark, N. J. Mr. Edison has recently ascertained that the weak sparks may be produced by means of an ordinary electro-magnet, and has also put the new sparks into working harness in the form of a telegraph apparatus. As before intimated, we have not carried our examination of Professor Reiss' experiments far enough back to determine whether he describes any method of obtaining them from magnets, and will therefore leave that branch of the subject for further consideration, giving briefly an account of Mr. Edison's new experiments, and what he supposes he has discovered.

The method by which Mr. Edison generates the weak sparks is so simple that any telegrapher or electrician can test it. A bar of metal (cadmium seems to be best) is placed on or over an electro-magnet in an electric circuit: attached to the metal is a wire (of iron or copper, possibly any other metal) which conveys the current of newly discovered force. On breaking the electric circuit with an ordinary telegraphic key, sparks are observed when the free end of the wire is brought in contact with any metallic substance. When the wire from the cadmium is attached to a gas pipe, sparks may be drawn from any part of the entire system of gas pipes simply by touching it with a piece of metal. By this simple means signals have been sent for long distances, as from Mr. Edison's laboratory to his dwelling house, in another part of the city, the only connection being the common system of gas pipes. Mr. Edison states that signals have also been sent the distance of seventy-five miles on an open circuit, by attaching a conducting wire to the Western Union telegraph line.

For some time Mr. Edison has been industriously studying the weak sparks, and the developments, he thinks, are unceasingly novel and surprising.

Thus far his examination has resulted chiefly in determining the fact that the weak sparks, first supposed to be a phase of inductive electricity, have really no further likeness to electricity than similarity of origin, the power of furnishing sparks, and the ability to transverse electric conductors. On the other hand, the sparks seem to travel over electric non-conductors with equal facility, a glass rod or a strip of hard rubber conveying them as well as a bar of metal. They require no closed circuit. They cannot be grounded, and seem to be incapable of insulation. They are retroactive, sparks appearing when the conducting wire is turned back upon itself, just the same as when the free end of the wire is brought in contact with any other metallic substance. They have no polarity, and apparently no mechanical power. With carbon points and points of several metals, the spark is highly actinic; yet the current seems to have no physiological effect, and does not influence in any way the most sensitive of electroscopes or galvanometers.

Such, in brief, are the leading points of Mr. Edison's observations concerning weak sparks from magnetism, and they closely correspond with the long prior observations of Professor Reiss.

We shall recur to the subject in our next.

WORKING MEN'S READING ROOMS.

We are very much in favor of the plan, which some contemporaries are just now discussing, of free evening reading rooms for workmen; and if such resorts could be started and maintained in every manufacturing village, we believe that an immense amount of good would be done, both in educating the men and checking the spread of intemperance. The average workman gets very little time to read except during the evenings; and if he be single and live in a boarding house, the lack of light, fire, and other necessities for comfort effectually precludes his doing so there. The tavern is, however, open to him, well lighted and well warmed; and there, perforce almost, he spends his evenings in idleness and in the acquisition of habits which are the reverse of beneficial. The trouble with most reading rooms which we have seen in country villages is the fact that they are generally the work of excellent and pious people who unfortunately imagine that a selection of religious literature and a pious cast over the general surroundings of the place are beneficial. However good the motive, this often fails to induce workmen to visit the places. The effect is indeed ordinarily the reverse; for working men are but human beings, and prefer the joviality and lack of restraint at the tavern to the perusal of tracts or the mental digestion of Sunday school books, be the morals and precepts of the last never so good.

The true way of making a reading room both successful and useful is first to render its advantages absolutely free, and secondly to make the room both comfortable and attractive so that every man of average intelligence may avail himself of its privileges. The literary fare may consist at the beginning of periodicals alone, leaving the formation of a library to the future, when a membership becomes established and the members feel like subscribing to enlarge its scope of usefulness by adding a library. Publishers will generally send their journals to such reading rooms at reduced prices; or the charitable in the town or village may often be successfully appealed to for contributions of papers, magazines, and sometimes books which they have read. If there be a local journal, and few towns in this country exist where one is not published, the editor will gladly contribute such of his exchanges as he does not need. In this way, it will be found, plenty of good reading matter can, with a little energy, be collected, and it will prove serviceable in benefiting the community without much expense.

Our plan for a working men's reading room is a plain apartment, as easily accessible to everybody as the tavern. There is no need of costly appointments of any kind; but plenty of good light and a warm fire are indispensable. A table and sufficient chairs, some files for newspapers, and a few shelves for books, include all the furniture absolutely necessary. If the philanthropic projectors can afford a few pictures, a tasteful paper for the walls, or any other ornamentation, so much the better; money thus laid out will not be lost, as such articles lend a home-like air which, to most people, is attractive beyond all else.

A few weekly papers and three or four monthly magazines will be enough for a start; and then, as it becomes apparent that the people of the town are growing more interested in the work, plans can be matured for a wider selection of reading matter; and perhaps, as we before intimated, a subscription among the readers can be taken towards putting the establishment on a broader basis. This is the season of church and similar fairs, for raising money for various benevolent purposes. Perhaps we may venture the suggestion that a small amount may be raised in this way, thus enlisting the coöperation of the young people in the good work. Certainly a free reading room would be a noble Christmas gift from the churches of a village to the working men residing in its limits, or from the proprietors of factories to their employees.

A PIECE of rubber belting fastened around the belt pulley of an engine will keep the belt from slipping.

THAT OBNOXIOUS POSTAL LAW.

Postmaster General Jewell, in recommending in his recent report the repeal of the Act of Congress passed last January which doubled the postage on transient newspapers, books, and similar third class mail matter, raising the same from one cent for every two ounces or fraction to one cent for every ounce or fraction, simply reflects public sentiment relative to that illconsidered and obnoxious law. It was a stupid blunder, on the part of those who framed the bill, that, contrary to their intent, by their own admission, language open to construction as affecting anything but the miscellaneous merchandise which the mails are allowed to carry should ever have entered into it; and the passage of the act shows even more reprehensible negligence on the part of those members who voted for it, in not subjecting the measure to proper examination. Except in the opinion of the express companies, who have been greatly benefited, and by whose influence the act was adopted, there was no necessity for increasing rates even on the miscellaneous matter, as the cheap postage on similar parcels, like seeds, bulbs, samples of merchandise, etc., was a great convenience to the public, and especially such to people living in out-of-the-way localities.

The Postmaster General excepts this mixed material from his recommendation to return to the old rate on printed matter, but fails to show a good reason therefore, based on a possible benefit to the Department. In fact in this respect the report logically contradicts itself flatly, for it may be justly inferred that: if, as the writer paradoxically asserts, "the sending of public documents through the mails has not delayed the delivery of ordinary mails or perceptibly increased their cost," some 200 to 300 tuns being the estimated amount sent: the sending of small parcels, not exceeding, if altogether aggregating, in weight the hundreds of tuns of documents which the members of Congress heretofore sent free through the mails, would, if the matter were paid for at any price, result in positive gain. It may be remarked in passing, that the sentence above quoted is unfortunate from another point of view, as it apparently offers an argument to those who are seeking the return of the franking privilege; for it is easy to predicate the assumption thereon that, if several scores of tuns of matter is imperceptible in point of cost or trouble, then as many hundred tuns would be practically inconsiderable.

There are rumors that Congress will act upon this subject early in the session. We trust that the same are well founded, and that our representatives will use no delay in restoring the old and popular rates, including all articles coming under what is "third class matter."

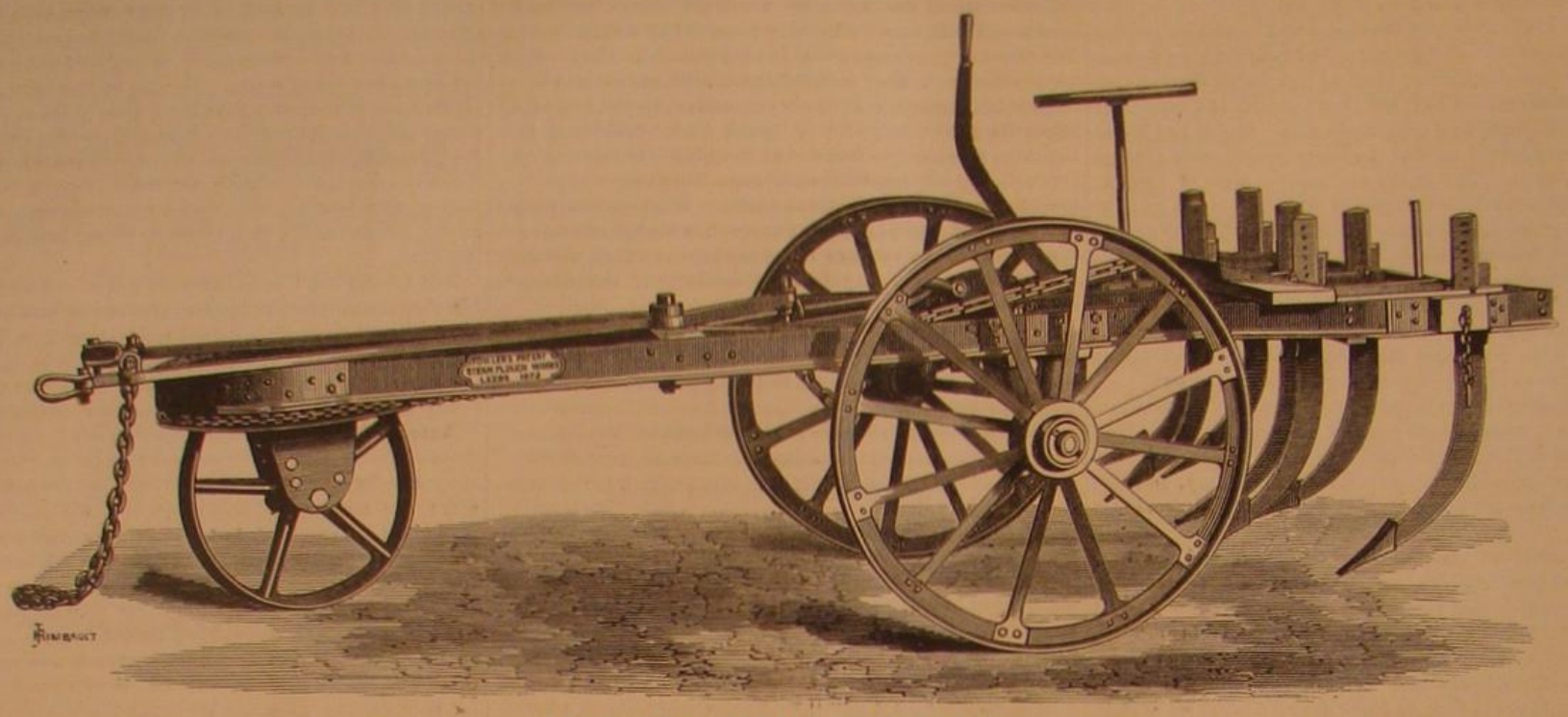
A Gas Shadow.

A striking and curious experiment, showing the superior weight of carbonic acid gas over air, may be made by projecting the shadow of the gas, as it is poured from its containing vessel, upon a screen. The latter should be of white paper and bright sunlight should fall on the stream of gas, which should be poured from the spout of a pitcher held within 10 inches of the screen. The curious result, of a shadow produced by apparently nothing, will be seen, the former resembling descending smoke, quite black at the spout of the vessel, but brightly illuminated whenever the sunlight is concentrated by passing through the gas.

To prepare tin for tinning brass, copper, and iron. Melt the metal in a crucible which has previously been slightly warmed; and at the moment the metal begins to set, and when it is very brittle, pound it up rapidly, and sift when cold to remove any large particles.

STEAM CULTIVATION.

The Fowler system of steam plowing has been frequently mentioned in these columns as being the most successful of many attempts to solve a problem of some difficulty and of great importance to the future of agriculture. We illustrate herewith a cultivator, intended by the makers for use where the double machine would be unnecessarily large and expensive; it is constructed so as to be readily turned and operated in the reverse direction after one set of furrows has been cut. Messrs. Fowler have made some improvements in this apparatus, one of which deserves special comment This consists merely in making the lever, to which

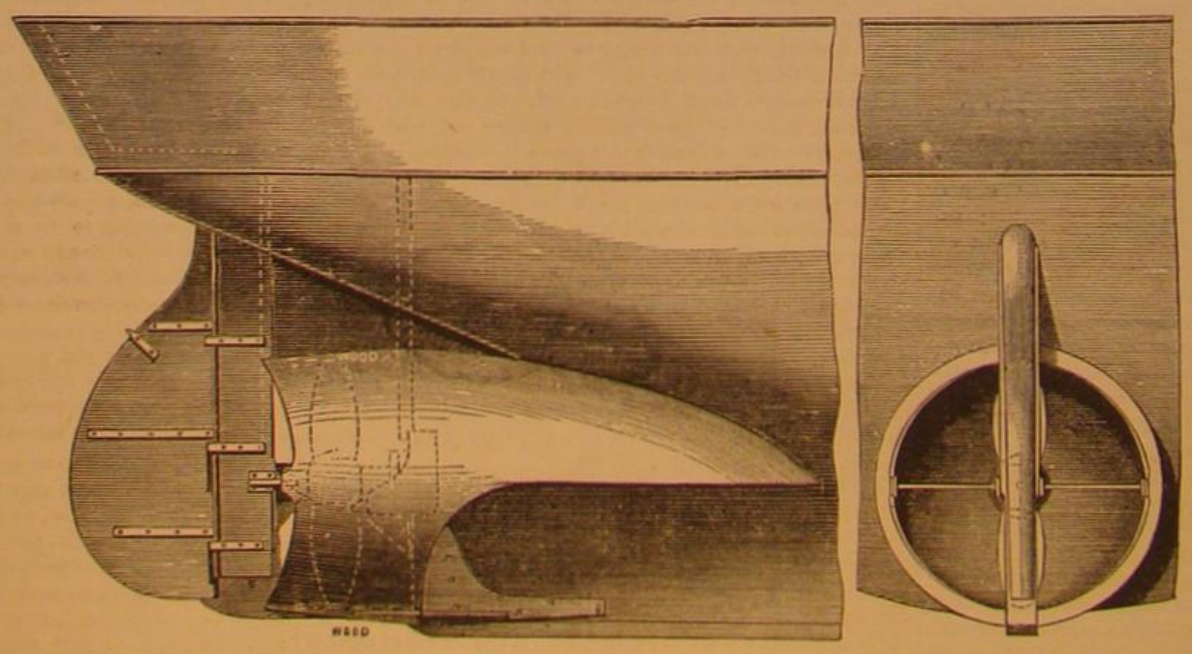


FOWLER'S STEAM CULTIVATOR.

the ropes are attached, of a forked shape, as shown. In use that arm of the fork to which the hauling rope happens to be attached is of course brought into a direct line with the strain; while the other arm is thereby caused to project laterally, thus bringing the tail rope clear of the wheels, and causing it to be in a favorable position for turning the implement when the headland is reached. The tail of the draft lever is coupled to a short chain; and when, on arriving at a headland, the strain is transferred to what was previously the tail rope, and the draft is thus brought at right angles to the implement, this chain is tightened and, by acting on a segment, turns the main axle, which is cranked, and this, by depressing the supporting wheels, lifts up the main frame, and raises the tines clear of the ground. The tines being maintained in this position by a lever and catch, the turn is readily made; and on its being accomplished, the steersman allows the frame and tines to fall again, and the implement starts on a fresh journey. The action of this turning arrangement is admirable. The turns are made with great promptitude, and within a very limited space, while the implement is altogether thoroughly manageable, and there is nothing about it liable to get out of order.

RECENT IMPROVEMENTS IN THE SCREW PROPELLER.

It would be by no means an easy task to enumerate the many inventions which have been made, since the introduction of steam navigation, to improve the form of the screw. The modification of the screw propeller devised by Mr. Griffiths has been generally admitted to be one of the best. Mr. Griffiths, however, has since arrived at the opinion that we have hitherto been neglecting the true principles in screw propulsion; and after a series of experiments he concludes that the difference, between the amount of power exerted to propel a ship by a screw and that required to tow her, which in one case Mr. Froude found to amount to a loss of 58 per cent of the power supplied, is due to the screw not being sufficiently supplied with water. With a full-sterned ship this is greater than in one having a fine run, as the water runs into the space left by the stern, and deprives the screw of its full supply.



THE GRIFFITHS SCREW PROPELLER.

To remedy this, Mr. Griffiths' plan is to put the screw into a casing of 50 to 75 per cent larger area than that of the screw's disk, and provided with an opening underneath, so that the screw is not supplied with the water which would otherwise flow into the space left by the ship, nor does the ship rob it of any of the water which it requires to force back in order to give the thrust to the screw shaft for propelling the ship. This view of the case was not, however, assented to by Mr. Froude, who thought that the effect of the screw working in the water of replacement was to take away some of the pressure which drives the ship. But with reference to the advantage of housing in a tunnel if the screw were driven at excessive speed, he thought it not unlikely that the housing would produce a beneficial effect by preventing the scattering of the water, and whatever reaction the water supplied would be more effectively directed into the line of motion; nevertheless he considered it would involve the drawback of adding largely to the surface friction of the vessel, and he expected that nearly the same advantage, but less encumbered by surface friction, would be obtained with any kind of shrouding given to the tips of the screw blades. Since then Mr. Griffiths has had H.M.S. Bruiser placed at his disposal to experiment with, and the results certainly appear to bear out the experiments with models previously made by that gentleman. The Bruiser was first tried, on February 26, with her propeller fitted in the ordinary way, her course being over the measured distance within the breakwater at Plymouth. The force of the wind was 2 to 3, and its direction E.S.E., and the sea smooth. The draft of the ship was 8 feet, both fore and aft, and she was fully equipped and ready for sea. The screw fitted was one of Griffiths', with two blades, having a diameter of 6 feet and 8 feet pitch, with 60 nominal horse power, and a mean pressure in the cylinders of 35·79 lbs. her mean number of revolutions, after six runs, was 881 per mile, and her true mean speed 8·016 knots. Having been docked, and the casing fitted to her, as shown in the accompanying illustration, she was again tried on July 2, under almost similar circumstances to those of the first trial. The force of the wind and the state of the sea were the same, though the direction of the former was S.W. instead of E.S.E. She carried one more tun of coals, and her trim was a little different, being 7 feet 10 inches forward, and 8 feet 1 inch aft. With the same nominal horse power, and only 0·4 more horse power indicated, the mean number of revolutions was only 836, whereas the speed gained was 8·274 knots, or rather more than a quarter of a knot beyond what was realized without that some loss of speed is thereby occasioned; but with th screw in a casing this is not necessary, and perhaps a good deal of the quarter to half knot increased speed obtained with the Bruiser may be due to this cause. Mr. Griffiths' system, however, is not all included in placing the screw in a casing, for he also proposes to divide his power into two parts, by using two small screws instead of one large one, and putting one at the bow and the other at the stern of a ship. The engines and shafts, also, would be placed lower down in the ship, and therefore, in men-of-war, be more protected against shot. But perhaps the most important improvement claimed for this system consists in having two separate sets of engines, boilers, and propellers, so that if one were placed *hors de combat* the other would still be available to keep the ship off a lee shore, or from getting into the trough of the sea. The experiments with the casing round the screw having proved so far successful, the British Government have now placed a small screw launch at Mr. Griffiths' disposal with which to try still further experiments.

Three Curious Discoveries.

A recent examination of the bottom of an old Roman well, located near the hot springs of Bourbonne les Bains, in France, has resulted in three remarkable discoveries, two of an archæological nature, and one of some importance from a geological point of view.

After the excavation had been thoroughly drained, and a thick layer of refuse penetrated, the first discovery was made in the bringing to light of thousands of small metallic objects of art. These included ornaments, statuettes, and coins, the last of silver, gold, and copper, dating back to the times of Nero and Hadrian.

Beneath the layer of ornaments, etc., a second layer was found, composed entirely of fragments of sandstone, which, together with the metallic objects, were completely covered and held in masses by metallic crystals, evidently deposited by the water above. These crystals were subjected to careful investigation; and as a result they have been pronounced to be of such a nature that geologists would unhesitatingly describe their formation to natural causes, working through ages. That such is not the case is plainly evidenced by the known eras of the coins above which they have formed. It will be seen that the circumstance, which constitutes the second discovery, may throw serious doubt over a large quantity of important geological deductions as to lapses of time, when the same, as is the fact in many instances, are wholly based on supposed slowness of formation of similar deposits.

The third discovery relates to the fragments of sandstone

By comparing these with other pieces, already found in similar localities, the investigators have concluded that such fragments were thrown into the wells as votive offerings to local divinities by the ancient inhabitants of the country, and that the same custom, continued through centuries, accounts for the presence of the much more recent Roman money. A chain of proof, mainly circumstantial, has been elaborated, which refers the stone fragments to the neolithic epoch, in prehistoric ages, and further shows that the pieces probably represent the earliest money used by man.

Self-Acting Car Couplings.

At a recent meeting of the Master Car Builders' Association, the subject for discussion was "Freight Car Couplings, Draw Bars, and Buffers," upon which Mr. Partridge made an address.

Mr. Adams was called upon for information on what is required by railroad companies, and said that he had no specific facts to present in relation to the repair of drawbars throughout the country. It was very difficult to get very specfic data. The habits and customs of our car men have not been of the character to present these data accurately. The committee appointed on this subject, in looking over the matter, had made up their minds as to some important points to arrive at in the way of improvements. "We have been shown by Mr. Partridge some of the defects in the present arrangement, which had been considered by the committee. But there were some other things that presented themselves to their minds, and one of the most startling of the whole of them was the expense of links and pins. Upon some roads this expense was enormous, amounting to anywhere from $10,000 to $60,000 or $70,000 a year, according to the size of the road. The ordinary roads perhaps would average $30,000 to $40,000 a year. We need something to couple our freight trains which will enable us to dispense entirely with pins and links. This was one of the points to be striven for. Another point in which we thought there was an absolute necessity for improvement was a greater power of resistance in our buffer springs, and a greater range of motion. Our resistance is altogether below the line of connection. If the springs were made stronger, given more motion, and placed in the direct line of resistance, the difficulty would be materially obviated. Various devices have been presented to us during the past year; a good many models have been brought out, and some of them have approximated somewhat to the accomplishment of the idea, but we have not seen any yet that meet our wants, in the opinion of the committee. The thing, after all, is progressing, but yet there is room for improvement. We have got to have a device that will couple freight cars without a link and pin, and, in addition to that, a separat ebuffer placed directly in the line of the frame or bottom of the car, and we have got at the same time to use our present stock; that device must be made to connect itself with our manner of coupling. We have got to use our present stock until it is worn out. But the committee is not as yet prepared to recommend anything. They have not found anything that will entirely accomplish the purpose. A buffer must be so built that it won't couple when you don't want it to. Many inventors seem to think that you must get something that will couple every time it strikes. There have been but few models that seemed to embody the idea to dispense with links and pins, but I think we shall have to make it in two parts, a separate buffer and separate hook, because we want our connections to be in the floor of the car. Mr. Stone in his model has accomplished considerably towards it, and I have no doubt he may be able to bring it perhaps to something near what we want."

Mr. L. Garey said that it was easy to find fault, and difficult to apply the remedy. "The necessity for improvement in the attachment by which cars are coupled together has been felt for a great number of years, and it was still evident that the improvement had not been got. The necessity of these improvements was shown by the immense number of patents granted year after year. The real necessity is an automatic coupler with buffing attachments, either connected or with another device placed on the line of resistance. The buffing requires from one half to double the resistance of the drawing to make it substantially strong. Now if some of our inventors will dispense with the use of the links and pins entirely, provide us with a coupling, automatic or not, which can be uncoupled from cars from the top or side, and give us a buffing attachment which is sufficient for the work, that ought to make a dozen fortunes for him and secure him the blessings of all the people, not only those that travel, but especially of the men employed on railroads. He thought that the railroads would say that, out of the cars which were side-tracked for repairs, eight tenths were owing to some defect in the drawing or attachment. If this could be reduced to three tenths, it would be a great deal. There was more difficulty from the failures of the attachments than in the drawbars themselves."

Don't Leave a Legitimate Business for Financiering.

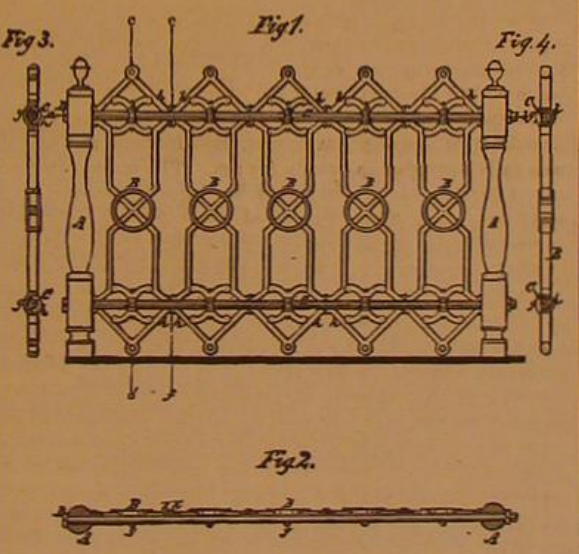
It is an evil of the intense competition in great mercantile communities that it drives many from the walks of legitimate business into schemes of speculation with reference to sudden and extravagant gains. The history of frauds teaches that they originate chiefly in the attempt to grow rich rapidly by financiering rather than by diligence in business. Financiering has its place in legitimate business. Some men have a talent for this, which is as true a mark of genius as is poetry or art. But it is not a talent that every man can acquire, and it is fortunate that this is so; for if all the world should turn financiers, the earth itself would soon go into bankruptcy. Now, the calamity of a great city is that every one who gains a little money takes to financiering as a readier mode of increasing it than regular business. Wall street, the focus of financiering, gives a tone to the whole business community.

But financiering is a deep game; and he who leaves an honest toil in a business that he does understand, for calculations of chance in matters where he has no skill, is very apt to become the loser, and, as in all lotteries, to grow desperate in the attempt to make up his losses. We do not speak of investments in stock as property, but of the spirit of speculation; and we have no doubt that a just verdict upon many cases of fraud would be: "This man lost his capital and his character by speculation in stocks." Keep, therefore, to honest toil in a legitimate business, and do not aspire to become a financier. "Be content with such things as ye have."

ROBERTSON'S IRON FENCE

The use of ornamental iron fences is no longer confined to expensive city residences, but is gradually extending to the more humble suburban or village houses; and they would be used much more but for their great cost; to lessen this is the object of an invention lately patented by Mr. T. J. W. Robertson, which is illustrated in the accompanying engraving, Fig. 1 representing an elevation, and Figs. 2, 3, and 4 showing sections through the lines, *a b*, *c d*, and *e f*, respectively.

This fence is made up of castings having the metal so disposed as to allow rods to be passed through the ornamental openings in the sections or pickets, whereby the latter are so effectually secured to the former that they cannot be removed when the panel is in place between the posts by which it is supported; and this is done without fitting, riveting, or other fastening, except that necessary to secure the rods in the posts. To accomplish this, the sections or pickets are made with three vertical bars, *h g h*, where the tie rods are to be connected to them; and these bars are so formed as to admit the tie rods between them, in the same manner as the weft thread passes through the warp in weaving cloth. That the tie rods may readily pass through the sections, the two side bars, *h h*, have recesses on one side, and the central one, *g*, on the other, so that an edge view of the castings would show holes through it about the size of the rods, C C, through which the latter are passed.



With sections thus cast, all that is required to make a panel of fence is to pass rods or gas pipes through a sufficient number of sections and the posts, and then bind the whole together by screwing nuts on the ends of the tie rods, when the panel is ready to be erected. Where large hollow posts are used the nuts may be concealed in their interiors.

From this it will be seen that the cost of a fence of this character may be reduced to that of the castings, rods, etc., as no time is spent in fitting, boring, riveting, etc.; and although thus cheaply built, it is one of the strongest fences made, as the whole strength of the materials employed is utilized in fastening the parts together.

For further particulars, or the purchase of State or county rights, application should be made to the patentee at 818 O street (N.W.), Washington, D. C.

A NON-RETREATING BUNSEN BURNER.

BY PRESIDENT HENRY MORTON, PH. D., STEVENS INSTITUTE OF TECHNOLOGY, HOBOKEN, N. J.

In consequence of the low pressure of gas during the day time, in this place, we have long experienced trouble from the retreating of Bunsen burners of the usual construction. This having repeatedly proved a source of annoyance and loss, I was led to a series of experiments with the view of removing the difficulty, if possible, by some modification in the form of the burner. After various trials with burners, in which the relation of hight to diameter in the main tube and the size of the gas jet were varied, I was led to the following consideration of the subject:

The retreat of a burner will evidently occur whenever any part of the ascending column of mixed gas and air is moving at the orifice with a velocity less than that at which the same will burn. Now, in an ordinary burner, with its main tube of regular cylindrical bore, it is evident that the friction of the surface of the ascending column of mixed gases will cause that portion to move at a less velocity than the central part, and that even currents of the nature of eddies will be developed. It will thus happen that, while the central portion of the ascending column of gaseous mixture issues at a velocity much greater than that at which the material can burn downwards, and thus is quite free from any danger of retreating, the marginal portions of the column or jet of gas will be escaping at a rate so much less that the velocity of their combustion downwards will exceed that of their upward motion, and retreat of the flame will ensue.

It is well known that, to secure a jet of water or of any other fluid whose particles shall move with equal velocities in all parts, and thus avoid currents and eddies, it is only necessary to make the orifice of efflux an aperture in a thin wall. In following out this idea, I made a burner of a bore rather large compared with its hight, and then drew in its upper edge into the form of an open-ended thimble, so contracting the orifice of escape to about two thirds of the area of the tube, and rendering this orifice practically an opening in a thin horizontal wall or plate. The results of this modification far surpassed my anticipations.

A burner thus constructed, as shown in the engraving, gives a a perfectly non-luminous flame with gas pressures varying between 1½ inches and $\frac{1}{16}$ of an inch of water, and with the lowest of these pressures cannot be made to retreat by the most violent handling in the way of sudden movement or waving about in the air, even when this violence is carried to the extent of extinguishing the flame altogether. Under like conditions of pressure, a burner of the ordinary construction is made to retreat by a slight draft of air or a very moderate amount of motion.

These burners are being manufactured, for our own use and for other colleges, by George Wale & Co.

Correspondence.

The Purification of Water.

To the Editor of the Scientific American:

In 1869 I took occasion through the columns of your valuable journal to call attention to the beneficial action of air for purifying water which had become foul with decomposing organic matter, and to offer my patent air treatment for the purpose, for domestic uses, free of charge. At that time the subject was new to the public; and few perhaps attached to it the importance which more recent developments have shown it to possess, especially for dwellers in cities. Recent articles by various writers on the subject tend not only to fully support my statements, but to show that bad water invariably suffers for want of oxygen, the degree of foulness indicating the diminished proportion or the absence of free oxygen.

The putrid water of a river can be reclaimed by absorption of oxygen, and it will arrive at sweetness and wholesomeness as soon as it possesses ⅓ of 1 per cent of free oxygen; this amount is necessary for fishes to thrive in water. But such water would not necessarily be suitable as a beverage for man.

Great apprehensions are now entertained that the horridly putrid condition of the ponds in Central Park will spread disease over the neighborhood, and these fears will be too fully justified if the present state of things continues. But there is no necessity for pond water to be putrid, or to become unwholesome, at any time. By the moderate annual expenditure incurred in running an air force pump or pressure blower, requiring about 20 horse power, in a place conveniently central, conveying the air by light but durable mains of about 12 inches bore to pipes of smaller bore near the bottom of the ponds, with perforated branch pipes through which the air issues, all apprehension of the re-occurrence of foulness in ponds can be entirely removed. Sufficient oxygen can be supplied by thoroughly agitating the water for about one hour daily, by pumping in air, to keep the ponds sweet. To purify them in their present state, the most rigorous air treatment for several days is needed; it may take a week to do it. The Croton water has suffered with this malady for years, and if it be not speedily provided against, it will fill our cemeteries at a still higher rate than 27 in 1,000 per annum, a death rate only exceeded by Bombay with 29.

R. D'HEUREUSE.

New York city.

The Treatment of Diphtheria.

To the Editor of the Scientific American:

I wish to make known to the public a method of treatment for diphtheria, which has been uniformly successful, in the practice of the writer, during a number of years, which included two epidemics; and in a large number of cases, not a case has been lost since this treatment was adopted. I feel confident that, by its general use, the mortality may be reduced to one per cent, or even less. I have heretofore delayed publishing the results in order to make sure that the treatment was really what it promised to be, and I now wish to use the columns of your journal, in order that the public generally may have the knowledge in their own possession.

An attack of diphtheria is usually ushered in with a high fever and headache, and, in children, with nausea and vomiting. There is great prostration. Upon the tonsils and surrounding parts are seen white, snow-flaky patches. In malignant cases, the patches are often yellow or brownish, and a terrible odor is perceived.

The remedy found successful by the writer is permangenate of potash, in conjunction (not combination) with the tincture of belladonna. The method of administration is as

follows: From 2 to 3 grains (not more) of the permanganate are dissolved in from 2 to 4 ozs. of water in a goblet. Five drops of the officinal tincture of belladonna, or, better, from 10 to 20 drops of the 1st decimal homœopathic tincture of the same drug, are put into another goblet with an equal quantity (2 to 4 ozs.) of water. A teaspoonful is to be taken from each goblet alternately at intervals of a half or one hour. It is, perhaps, needless to say that separate spoons should be used, and the goblets kept covered.

In twenty-four hours, frequently, a favorable change will be seen, but quite as often the disease seems to go on unchecked, save that the fever may seem a little more moderate; but I can assure my readers that, during the second day of the treatment, a most marked change will take place. The fever will entirely subside, the mind will brighten, the tongue will begin to grow clean, and the deposits upon the fauces will peel off at their edges or gradually break away. The patient will be upon the highway to recovery, and a day or two more of the treatment will bring back the normal hue of health, and an appetite to correspond. In rare cases, however, when the constitution is bad (cachectic), a longer time, five, six, seven days, may be required; but even here the treatment has not failed.

I think that, under this treatment, diphtheria is not a disease to be dreaded by the profession. The belladonna may, in special cases, find a substitute, but not the permanganate of potash. The only case in which the above treatment will promise unsatisfactory results is when the disease rapidly invades the larynx and bronchial air passages (diphtheritic croup), when suffocation threatens to supervene before the remedy can act, or when the mere presence of large detached deposits in the air tubes imperils the success of the case. Such an instance recently occurred, which was successfully treated with inhalation of the vapor (not the spray) of a dilute aqueous solution of bromine.

I know that the permanganate has been used as a disinfectant, locally applied, in putrid diphtheria heretofore, in dilute form (as a gargle), and upon general principles as an antiseptic; but I am not aware that the persistent use throughout the disease has heretofore been made known to the public or profession. That it does not act as an antiseptic is shown by the fact that the other antiseptics have no analogous effect; that it does not act locally may be inferred, because its marked curative effects appear in the system before they are seen in the fauces. The theory of the writer is that diphtheria finds its nutriment in partly devitalized organic matter in the blood, which the permanganate, rapidly absorbed, attacks and destroys by oxidation (being the most powerful non-poisonous oxidizer we have): thus cutting away the pabulum of the disease, when the deposits die a natural death and disappear. The process certainly sometimes appears magical in its action. I trust that, if others employ this treatment, they will not attempt to modify it till they have first given it a fair trial in the manner above proposed.

I have also found the permanganate of potash very successful in the treatment of certain slow forms of putrid and typhoid fevers, with loaded tongue, foul breath, etc., and in recurring boils. This lends additional force to the theory of its action above indicated. I am sure that this drug, so rich in oxygen the life-giver, so harmless in its action upon the human system, will well repay study by the profession generally, which it has heretofore only received, and that in a very inadequate degree, from the homœopathic branch.

Philadelphia, Pa. I. W. HEYSINGER.

What Flies Do.

To the Editor of the Scientific American:

An article on this subject, in a recent issue of your paper, by Mr. Emerson, an English chemist, has induced me to send you the result of some careful observations made upon the parasites that infest flies. It is not my purpose to dispute the theory, advanced by Mr. Emerson, that flies are scavengers of the atmosphere, and that, while flying through foul places, they collect on their bodies various organisms, which they feed upon at leisure. My desire is only to draw attention to the fact that the common house fly (*musca domestica*) is at certain seasons possessed of parasites. In examinations made during the summer months, I have failed to detect the parasites; but in the autumn, as a rule, they can be discovered in large numbers around the *coxa* (the joint of the leg that is attached to the thorax); and when disturbed, they become very active, running up and down the spines or hairs of the fly. They somewhat resemble in form the *acarina tellarius*, the little red mites of our hot-houses. They differ from them in having but six legs; and in fact, they possess every quality, excepting wings, necessary to constitute perfect insects. They are half a line long, and, by the unaided eye, can be seen as mere specks, and therefore do not belong to the animalcules which represent the smallest and imperfect forms of life. By placing a fly possessed of these parasites upon a piece of clean glass, and then killing the fly, the parasites will immediately leave the dead body and wander away upon the glass. By holding the glass up to the light, the parasites can be seen as atoms, moving. Under frequent careful microscopic examinations, I have never observed that these parasites were eaten by the fly. On the other hand, I am very much of the opinion that the fly is consumed by the parasite. In every case of my observation, the fly possessed of these parasites was in a sickly condition. F. C.

By a recent fire in the arsenal at Rendsburg, Holstein, forty thousand new Mauser rifles, an equal number of rifles of older construction, and much other war material were destroyed.

Prizes for Designs for a Concrete Villa.

In pursuance of past promises, and in compliance with numerous requests, we invite competition designs for a class of structure which commends itself to notice. Of the various kinds of building open to selection, not one seemed to us more suitable, in calling into exercise the skill and ingenuity of architects and the younger members of the profession, than the one we have chosen. We have thought of dwellings for the poor and middle classes, hospitals and asylums, churches and schools, all deserving subjects, but they have been more or less used up, and there appeared to us little in them to provoke inventiveness or to afford so ready a response as a villa designed in a material comparatively new, and affording ample scope for an independent architectural solution.

CONDITIONS OF COMPETITION.

1. The design to be adapted for a villa of the ordinary suburban class, suitable for a corner site.

2. The accommodation provided is to comprise a porch, hall, morning room, library, dining room, kitchen, and necessary domestic offices on the ground floor; two principal bedrooms, dressing room, bath room, and three other bed rooms on the first and second floors. Coal, wine, and beer cellars to be arranged in the basement. A servants' staircase to be provided. The sizes of the rooms are left to the discretion of the designer.

3. The cost of the villa not to exceed $9,000, calculated at 14 cents per foot cube of the whole building, the contents being measured from the foundation level to half way up the roof. Preference will be given to a design that exhibits economy of plan combined with a suitable architectural treatment of concrete.

4. The general drawings to be to a scale of one sixth of an inch to a foot, and to comprise the following: Cellar plan showing drainage, ground plan, first floor plan, three elevations, one section taken through principal staircase. A sheet of details, illustrating any important part of the construction or decoration, drawn to an inch scale, on a sheet of paper 22 by 14 inches, may accompany the drawings. The whole of the general drawing to be arranged on a sheet of double elephant paper (hotpressed), 37½ inches by 27½ inches, and to be sent in unmounted. The designer to be at liberty to send in a perspective view with the general drawings, in lieu of one elevation, but no account will be taken of this in selecting the design.

5. All the drawings to be drawn in black (Indian ink) lines, and to be suitable for photo-lithography. No wash of any kind to be used. The shadows, if any, should be hatched in line.

6. The drawings to be accompanied by a general specification of the method of construction proposed to be adopted, the scantlings of timbers, etc., with a general statement of the reasons that have influenced the designer, and the dimensions of the several rooms.

7. Particular regard will be paid to the constructive and sanitary merits of the designs submitted.

8. The drawings to be sent in under motto, accompanied by a sealed envelope containing the name and address of the designer, to the editor of the *Building News*, London, on or before the 25th day of January, 1876, carriage paid.

9. The decision will be published in the columns of the *Building News*, with a report of the judges.

10. The editor reserves the right of publishing any or all the designs.

11. The sum of $50 is offered for the best design; $35 for the second; and $15 for the third, all in gold.—*The Building News.*

Tænia and Raw Meat.

"Seventy years ago tænia (tapeworm) was such a rare affection in France that many physicians of large experience had not met with it; or if they had, the cases were extremely few. To-day tænia has become so common that every practitioner meets several or many cases yearly. To what is due this sudden multiplication of tæniæ? It is twenty or twenty-five years since Trousseau first, and many physicians after him, and more recently Professor Fuster, began to employ raw meat as a remedial agent; and it was at first received with distrust, but at present it has become of general use. This coincidence alone permits us to suppose that raw meat may have something to do with the production of tænia, and most physicians have adopted this etiology, which appears absolutely certain. Beef frequently contains the germ of tænia, which germ, transported into the stomach of man, developes, taking the form of the tapeworm. In Abyssinia, where the use of raw meat is general, every one has tænia. At St. Petersburg, Dr. Weisse observed, according to Cauvet, that children fed upon raw meat were frequently attacked by tænia.

"For my part, I have observed a great number of cases of tænia during the past few years, and in every case the individual had made use of raw meat or was at the time under that regimen. In a convent I recently administered raw meat to four nuns, three of whom were seized with tænia afterward.

"M. Laborde (*Tribune Médicale*, page 472) does not believe that raw meat is the cause of the increased production of the worm. 'Each of the three varieties of tænia which are found in man,' says he, 'argues its origin in an absolute manner. The *tænia solium* results from the transformation of the *cysticercus cellulosæ* of pork. The *bothriocephale tænia* is produced by fish. The *tænia mediocanelle* is the only one that can be communicated by beef or mutton, and we all know how rare the *tænia mediocanelle* is.' There is precisely where the error lies. The *tænia mediocanelle* is not rare; on the contrary, it is at least as frequent in our time as the *tænia solium*; and it is readily recognized by a simple magnifying glass. If M. Laborde were to examine the tænia that follows the ingestion of raw meat, he would see that the *tænia mediocanelle* has become very common in France from our new therapeutical habits, while the frequency of the occurrence of *tænia solium* has not increased, for pork meat slightly cooked or raw remains exceptional. Thus we see that it is beef or mutton which furnishes these frequent cases of tænia. Have we any means of doing away with this terrible inconvenience?

"It is at least probable, if not certain, that the addition of alcohol to raw meat, following the method of Fuster, of Montpellier, suffices to kill the germ. For that, the alcohol employed must needs be strong, and the meat should be well mixed with that liquid and allowed to macerate for some time. Thanks to heaven, the moment tænia becomes frequent, the *materia medica* enriches itself with the knowledge of a new tænifuge, at least as efficacious as any other, and superior, inasmuch as it is absolutely innocuous, and that its abundance and low price place it within the reach of every purse. Freely administered pumpkin seeds constitute a sure and inoffensive tænifuge, that seldom misses its effect. Some precautions are necessary in the employment of this medicine.

1st. The intestine is previously emptied by recommending the patient to abstain from eating on the eve of the day on which he proposes to take the remedy.

2d. Early in the morning we administer on an empty stomach 60 grammes (1 oz., 7 drachms) of pumpkin seeds, deprived of the skins and ground with sugar, then mixed with water, forming a sort of milk of almonds.

3d. When the patient feels the worm detaching itself, we administer 70 grammes (2 oz., 125 grains) of castor oil in a cup of hot broth or black coffee, and the worm, in all probability, will come away during the day.

If the head of the worm is not found, the same treatment is repeated in eight or ten days, or the day following the first treatment, if desirable. To recapitulate: It is certain that raw meat as prescribed to-day expose the patient to tapeworm. The species observed in such cases is the *tænia mediocanelle*. Mixing the meat with alcohol lessens the danger. The tænia, once developed, is easily removed by pumpkin seeds properly administered."—*G. Régnault.*

Punctuality in all Things.

It is astonishing how many people there are who neglect punctuality. Thousands have failed in life from this cause alone. It is not only a serious vice in itself, but it is the fruitful parent of numerous other vices, so that he who becomes the victim of it gets involved in toils from which it is almost impossible to escape. It makes the merchant wasteful of time; it saps the business reputation of the lawyer, and it injures the prospects of mechanics who might otherwise rise to fortune: in a word, there is not a profession, nor a station in life, which is not liable to the canker of this destructive habit.

In mercantile affairs, punctuality is as important as in military. Many are the instances in which the neglect to renew an insurance punctually has led to a serious loss. Hundreds of city merchants are now suffering in consequence of the want of punctuality among their Western customers in paying up accounts. With sound policy do the banks insist, under the penalty of a protest, on the punctual payment of notes; for were they to do otherwise, commercial transactions would fall into inextricable confusion. Many and many a time has the failure of one man to meet his obligations brought on the ruin of a score of others, just as the toppling down, in a line of bricks, of the master brick causes the fall of all the rest.

Perhaps there is no class of men less punctual than mechanics. Do you want an upholsterer? He rarely comes when he agrees. So with carpenters, painters, and nearly all others. Tailors and shoemakers often do not have their articles home in time. The consequence is that thousands remain poor all their lives, who, if they were more faithful to their word, would secure a large run of custom, and so make their fortunes. What would become of the SCIENTIFIC AMERICAN if it were not punctual in going to press? or if our paper makers were not punctual in delivering paper? or if our compositors were not punctual in coming to work? Be punctual, if you would succeed.

RAILWAY IRONCLADS.—Cologne is to be surrounded by a chain of forts in the same manner as are Metz and Strasburg. The works, which are now in course of construction, are connected with each other by a protected circular railway, which, now used for transporting material, is designed as an additional means of defence, as it will convey portable ironclad batteries from point to point. Within the outer fortifications there is to be a second line, and a series of revolving iron turrets.

PROFESSOR JAMES ORTON, of Vassar College, proposes at an early day to make an exploration of the Madeira and Beni rivers, which are branches of the Amazons, with the view of opening to science and commerce that portion of South America which is watered by those rivers. The Chamber of Commerce of New York city heartily seconds Professor Orton's project, and has addressed a memorial to the Secretary of the Navy, urging the importance to the United States of a knowledge of that district, and asking his co-operation in the enterprise. Professor Orton has had much experience on the Amazons.

Milk Preserving.---How an American Invention is Worked in England.

The Anglo-Swiss Milk Condensing Company has three establishments in England, one at Middlewich, one at Aylesbury, and the other at Chippenham. Perhaps a better situation for a milk-preserving depot could not be found than at Chippenham, a town long famous for the excellence and the large quantity of its dairy produce, and in the heart of one of the richest milk counties in England. By the kindness of the company's manager, Mr. Bosworth, we were lately allowed the privilege of going over the works in that town; and thinking that what gave us great pleasure might also interest our readers, we give a short account of what we saw and heard there.

Close by the side of the Avon (not the Swan's Avon),on the right hand side as you walk from the railway station to the ancient town of Chippenham, a nice, clean,white stone building attracts the eye. A tall brick chimney suggests a factory of some description, but the general appearance of the building is so clean, and there is so little noise or bustle, that at first one is inclined to think that, whatever work it is dedicated to, business has not yet been commenced. This, however, is not the case, for a busy and successful summer has just been concluded. Entering the large double doors we went upstairs to the office; and on making our desires known, a gentleman, Mr. Page, kindly undertook to show us round. Like Alice in Wonderland we wished to "begin at the beginning and go right on to the end"; and so we went to the other end of the building, where the farm carts bring inthe milk every morning. At present this yard is open, but preparations are being made for roofing it in, so that the horses may stand there in comfort while the unloading is proceeded with. In the first room, into which the milk is taken from the carts, we noticed a number of tin saucers with brass plates on them, all numbered, and about half filled with milk. These, we were informed, were used for testing the cream-producing qualities of the different lots of milk; a small equal quantity from each farmer's consignment being poured into one of these neat little saucers,and allowed to stand until the cream was thrown up. It struck us that testing cream must be a most agreeable occupation. Here the milk is carefully weighed (measures are not used) and tested. It is then poured out of the farmers' cans into those of the company, and taken into the next room, where the cans containing the milk are placed into large tanks full of hot water. In the first room the milk cans used by the farmers are washed, the company prudently preferring to have this important duty performed in a thorough,systematic manner by its own servants rather than to trust to the tender mercies of the farmers' servants, and risk the loss of milk in hot weather. The way the cans are washed is at once simple and effective. First, they are roughly rinsed in a large tank nearly full of water; then the can is taken to a table, on the top of which a round hole is cut, the exact size of the can's mouth. In this hole are two pipes, pointing upwards, on a level with the table. The can is placed mouth downwards over this hole; and a handle being turned, a jet of spring water rushes with great force up one of the pipes into the can, thoroughly cleansing it. After this another handle is turned, when a jet of steam acts in exactly the same manner. Another turn of the first handle, and the cold spring water finishes the washing. Thus a very large number of cans are thoroughly washed in a marvelously short time, with very little labor. Leaving this room,we went into the next, where, as we said, the milk cans are placed in tanks containing hot water. From these the cans are lifted, and the milk poured into large open round copper tanks, and boiled by the action of steam. After remaining here for some time it is pumped up into the condensers in the room overhead. These condensers, of which there are three in this room, are also worked by steam, and in them the milk remains for from three to seven hours, according to the quantity. In these condensers a vacuum is created of about 20 lbs. to the square inch, and thus the vapors are drawn off from the milk,which we understand to be one of the most important details in the process, and that on which the future keeping properties of the milk chiefly depend. When the milk has remained in these condensers sufficiently long,it passes into another room, when it is cooled by being put in cans and placed in cold water. The final process is unknown to us, being the one secret of the establishment, but we have a shrewd suspicion that, like many other secrets, there is no great mystery connected with it. Be that as it may, when next we saw the milk it was in exactly the condition we see it in when the little cans are opened for table use. The filling room is a large airy apartment; and as the little cans are filled, they are closed up and sent to the room above to be packed away ready for the market.

Everything is made, and all the work is done, on the premises, upwards of 100 people being employed, of which about forty are boys and girls. One engine of four horse power is sufficient to do all the work, but the boiler requires to be much larger in proportion,in consequence of the amount of steam used for other purposes. Owing to this the boiler is large enough to supply working steam for a forty horse power engine. Not the least interesting part of the establishment is the portion devoted to the making of the tins, in which the milk is put when ready for sale. Here nearly all the work is done by boys and girls; and as each has only one part of the tin to make, the work proceeds rapidly. Thus, one boy cuts the sheets of tin into the proper sizes for the sides or barrel of the tin; the next boy passes three pieces between two little rollers, which curl them up ready for joining. From here they go to another little fellow, who sits and solders the two edges together, and so quickly is this done that a boy can turn out 2,000 a day. After this, the ends, which are punched out by machinery, are fitted on, and milled, or squeezed tightly to the top and bottom of the little cylinders which form the tins, when they are soldered and the tin is labeled. The milk is then run in through a small round hole left in the top, and then this hole is covered; the tin is rolled in paper and packed, which work is entirely performed by girls. The chief characteristic in thir milk-condensing is cleanliness, and the quantity of water used for this purpose is enormous. Ventilation is anothes necessity, and thus the employment is pleasant and healthy. With foot and mouth disease increasing, it is satisfactory to be able to get a pure article of food for children, and as the milk from diseased cows cannot possibly be used by the Preserving Company,it is particularly suitable for young or delicate persons. It has also the great advantage of being always at hand, ready at a moment's notice, and in any kind of weather, which is a matter of some importance. Condensed milk has long been largely used on board ship and in yachts, but it is only lately that it has begun to come into general use in families; so that,with increased consumption, it is probable that other establishments will have to be formed by the energetic Anglo-Swiss Condensing Company, and if so we wish it the same success which has hitherto attended it.

[The above from *Land and Water*, describes the valuable process invented by the late Gail Borden of Texas, and by him first put in operation in this country about fifteen years ago. Since that time it has spread to all parts of the world,and his condensed milk has become a staple article of commerce and manufacture. The adoption of Mr. Borden's invention in England is only one of many examples of American improvements there worked.—EDS. SCI. AM.]

Uncertainty of Wealth.

"The absence of the law of primogeniture causes a frequent change of ownership in the private residences which contribute so much to the adornment of our cities. While the head of the family lives, the home may be retained—though very often a reverse of fortune compels him to seek humbler quarters—but when he dies the heirs are obliged to get rid of the too expensive luxury. How many of the houses built in St. Louis twenty years ago are now owned by the men who erected them, or their descendants? How many of later date, now occupied by their builders, will be in possession of their present tenants, or their descendants, twenty years hence? Other influences beside the lack of primogeniture contribute to this, in some respects, unfortunate result. There are more ups and downs in life in the new world than in the old. Fortunes are made much more quickly, and disappear much more rapidly. Wealth is seldom transmitted beyond the second generation, and in many instances does not last through the first. The boy born with a silver spoon in his mouth frequently has to taste pewter before his pilgrimage is over, and he may have the pleasure of being splashed with mud from the carriage wheels of the man who was once his father's porter. This is a free country, very free indeed, and among the consequences of that freedom is the exceeding uncertainty of financial matters. Yet in no country is less provision made for the evil day so far as our children are concerned. The wealthy parent brings up his sons and daughters as though there were not the remotest possibility that they could ever be poor. If a rich father should insist upon his boy learning a trade he would be set down as a mild-mannered lunatic. If a rich mother should instil into her daughter rigid ideas of economy and industry, she would be looked upon as either very mean or very foolish—probably both. Yet every day we are taught the necessity of this preliminary discipline; every day we see men and women falling from affluence to poverty, who, if properly trained, might not have fallen at all, or, if they did fall, could have risen again. It is a shame and disgrace that, in a land where labor is supposed to be honorable, and where the law recog nizes no distinction of caste, so small a proportion of the sons of the wealthier classes learn trades. No young man has a right to consider himself thoroughly independent unless he has some avocation by which, health permitting, he can always make a living. And the best and surest avocations are those for which there is always a demand. Lawyers, doctors, preachers, professors, clerks—all these and their kindred are frequently a drug in the market; but how seldom is it that a good carpenter, blacksmith, machinist, wagon maker, shoemaker, tinsmith, book binder, or printer has to travel far in search of remunerative employment! We shall never be thoroughly republican until there are fewer genteel drones in the national hive."

There is probably no subject on which more has been written than the above. Almost everybody has seen evidences of the fact about them; and how many who will read this article (from the St. Louis *Republican*) can realize its truthfulness!

Gas for Heating Purposes.

We confidently look forward to the time—and we hope it is not far distant—when, in all large cities, at least, a heating gas will take the place of solid fuel for culinary and general heating purposes. What the consumption for that use would be, were the price sufficiently low, can scarcely be calculated; but if the consumption of illuminating gas on the island of Manhattan alone may be roughly estimated at fifteen million feet per day, the consumption of heating gas would, probably, amount to one hundred million feet; and since it must be made on an enormous scale, at a very low cost, and sold with a narrow margin for profit, there is reason to hope that the efforts to solve the question of an economical heating gas will solve also the problem of cheap illuminating gas; for though the essential properties, and even the composition, of these two will differ greatly, yet any process that will enable us to make a heating gas, at, say, 20 cents per thousand feet, can, probably, be adapted to the manufacture of a cheap illuminating gas. In the interests of metallurgy, of manufacturing, and of general needs of civilization, we welcome every step toward the attainment of this great desideratum; and it seems, indeed, that no more inviting field for the application of science, skill, and economy exists than that of gas-making. This art has stood almost stationary for nearly half a century, while every other branch of productive industry has made enormous progress; and if the signs of the times are not deceptive, the day is approaching when the demands of consumers will force gas-making out of the rut of conservatism into the path of progress that is characteristic of our time and people.—*Engineering and Mining Journal.*

How to Reach the North Pole.

C. S. says: "I propose to reach the north pole by the construction of an overground tubular railroad, under the auspices of several governments, which should pay sufficient money to construct suitable shops for the making of a wooden tube, 5 or 6 feet in diameter, to be made in light sections for transportation. After some suitable landing place has been chosen, the road could be commenced at the dock. The sections of the tube could be placed on a car which would run inside of the tube and be propelled by hand, and furnished with a light, strong, convenient dummy engine and boiler, to be used when required. Theoretically this idea has many points of great benefit to the explorers. A car can be made and furnished with nearly all the comforts of a home; and the tube, getting covered with snow in the winter, would be quite warm. With properly constructed stoves, plenty of provisions, and fuel,a scientific party could pass a winter in the tubes quite comfortably. I have no doubt but that there are plenty of civil engineers who would jump at the chance of constructing a road of this nature if solid government support was guaranteed. If this idea proved feasible, and the barrier of 120 miles that is supposed to exist could be overcome, and the unexplored supposed open sea found, this road could be made the means of carrying material for the construction of suitable fishing vessels. If the open sea does exist, there is no doubt but whales are to be found there in immense numbers, so as to make the road profitable,and furnish oil for the people when the products of the oil region commence to give out. Shelter in nearly all emergencies would be found in a road of this description. Who can tell of the benefits that might come to the nations if the mysteries of the vast unknown region could be brought to light? The outlay on a road of this character would be a mere bagatelle to the results that would accrue from it."

A New Fumigator.

A new and excellent fumigator has recently been devised by Mr. Thomas Shaw, of Danville, Pa. (P. O. Box 612). We are indebted to the inventor for one of the machines, which we have practically tested to our satisfaction. It consists in a hopper in which the tobacco, sulphur, or other fumigating material is placed, resting on a perforated bottom. A pipe from the hopper enters a miniature fan blower, above the casing of which the hopper is placed. There is a hand wheel which is belted to the fan shaft, so that the latter is very rapidly revolved, causing a down draft through the material ignited in the hopper, and a strong current of smoke to be delivered through the outlet tube of the blower. The device is made large enough for use in large greenhouses or of a size convenient to be carried in the hand. It will also be found admirably adapted for smoking plant lice from window gardens, and for burning coffee or other disinfectants in hospitals and ships.

TO PREVENT GLUE FROM CRACKING.—Glue frequently cracks because of the dryness of the air in rooms warmed by stoves. An Austrian contemporary recommends the addition of a little chloride of calcium to glue to prevent this disagreeable property of cracking. Chloride of calcium is such a deliquescent salt that it attracts enough moisture to prevent the glue from cracking. Glue thus prepared will adhere to glass, metal, etc., and can be used for putting on labels without danger of their dropping off.

ENGINEERS and shipbuilders on the northern rivers in England feel the effects of the general depression. At some of the engineering shops and shipyards there is scarcely sufficient work to employ foremen and apprentices. Nothing better is expected till the spring of 1876, when it is hoped that the trade will vie with the promising season of the year.

A GERMAN astronomer has discovered two new small planets, not visible with the naked eye, in the constellation *Aries*. This makes the number of the lesser planets one hundred and fifty-three.

AT Bonn, Germany, headaches, dyspepsia, etc., affecting several patients, have been traced to evening studies pursued under the baleful influence of a green lamp shade, from which arsenic was set free by the heat of the flame.

EUGENE SCHNEIDER, the French statesman and mechanical engineer, died recently, at Paris, at the age of 70 years. He was called to the Paris Cabinet in 1821.

RECENTLY there was a lifting match at Eureka, Nevada, between two men, for a prize of $200, the winner lifting a 15 lbs. dumbbell at arm's length the greatest number of times. The loser lifted it 1,180, the winner 1,144, times.

PLATE SHEARING MACHINERY.

A plate-shearing machine, with revolving cutters, of which we give an engraving herewith, was recently exhibited at Manchester, England. It is provided with an adjustable grooved table and sliding bar, with a stud on the latter, for shearing plates to different radii. A special feature in the machine is that the top cutter shaft is mounted in eccentric bushes, so that by turning these bushes it can be brought nearer the bottom shaft, so as to take up the wear of the cutters. The eccentric bushes are graduated on the edges, so that the two may be turned equally, and the two shafts be thus maintained parallel. The machine will shear plates up to three sixteenths of an inch thick, and it is altogether of a neat and good design.

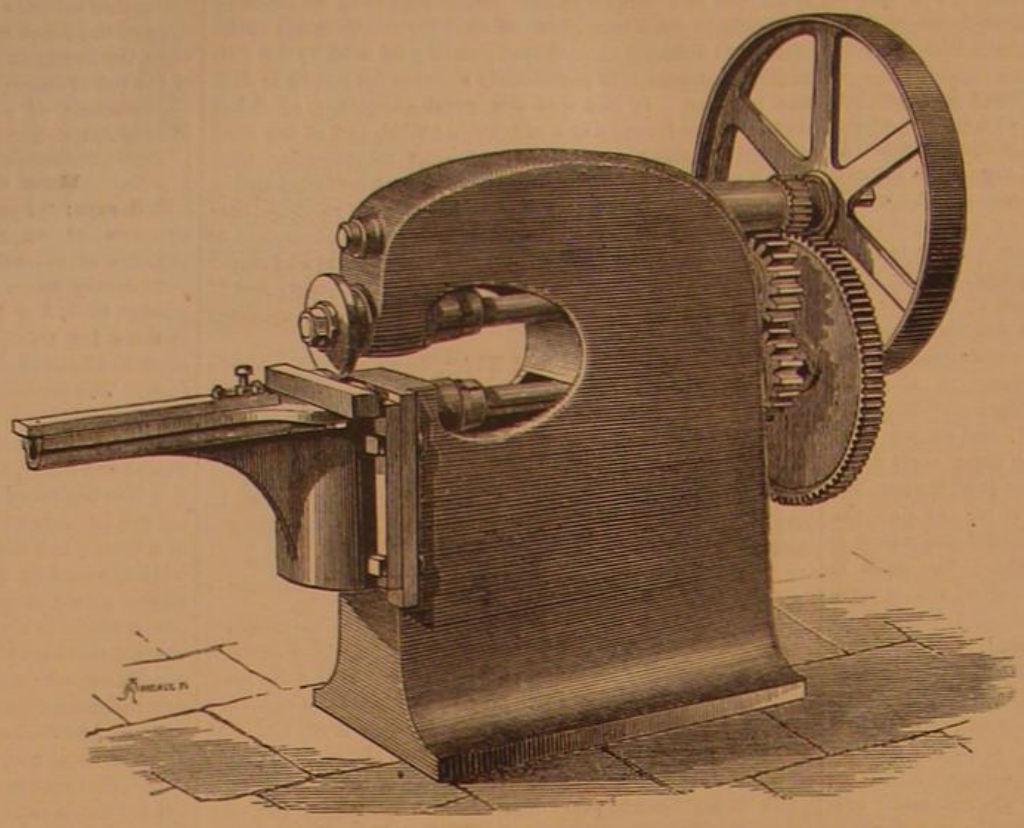


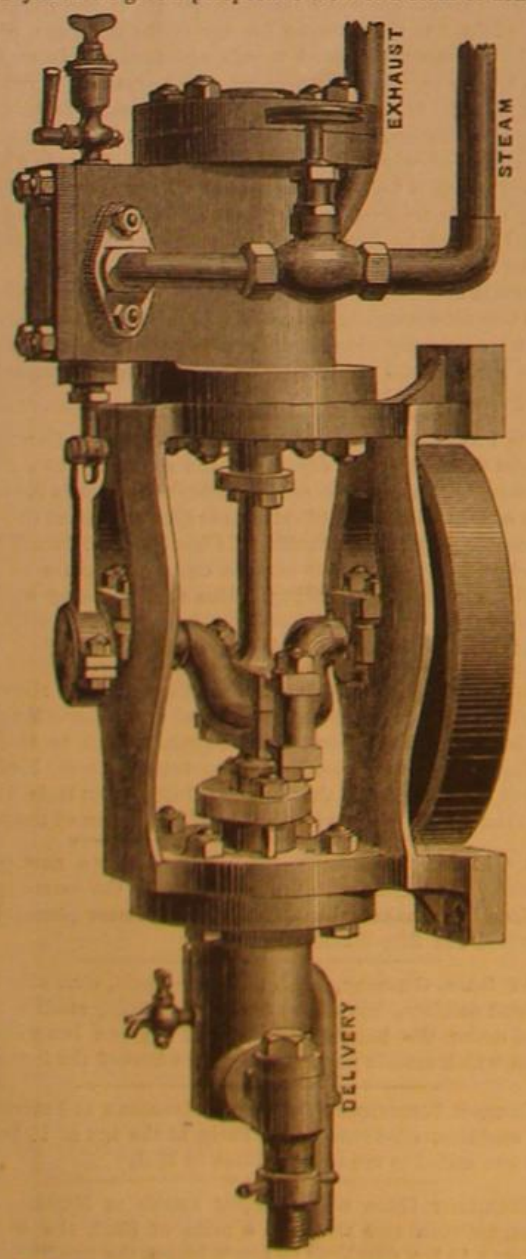
PLATE SHEARING MACHINE WITH REVOLVING CUTTERS.

Natural Gas Fuel.

A few weeks ago a line of pipe was laid from wells in Butler county, Pa., to the mills of Graff, Bennett & Co. on the West Pennsylvania Railroad, in Sharpsburg and Ætna, a distance of eighteen miles. It was not known before the connections were made whether there would be a sufficient pressure of gas to make the scheme a practicable one. At a fixed time, however, the connections were made at the well; and the air having been exhausted from the eighteen miles of pipe, the gas rushed through, and in twenty minutes was pouring in great quantities out of the pipe at the furnaces [The velocity maintained is doubtless a mistake.—EDS. SCI. AM.] When the gas was lighted the flames flared up 40 feet high, with a volume sufficient to supply double the quantity of heat required. It is expected that in these two furnaces a saving in fuel of from $40,000 to $50,000 a year will be made. In Rogers & Burchfield's rolling mill, the gas has been used for more than a year, and the saving in fuel is estimated at $60,000 per annum, although only 125 men are employed there. The gas has been flowing with apparently undiminished force for ten or twelve years, and there is no known limit to the supply. Some enthusiasts in Pittsburgh prophecy that within a few years the majority of the furnaces and mills in that great manufacturing city, as well as the parlor grates and kitchen cooking stoves and ranges, will be heated by this new fuel.

DONKEY PUMP.

Subjoined we give a perspective view of a form of donkey



pump which is now being made by Messrs. Hayward, Tyler & Co., and which was exhibited by them at the recent show of the Royal Agricultural Society at Taunton, England. As will be seen from the view given, the pump is adapted for being bolted up against a wall or boiler, and it is of a neat and compact form, while the pump valves are very readily accessible. The arrangement is so clearly shown by our engraving that no further description will be necessary.

Hygiene for Smokers.

The following are Dr. Berthand's precepts and advice to smokers. Never smoke more than three or four pipes or cigars a day, and, if it is possible, limit yourself to two. It is unwholesome to smoke on an empty stomach or immediately before or after a meal. Whatever be the mode of smoking, direct contact of the tobacco with the *mucus buccalis* (mucous lining of the cheeks) and the teeth must be avoided. Cigars should be smoked in an amber, ivory, or enameled porcelain mouthpiece. To smoke, by relighting them, portions of cigars that have been extinguished, together with the system of blackened and juicy pipes, constitute the surest way of being affected by nicotene. Every smoker would do well, if he could, to rinse his mouth after smoking. *A fortiori* is the same precaution applicable to chewers. For the same reason it would be well to subject pipes and bowls, in which tobacco has been burnt, to frequent washings either with ether or with water mixed with alcohol or vinegar. It is difficult to choose between the different ways of smoking. I give preference to the cigarette, by reason of its slight quantitative importance and the paper which interferes with the contact of its contents with the buccal mucous membrane. But to realize all the *desiderata*, it would be necessary to have the *papelito* made of flax thread and to abstain from the practice which has become the *ne plus ultra* method of its kind, retaining the aspiration at the back of the mouth, so as to pour it out of the nostrils afterward. The premature habit of smoking is certainly hurtful to childhood and during the adolescent period of organic evolution. The economy cannot but suffer, at this period, from the narcotic influence, be it never so slight, and from the salivation which is inseparable from this act. All persons cannot smoke with impunity. There are pathological counter-indications or idiosyncrasies to this habit that it would be imprudent and culpable to infringe. Diseases of the lungs, of the heart, chronic affections of the mouth, nose, eyes, throat, and stomach, are the results of the principal incompatibilities. The airing of apartments where smoking has taken place should be well attended to. To sleep in rooms where tobacco smoke exists, slowly constitutes a grave infraction on the elementary laws of hygiene."—*Tribune Médicale.*

Chloride of Silver Battery of 3,240 Elements.

Messrs. Warren de la Rue and H. W. Müller have constructed a battery composed on the one part of 1,080 elements, each consisting of a tube of glass 6 inches in length, and of 2,160 elements formed of glass tubes of 5 inches in length only. All the tubes are 0·75 inch in diameter, and are closed with stoppers of vulcanized india-rubber, perforated with a hole near the edge to permit the introduction of a rod of amalgamated zinc, 0·2 inch in diameter and 4 inches in length for the first 1,080 elements, and 3 inches for the remainder. At the bottom of each tube, powdered chloride of silver is placed, 220 grains in weight, compressed strongly with wooden rods, a flattened silver wire having been first introduced to the bottom of the tube. The silver wires are covered in their upper part, above the chloride of silver and up to the point where they emerge from the vulcanized stoppers, with leaf gutta percha, to isolate them and preserve them from the action of the sulphur in the stoppers. The electromotor force of this battery is to that of a Daniell's battery as 1·03 to 1.

God's First Temples.

Bayard Taylor, in his interesting work entitled "Home and Abroad," in a graphic account of the mammoth trees of California, thus describes the felling of one of the largest specimens of the Sierra Nevada: "After a steady labor of six weeks the thing was done, but the tree stood unmoved, so straight and symmetrical was its growth, so immense was its weight, and so broad its base, that it seemed unconscious of its own annihilation, tossing its outer branches derisively against the mountain winds that strove to overthrow it. A neighboring pine of giant size was then selected, and felled in such a way as to fall with full force against it. The top shook a little, but the shaft stood as before; finally the spoilers succeeded in driving their wedge into the cut. Gradually, and with great labor, one side of the tree was lifted; the line of equilibrium was driven nearer and nearer to the edge of the base; the mighty mass poised for a moment, and then, with a great rushing sigh in all its boughs, thundered down. The forest was ground to dust beneath it, and for a mile around the earth shook with the concussion." The work was performed by two sets of hands with the aid of long pump augers. The tree was a mass of solid wood ninety feet in circumference, containing some two hundred and fifty thousand feet of timber; and according to the annual rings, its age was three thousand one hundred years. The stump is now used for a ball room, and the trunk for a bowling alley. Dr. Bigelow said of this specimen: "It requires thirty-one of my paces, of three feet each, to measure its circumference at the stump; and the mere felling of it cost, at Californian prices for wages, the sum of five hundred and fifty dollars. An idea of the sublime proportions of these wonderful fathers of the forests can be formed after seeing a man on horseback riding a distance of seventy-five feet through a hollow trunk, and emerging from a knot hole in the side."

IMPROVED SCREW CUTTING DIE AND HOLDER.

We illustrate in the annexed engraving a new adaptation of an improved screw cutting die, made so as to be conveniently held in a bit stock instead of in the ordinary plate. The construction will readily be understood from Fig. 1, and also from the representation of the die taken apart in Fig. 2. The screws shown at A, in Fig. 1, serve to close the parts of the die together from the sides, and the taper screws, B, Fig. 2, spread the die when driven in, thus regulating the size of the cut. By operating either screws, A or B, the portions of the die may be adjusted and held with great nicety, while wear, at the same time, is compensated for in a very simple and effective manner.

The die does its work in a single cut, thus forming the

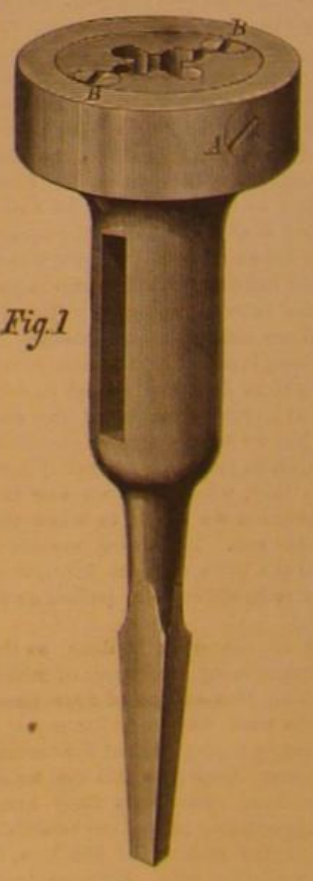
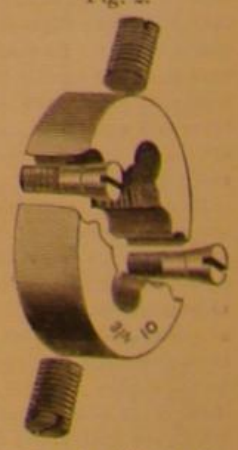


Fig. 1

Fig. 2.



screw thread at once, neatly and sharply, and without raising the thread above the normal surface of the material operated upon. The die also allows of nuts and bolts for different purposes being made to fit together tightly or loosely, as desired.

For further particulars, address the manufacturers, the Wiley and Russell Manufacturing Company, Greenfield Mass.

THE KRUPP TWELVE HUNDRED POUNDER GUN.

In a recent issue we published an engraving showing the most important types of the armored vessels which have been built during late years. These floating forts represent the theories of one party, of the two which are contesting the question whether the victories in future naval conflicts will be gained by the thickest armor or the heaviest guns. The result of this competition is a constant transition in the prevalent system of warfare; and hence upon what strength, whether of shield or of gun, combatants will rely in conflicts yet to come, neither opinion nor prophecy can be predicated. The naval engineers construct vessels with solid iron walls, some 24 inches thick; but hardly are the ships launched before a gun is produced by the artillerists, capable of penetrating the armor at long range; then follows a new vessel, succeeded by a yet more powerful gun; and so the duel continues, each side gaining the advantage in turn until one can see no definite end unless he venture into the realms of theory, and vainly endeavor to imagine the impossible conditions of that time-honored mechanical puzzle, "the irresistible force meeting the immovable body."

The majority of the experiments, and very costly ones they are, are carried on in England. New ironclads are almost entirely of English construction, the exceptions being a few built by Russia. In the making of heavy guns, however, England is not alone, as Germany, through the great steel works of Krupp, enters the field as a rival—the German policy apparently being first to allow England to vanquish the armor of her own engineers, by the heavy guns of her own artillerists, and then to produce German cannon superior to the English gun. A very recent instance of this has occurred in the construction of the 81-tun gun by England, the tests of which are hardly concluded before Krupp announces the undertaking of a 124-tun cannon, capable of throwing bolts which will pierce 23·8 inch armor at seven and a half miles range. The distinctive features of the English guns we have already described. In the present article we give an excellent engraving of one of the large Krupp guns (which we take from the pages of Knight's "New Mechanical Dictionary"*), from which the general characteristics of the German breech-loading system will be understood.

The gun itself is made of crucible cast steel, of a quality especially adapted for the purpose, and is constructed on the built-up system. It consists of an inner tube weighing 20 tuns, upon which are shrunk cast steel rings, forming at the breech a three-fold, and at the muzzle a two-fold, layer of metal. Both tube and rings are formed from massive ingots without welding. The caliber of the gun is 14 inches, weight 50 tuns, total length 17½ feet; weight of solid shot 1,212 lbs.; weight of shell 1,080 lbs.; charge of powder from 110 to 130 lbs. The breech-loading is on Krupp's patent plan. The shot or shell is raised by a tackle and is rolled into the side of the breech through an aperture closed by a slide. The gun is mounted on a steel carriage weighing some 15 tuns, supported on a center pintle chassis weighing 25 tuns.

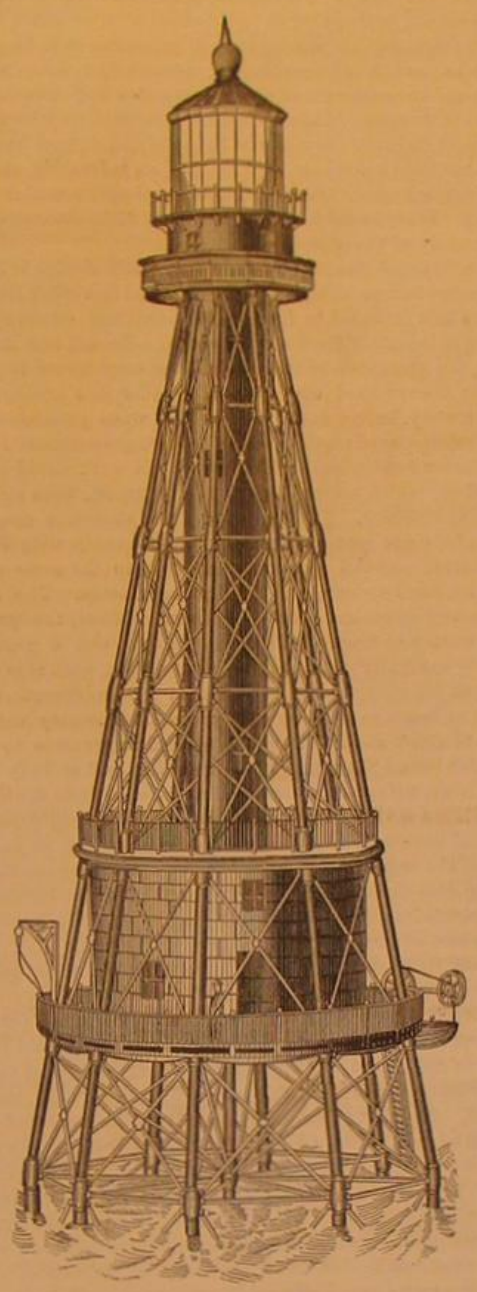
Postal and Telegraph Service.

The twenty-first annual report of the British Post Office has just been issued, giving the postal and telegraphic statistics for 1874. It appears that the estimated number of letters sent through the post during the year was 967,000,000, besides about 79,000,000 post cards, and 259,000,000 newspapers and book packets. On an average there were 30 letters to each head of the population in the United Kingdom, but the national average was 33 per head for England, 25 for Scotland, and 14 for Ireland, showing some interesting facts in regard to the comparative educational, social, and commercial relationship of each division. The return letters amounted to about 4½ millions, giving an average of about one on each 230.

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

THE TRINITY SHOALS LIGHTHOUSE.

An interesting application of iron to the construction of



a building requiring exceptional strength and stability is represented in the annexed engraving of one of the two similar lighthouses erected at Trinity Shoals and at Timballer, in the Gulf of Mexico. The structure is supported upon nine screw piles—a central one surrounded by eight others, at distances of somewhat less than fifteen feet four inches each being twenty feet distant from the central one and secured together at the ground by adjustable wrought iron links, and above by diagonal braces and by radial struts to the central pile. The summit of each pile is incased in a cast iron socket for receiving the column and the radial and diagonal braces. The jointed columns which support the lantern have a similar provision for their diagonal braces, the arrangement for which will be understood from the illustration, which we take from Knight's "New Mechanical Dictionary." The different series of columns are joined together by sleeves. The first series above the foundation is 20 feet long, the second 15 feet, the next two 18 feet. The fourth, fifth, and sixth are respectively 15 feet 6 inches, 14 feet, and 12 feet 6 inches. The columns of the first series are of wrought iron, forged tapering; those above are of hollow cast iron, each series successively decreasing in diameter. The lantern is supported on a cylinder of boiler iron, resting on a platform at the top of the columns.

Anthracite Coke.

The high calorific power of anthracite, consisting as it does of nearly pure carbon, and the low percentage of sulphur and ash contained in most varieties, naturally render it of great value as a fuel in the cupola and the blast furnace; while from its abundance in many districts, and the cheapness with which it may generally be worked, it should at once be the best and the cheapest fuel that could be used. The practical drawbacks to its use, which diminish its value and to a great extent restrict its employment, are the difficulty of utilizing the slack or small anthracite, of which a good deal is made in mining and handling, and in breaking the large pieces, and the tendency of many anthracites to split up into small particles if suddenly heated. In the blast furnace this decrepitation is especially injurious, as the fine dust is apt to form, together with the cinder, pasty masses that can neither be melted nor burnt away, and may choke the furnace up or seriously derange its working.

These difficulties in the way of using anthracite generally in its natural or raw state, have led to many attempts to make it into a serviceable coke, by coking it in admixture with a greater or less proportion of binding coal, pitch, or other bituminous substances. None of these attempts, until very recently, appear however to have been commercially successfully; none, at least of those made in South Wales, have been carried out largely or continuously; as, though coherent coke was made, it was friable and of inferior quality.

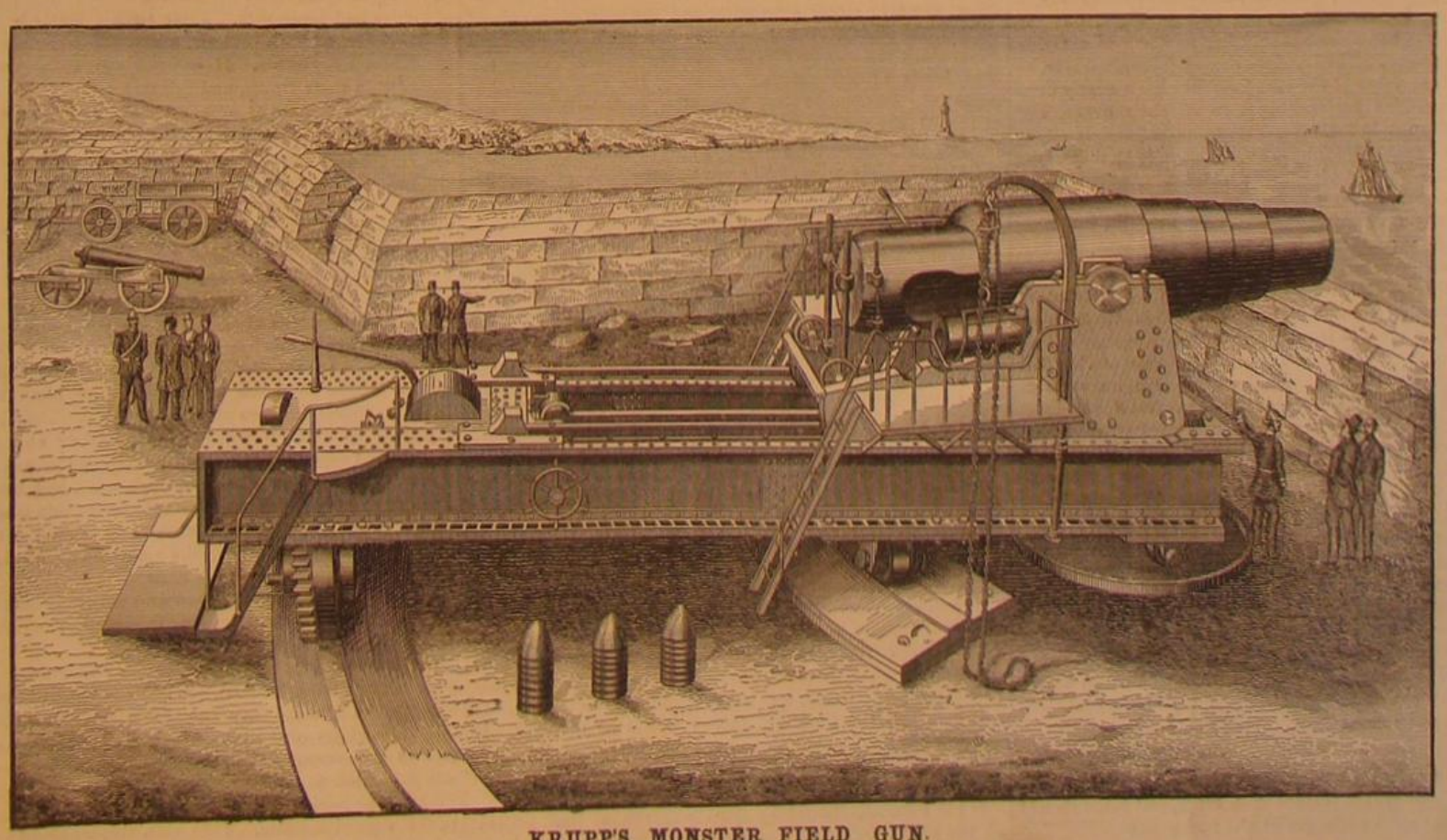
Some samples exhibited would appear, however, to show that the production, on a working scale, of a hard and sound anthracite coke is not at all impossible.

They are fair specimens of the coke now being made by the process of Messrs. Penrose and Richards, of Swansea, to whom the writer is indebted for them, as well as for the information as to the mode of manufacture, and the characters of the coke obtained, on which the present note is based.

The materials used are any quality of anthracite or semi-anthracite, if free from shale or stones, good bituminous or binding coal, and pitch, in the following proportions:

Anthracite, 60; bituminous coal, 35; pitch, 5.

Specimens have been shown of coke made of Messrs. Brock and Sons' anthracite, from Cwmllynfell Colliery, near Cwm Amman; of a mixture of this with Ynisedwyn anthracite; and of culm or semi-anthracite from Birch Rock Colliery, near Pontardylais. The bituminous coal used in making all the samples exhibited was that from Tyrissa Colliery, near Swansea.



KRUPP'S MONSTER FIELD GUN.

The materials are passed, together, through a Carr's disintegrator, to crush and mix them: the proportions in which they are mixed being regulated by supplying the feeding hopper of the disintegrator by three elevators, one carrying up each constituent, and each provided with buckets of such size and number as to bring up the relative quantity required. Samples are shown of the anthracite, bituminous coal, and pitch, in the condition in which they are supplied to the disintegrator, and of the crushed mixture produced.

The ovens used are of the oblong shape generally employed in South Wales: 15 feet long, by 5 feet 7 inches wide at the back and 6 feet 2 inches in front, and 4 feet 4 inches high to the under side of the arch. Each oven is charged, through a hole in the roof, with about four tuns of the crushed mixture; this is leveled by a rabble put in through the door at the end; and a small quantity of bituminous coal, sufficient to form a layer about 2 inches thick, is thrown in and spread uniformly over the surface. The oven is then lighted, by throwing a few shovelfuls of hot embers on the top of the charge, immediately inside of the door, and the coking is managed as in working an ordinary charge of bituminous coal. The object of covering the charge with a layer of bituminous coal is to prevent the burning away of the pitch, and its use appears to be essential for the production of a hard and strong coke. Ordinary slack, of the same quality as that in the mixture, is used for the covering; this is mostly very small, but is not specially crushed.

Rather more than two charges per week are made in each oven; the coke is watered in the oven, and is then drawn out in one mass, by a chain and hand winch.

The yield of coke is 80 per cent of the weight of the charge. The coke is steel gray in color, and very much harder than the anthracite from which it is made: so hard, indeed, that it scratches glass with comparative ease. In a common fire, or under the action of a blast, it burns away without showing any tendency to crumble or decrepitate. It is about 23 per cent heavier than the best coke made from Welsh bituminous coal; so that in sending a cargo abroad recently, a vessel that could not carry more than 240 tuns of ordinary coke was able to take in as much as 310 tuns of anthracite coke. Another valuable consequence of the dense compact character of the coke, in addition to the saving in cost of carriage, is that, even if soaked in water, it takes up very little, only from 1·5 to 2 per cent of its weight; while many kinds of ordinary coke absorb readily 10 per cent or more. The coke is harder and more dense, the finer the materials are crushed, and the more intimately they are mixed.

In practical use, both in the cupola and in the blast furnace, the coke, so far as it has been tried, has given remarkably good results. These are probably due in part to its hardness and density, or rather to the high temperature required to set it on fire, which brings the zone of combustion closer to the tweers, and diminishes the waste of fuel in the upper part of the furnace caused by the transformation of CO_2 into CO: and in part to its freedom from water, and the small amount of ash that it contains.

In a small foundry cupola, in which 1 lb. of good Welsh coke, that from Bryndu, near Bridgend, melts 10 lbs. of iron, 1 lb. of anthracite coke melts 16 lbs. and the metal is hotter when tapped out; and in a trial carried out at Messrs. Tangye's Works, near Birmingham, anthracite coke melted well with 25 per cent more burden than that placed on ordinary coke, and would probably have done more, but the managers were unwilling to run any risk of deranging the working of the cupola, and did not push the experiment further.

In a trial made in one of the blast furnaces at Landore, working on spiegeleisen, the burden, in using anthracite coke, was increased 28½ per cent; and the economy might probably have been raised to 30 per cent or more, but the stock of coke in hand was not sufficient to admit of carrying on the experiment. The Landore company are, however, so satisfied of the value of the coke that they have nearly completed preparations for making it in all their ovens, and using nothing else in their two blast furnaces.

The cost of anthracite coke is about the same as that of the best ordinary coke made in the district. Anthracite, in Wales, is about 48 cents a tun cheaper than bituminous coal—an economy in one constituent that balances the extra cost of the pitch; and in making best ordinary coke, the coal used is ground, at a cost of about 12 cents a tun, just as in the case of coke from anthracite. The yield of 80 per cent in coking anthracite, against 70 per cent or less in coking bituminous coal, is again in favor of the former.

The cost of the crushing and mixing arrangements, to grind 1000 tuns a day, is estimated by the inventors at from $10,000 to $12,500. This would include a 6 feet 3 inch disintegrator, with driving power, elevators, and shed.

The process has been carried on near Swansea for about nine months; and though it was suspended for some time during last winter, on account of the colliers' strike, between 2,000 and 3,000 tuns have in all been made.

The field for the application of any practical method of utilizing small anthracite is very great; the quantity available in Wales and in America is almost unlimited, and very much of that raised is now unsaleable, merely because it is too small to be used. In Pennsylvania, according to Mr. Bell, from one fifth to one half of the material brought to the surface in the anthracite collieries, is thus thrown aside: partly shale and stones, but chiefly small and dust coal, perfectly clean and bright.

AN engine cylinder piston will not wear the packing in the stuffing box if it is incased with brass, and brass should always be put on the plunger of the feed pump

The British Channel Tunnel.

The proposition to unite England and France by means of a railway tunnel beneath the waters of the English Channel, which has, during the past few years, figured largely among the items and comments of the engineering press and in the discussions of various learned bodies abroad, has at length assumed such definite shape that the actual undertaking of the enterprise in the near future is rendered highly probable.

To cut a tunnel of the enormous length of twenty miles, beneath the waters of the ocean, is an undertaking which, to most minds, will appear to be attended with so much hazard and uncertainty—to say nothing of expense—as to be practically impossible of completion; nevertheless, after a most thorough investigation of the subject, and full consideration of the difficulties, dangers, and uncertainties surrounding it, the most eminent engineers of England and France have pronounced their conviction that the project is feasible, and that the building of the Channel Tunnel is simply a matter of expense. We present herewith the main facts connected with the history of the prospected entireprise.

The Channel Tunnel Company was established in 1872, and comprises two societies—one French and the other English. It was first intended to form an international company; but owing to certain differences between the French and English laws, the promoters of the undertaking were forced to resort to the abovenamed combination. Under this arrangement each society, before expending money upon preliminary investigations, made application to its own government for the legislative concessions needed before the work could be undertaken, which concessions, it is announced, were obtained without difficulty. The first society will therefore open the door of France beneath the sea in conformity with French legislation, and the second society will do the same on the English coast according to English legislation. The assent of the two governments having been obtained, the preliminary work was begun. The first inquiry was a geological one, by carefully measuring to ascertain on each side of the channel the outcrops of the beds that lay underneath, accurately as could be done by that process. The gray chalk—a mass of strata about 500 feet thick and impervious to water—which forms the principal mass of the cliff at both Dover and Calais, strikes across the channel so with little divergence from horizontality that a tunnel could be pierced within the vertical bounds of its thickness, presuming it to be continuous all the way across. From the geological map constructed on the data thus obtained, it appeared that a line between St. Margaret's Bay (a depression in the chalk cliffs about four miles east of Dover) and a point on the French side, about midway between Calais and Sangatte, would be suitable to carry the tunnel through the lower chalk.

To verify this presumption, an examination across the channel was made by dropping from a steamer a weighted instrument in 500 places, the apparatus running with great velocity to the bottom, and bringing up chalk wherever it was expected. The device employed in this work consisted of an iron tube, over which a hollow shot, fitting loosely, was raised and let fall upon a flange attached to the tube, the end of which is in this way driven into the substance of the sea bottom, the core thus obtained giving the required sample of the rock perforated. The results obtained afforded a complete confirmation of the correctness of inferences drawn from the maps previously made, and were sufficiently satisfactory to establish the feasibility of the project on purely geological grounds.

The line of the main tunnel as proposed, which is to be large enough for a double line of railway, is drawn straight between the proposed termini on both sides. In longitudinal section it presents a slight fall of 1 in 2,640 from the center towards either extremity, and the vertical depth of the highest point of the floor is 436 feet from Trinity high water mark and 200 feet below the sea bottom. From the land levels of the existing railways, the two approaches make long descents of over four miles, each with gradients of 1 in 89 into the tunnel ends, over two miles being under the sea, the total of the whole amount of tunneling amounting to over thirty miles. The maximum depth of water on the line of the proposed tunnel nowhere exceeds 180 feet below high water mark, the water being deepest in the center, and gradually diminishing in depths towards the sides. Below the railway approaches, and continuous with the floor of the submarine tunnel, there will be at each end a driftway leading to vertical shafts ashore for ventilation and drainage. These terminal shafts and driftings comprise the preliminary work which it is intended to make as a test of the general practicability of the undertaking, and of which they will, when completed, form essential portions. On the French side the work of sinking the shaft has just been commenced, while that on the English side is nearly or quite completed. It is proposed to execute the work with the aid of the tunneling machinery recently invented by Mr. Dickinson Brunton. This machine works after the fashion of an auger, and the *débris* excavated falls upon an endless band which carries it to the wagons in the rear. By this means a driftway, seven feet in diameter, can be advanced at the rate of about a yard and a quarter per hour, at which rate it would only require two years to pierce the channel through, a machine being worked from both sides. For this preliminary work, the engineer's estimates of time and cost are four years and $8,000,000 respectively, but experienced contractors declare that only half the time and money would be required. It has also been computed that, after the driftway is finished, four years' time and $20,000,000 will complete the entire work.

It has been ascertained by actual experiment that, provided the chalk be solid, the water will not permeate it, in proof of which, the Brighton tunnel (5½ miles in length, in close proximity to the seashore, and from 12 to 20 feet below the sea level, and excavated in the comparatively incompact upper chalk) is offered in illustration. In this case comparatively little water was met with. Taking everything into consideration, therefore, it is reasonable to infer that the only natural obstacle that could hinder the completion of the work would be the existence of open, unfilled fissures in the bed rock, reaching from the sea bottom to the depth of 200 feet through the rock. The probability of the existence of such fissures and the chances of striking them on the line of the proposed tunnel are extremely small.

The preliminary work abovenamed is being steadily advanced; and should the results obtained continue to verify the anticipations formed by the engineers in charge, the actual undertaking of the tunnel proper will not be long delayed. The funds for the preliminary work are guaranteed by several prominent corporations and the Rothschilds, and there is every reason to believe that the two governments interested will come to the aid of the projectors of the work, at the proper time, by the grant of a liberal subsidy.—*Dr. W. H. Wahl.*

The Mass Copper of Lake Superior Mines, and the Method of Mining it.

BY PROFESSOR WILLIAM P. BLAKE, OF NEW HAVEN, CONN.

The occurrence of enormous masses of pure copper has given the mining districts of Lake Superior worldwide reputation. The first masses brought from there excited great attention, and directed the notice of the mining world to the few particular mines from which they were taken. It may not now be generally known that nearly all the veins which are worked, and which cut across the trap ridge, contain mass copper, and that large masses are continually being raised from them.

The largest continuous mass which has been taken out was probably that from the Minnesota in 1857, which is variously stated as weighing 420 tuns and 470 tuns. Its length was about 45 feet, its breadth or hight 22 feet, and its greatest thickness 8 feet. All such masses are very irregular and ragged in their form and thickness, thinning out gradually from a foot to a few inches, and struggling through the vein until they connect with other large masses. This was the character of a mass found in the Phœnix mine, one of the oldest on the Lake, which mass altogether weighed some 600 tuns. But this was really a series of masses more or less connected by strings of metal, yet no one large part of it weighed, singly, over 200 tuns. A similar series of masses, weighing about 600 tuns, was extracted from the Minnesota. Some of the Phœnix masses were four or five feet thick of solid copper. The Cliff mine has yielded masses weighing from 100 to 150 tuns in one piece. One of 40 tuns was taken out this year, besides numerous blocks weighing from 1 to 8 tuns. This mine and the Central are now yielding mass copper in abundance.

It is of course impossible to pick, or to drill, or to break out such huge masses of solid metal, when they are found by drifting upon the course of the vein. The method is as follows: The miner picks out, or excavates, a narrow passage or chamber upon one side of the mass, laying it bare as far as possible over its whole surface. It is usually firmly held by its close union with the vein stuff, or by its irregular projections, above, below, and at the end. If it then cannot be dislodged by levers, the excavation of a chamber is commenced behind the mass, and this excavation is made large enough to receive from five to twenty or more kegs of powder. In one instance, in the Cliff mine, a charge of 21 kegs of powder threw down 200 tuns of copper. Bags of sand are used for tamping, and the drift is closed up by a barricade of refuse and loose dirt. After such a blast the drift is, of course, charged with foul air, and it cannot safely be entered for hours afterwards. If entered too soon, men lose all strength in their limbs, and fall down.

The huge masses of copper dislodged in this way are too large to be handled and got to the surface. They have to be cut up. The copper cutters are called in, and the mass is marked off in squares or blocks of suitable size. Copper cutting is a distinct art, and requires considerable skill and experience. Ordinary miners, however skillful they may be cannot cut up copper without long training.

The tools are simply narrow chisels and striking hammers The chisels are shaped like the parting tools of turners. They are made of flat bars of half inch steel, about 2 inches wide and 18 inches long. They are chamfered each way like a cold chisel, to form the cutting edge. This edge is made a little longer than the thickness of the bar. The cutter holds the chisel and two men strike it. A thin slice or chip of copper is in this way cut out in a narrow channel across the mass of copper. The operation is repeated until the narrow cut, but little over half an inch wide, has been carried through the mass. The chips cut out in this way are long narrow strips of copper only about half as long as the groove from which they are taken, the metal being condensed and thickened by the force of the blow

This work is necessarily slow and tedious, and it costs $12 per square foot by contract. At this price, the cutters make $2 per day.

It is inconvenient to handle masses weighing over 6 tuns. Such masses, when hoisted, are landed upon very strong platform trucks, and are then dumped in the rock house upon a large pile of dry pine logs. When a considerable number of masses has accumulated, the logs are fired and the whole pile is heated to redness, for the purpose of loosening the very considerable quantities of vein stone which are enclosed in the ragged cavities. This vein stone consists chiefly of calcite; and after cooling off, it is so much softened that the

greater portion can be knocked out by pounding upon the copper.

The masses are then marked, numbered, and recorded, and are shipped to the smelting works, where they are melted down in reverberatories.

Knight's Mechanical Dictionary.

This excellent publication, from which we often give extracts and select engravings, has lately been purchased by the firms of Messrs. Hurd & Houghton, New York city, and Messrs. H. O. Houghton & Co., Riverside Press, Cambridge, Mass., from Messrs. J. B. Ford & Co., the former publishers. The well known reputation of the new publishers is abundant assurance that the work will lose nothing, in point of superiority, in the manner in which the few parts yet to be issued will be brought before the public. We learn from Mr. Knight that the Dictionary will be rapidly pushed forward to completion, and will probably be finished within four months. Some twenty-seven numbers have already been published.

NEW BOOKS AND PUBLICATIONS.

CAMP LIFE IN FLORIDA, a Handbook for Sportsman and Settlers. Compiled by Charles Hallock. New York city: Published by the "Forest & Stream" Publishing Company. American News Company, Agents.

We have heard so much of the Adirondacks, during late years, as the "sportsman's paradise" *par excellence*, that it is altogether refreshing to take up a book which suggests the advantages of one of the most beautiful and, save a small part of Florida visited by invalids, least frequented portions of the country. The compiler has embodied, in a handy volume, some excellent papers published in *Forest and Stream*, which were the result of the labors of an exploring expedition sent out by the enterprising publishers of that journal during the last two winters. We can commend it as something very much better than the hybrid productions, half fact, half fiction, in which modern writers, describing the scenes of past sporting adventure, are very prone to indulge.

ORNAMENTAL DESIGNS FOR FRET-WORK, FANCY CARVING, AND HOME DECORATIONS. Part 1, price 75 cents; Parts 2 and 3, $1 each. Edited and Published by Henry T. Williams, 46 Beekman street, New York city.

Since the introduction of the ingenious machine saws for amateurs, with some of which the readers of the SCIENTIFIC AMERICAN are already familiar through the illustrations and descriptions published from time to time, there has been a growing taste for this most fascinating and artistic branch of woodworking. So many beautiful home adornments can be cut out of various colored woods that an endless fund of amusement is found in the manufacture, and in many instances considerable profit beside. The work (published in numbers), the title to which we give above, is one which will be an invaluable aid in the designing of objects to be carved, embracing artistic designs for picture frames, wall pockets, brackets, book racks, book stands, baskets, easels, platters; in fact, a great variety of other fancy articles can be produced by fine saws. The numbers are mailed on receipt of price.

GASFITTER'S AND PLUMBER'S GUIDE. By Joseph D. Galloway, Gas Engineer. Published by the Author. Price, in paper, 75 cents. Philadelphia, Pa.: 1332 Chestnut street.

A handy volume of practical suggestions for the trades to which it is addressed. There are a large number of useful recipes, and a few illustrated descriptions of patented devices invented by the author, together with tables relating to weight of pipes and wire, and other data referred to constantly by workmen. The directions are clear and concise, and comprehensible by any one of average intelligence. The book contains about 100 pages; and its accuracy is vouched for by the long practical experience of its author.

IMPROVED DIARY AND MARGINAL INDEXED BOOK OF DAILY RECORD. Revised and Arranged by M. N. Lovell. Mailed, post paid, for $2.00. Erie, Pa.: Erie Publishing Company.

This diary is so arranged that, by means of marginal indexes, the user can at once turn to the page on which the events of any day are recorded; and also, through an alphabetical index, he can easily find notes of various days on which similar events have happened. It is available for five years. For inventors desiring to keep proper chronological records of their ideas, it will prove a useful aid. It is especially well suited to be in one's pocket during visits to the Centennial, as it affords excellent facilities for jotting down notes, and grouping and easily finding them at will.

REPORT OF GENERAL CHARLES K. GRAHAM, Engineer-in-Chief of the Department of Docks, for the Year ending April 30, 1875. New York city: M. B. Brown, 201 William street.

Recent American and Foreign Patents.

NEW AGRICULTURAL INVENTIONS.

IMPROVED COMBINED CULTIVATOR AND HARROW.

George Croll, Tontogany, O.—This relates mainly to a new mechanical construction, which is such that the beams which receive the shovel plows may be adjusted to run level, whatever the position of the draft bars, and so that, when the said bars are parallel, the beams may incline toward each other. Braces are added, which may be adjusted to correspond with the draft bars.

IMPROVED ANTI-SUCKING BIT FOR CALVES, ETC.

John H. Bailey, Toledo, Iowa.—This is a novel device to prevent the sucking of calves or colts. It consists in a tubular bit, having open ends in communication with the external air, and an opening located inside of the mouth, so that, when the animal attempts to suck, air only will be drawn in through the bit.

IMPROVED MACHINE FOR BINDING GRAIN.

Argyle W. Tucker, Waxahachie, Tex., assignor to himself and L. J. Stroop, same place.—This machine combines several novel and ingenious devices, which together operate as follows: A band procurer moves forward into a band trough and takes up enough straw for a band. On the latter the gavel is caused to fall and then is compressed between fingers. The free end of the band is next carried over and caught by a forked needle, by which it is twisted around the stationary end. As the needle makes its last half revolution, it draws the stationary end out of the jaws of the band procurer and tucks the free end of the band under the body of the same. The mechanism then leaves the sheaf free, and a fork, moving upward and outward, throws it from the machine.

IMPROVED CORN-SHELLER FEEDER.

William B. Quarton, Fremont, Iowa.—This invention relates to certain improvements in feeders for corn shellers in which the ears of corn are carried up by means of endless belts and delivered to the holes or feeding throats of the machine. The improvement consists in using a single broad apron, or wide endless belt, which moves beneath the channels in the feeder, and is provided with buckets, which receive and carry up the ears. It also consists in dividers of considerable hight, which are applicable to machines having four or more throats, and divide the channels into sets of two, thus causing the ears, which are dumped promiscuously, to assume a longitudinal position in the channels, and thereby increasing the feeding capacity of the device.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED AUTOGRAPHIC TELEGRAPHIC INSTRUMENT.

John C. Ludwig, San Francisco, Cal.—This invention relates to a new telegraphic instrument belonging to the autographic or *fac simile* class, and designed to produce a record in the same handwriting as the original written message. The invention consists in an oscillating traverser, vibrating in unison with a similar traverser, at another station, which first traverser makes the circuit through the conducting lines of writing upon a slip of paper, and the second traverser effects the record by puncturing the paper through the instrumentality of a spark from an induction coil, so that the message is recorded in facsimile by a series of little holes or punctures. Another important feature of the invention is the method of preparing the paper upon which the message is written, and it consists in treating it with a mixture of ferrocyanide of potassium and coal oil, which renders the paper non-conducting except in the lines of writing made by an ordinary lead pencil. The invention also consists in numerous other details of construction for which reference must be made to the specification.

IMPROVED SEWING MACHINE FRAME.

Harriet Ruth Tracy, New York city.—This invention consists in an improved construction of the end frame for sewing machines, which frame is provided with peculiarly arranged casters or rollers, and with lugs or cars which adapt the frame to receive a hinge-folding section of drawers without alteration or injury to the said frame.

IMPROVED CAR LIFTER.

General John D. Imboden, Richmond, Va.—This invention relates to means for transferring loaded cars from a track of one width to that of another without breaking bulk. It consists in using inclines located in a pit under the railroad track, movable truck frames, and a vertical lifter; also in combining with the latter crutches, a pitman and stirrups connected with the crosshead of an engine.

IMPROVED COTTON PRESS.

W. W. Wallace, Neckesville, Tex.—This invention relates to the mode of actuating the follower of a cotton press so as to combine convenience and facility of operation with a maximum of compressing power. It consists in connecting the lever arms and follower by arms that are pivoted to each, while the windlass is arranged under the press follower and connected by cords with a set of levers.

IMPROVED EYELETING MACHINE.

John J. Allred, Charlotte, N. C., assignor to himself and Alson G. Jordan, same place.—In this machine, the magazine containing the eyelets and the chute for conducting them to the inserting tool slide forward to carry the eyelet over the tool by a spring, and are forced back by a cam lever worked by the slide of the tool. In going back they work the feeder, by which the eyelets are delivered from the magazine into the chute. The slide of the inserting tool also works the feed, and the punch is worked by a cam on the driving shaft and a spring. The general arrangement is simple and doubtless effective.

NEW HOUSEHOLD ARTICLES.

IMPROVED CLOTHES HOLDER.

James Lesh, Warren, Pa.—The invention is an improved device for holding bed clothes or coverings properly stretched, and preventing their being thrown or pushed off in consequence of the restive movements of children while asleep. It is also applicable for holding lap robes when riding. The same consists of an elastic band having a sheath or guard hook attached at one end, and tapes or cords attached to the other. The hook is inserted through the clothes or robe, and the strings are tied to the person or to some fixed object. The elasticity of the band enables the clothes or robe to yield and adjust themselves to the movement of the legs or body.

IMPROVED IRONING STAND.

John Finfrock, Piqua, Ohio.—The invention relates to the manufacture of ironing stands, so that garments can be conveniently manipulated in the process of ironing, and so that they may be readily folded up and packed in a small space. The stand consists of two posts, provided with crossbars at top and connected by a rail jointed at one point, the board being open at the end and provided with a clamp screw.

IMPROVED INVALID BEDSTEAD.

William Huntress, Richmond, Va.—A portion of the mattress is supported on a hinged frame, which, being dropped, allows a vessel and a chute to be adjusted in a portion of the bed convenient for the requirements of the occupant.

IMPROVED PICTURE NAIL.

John P. Stockton, Jr., New York city.—This inventor proposes a nail having a stationary disk upon it which presses close against the wall, and so affords an additional support, and having a knob composed of two parts, the inner portion being loose. The idea is to allow of the ready adjustment of the suspending cord or wire without requiring the raising of the suspended object.

NEW WOODWORK AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WAGON BRAKE.

Halvord Markrud, Ettrick, Wis.—This inventor proposes an arrangement of brakes in connection with the tongue, which is pivoted to the hounds and has rear branches which act upon the horizontal brake levers. By this, when the wagon presses forward against the tongue, the levers are operated to press shoes forward against the wheels, and the friction of the wheels causes the shoes to rise, bringing their wider part against the wheels and making the pressure greater. When the wagon is backed, suitable devices prevent the shoes from acting upon the wheels.

IMPROVED WAGON BOX.

Timothy Jennings, Moulton, Iowa.—This invention relates mainly to an improved and strong construction of a wagon body which may at any time be used with or without top box, which forms a rigidly attached extension of the same. The different binding straps and stays connect the body in a solid and durable manner, so as to impart to it the required strength and resistance to heavy loads, while they may be readily replaced without difficulty when they get broken or injured by use.

IMPROVED SHIFTING BUGGY TOP.

Henry M. Gillespie and Virgil True, Laclede, Mo.—This invention relates to certain improvements in shifting tops for carriages, buggies, etc; and it consists in a horizontal bottom rail, to which the top frame is attached, which said rail is slid into grooves around the top edge of the seat and held therein by a locking key. It also consists in a double set of vertical supporting props for the top, whereby the latter is more securely held in an elevated position.

IMPROVED SCROLL SAW.

Wm. C. Margedant, Hamilton, Ohio.—The object of this invention is to provide a straining device for a scroll saw adapted to a great length of stroke, and of uniform tension or strain through all parts of said stroke. It consists in a spring bent in a circular, elliptical, or oval form, so that the two ends approach each other, in combination with a lever placed between said ends and swiveling upon either an independent or imaginary fulcrum, so that as the lever is depressed the ends of the spring are active upon the same upon opposite sides of the fulcrum, and as the lever approaches its limit of movement the ends of the spring approach an alignment, and the strain of the spring is correspondingly diminished, just in proportion as the leverage of the lever increases, thus rendering the strain uniform throughout its entire movement. The invention also consists in the peculiar construction of a hollow pitman pin, to be filled with lubricating material, and designed to operate as an automatic lubricator.

IMPROVED BAND SAWING MACHINE.

Wm. C. Margedant, Hamilton, Ohio.—This invention relates to ingenious and valuable improvements in band sawing machines; and it consists principally in the construction of the upper band saw wheel, which is made with an independent loosely sliding face, periphery, or rim, upon which the saw blade runs, the object being to obviate the bad effects arising out of the momentum of the said upper wheel when the lower wheel and actuating mechanism are stopped. The invention also consists in a double acting brake, designed to operate upon both sides of the periphery of the driving wheel to prevent strain and uneven wear upon the shaft, and also in the peculiar construction of back thrust guides, which consist in a series of balls or spheres, which are so arranged as to present always a new surface to the back of the saw blade. The invention also further consists in the means for adjusting the upper band saw wheel, and in other details of construction.

IMPROVED WATER SUPPLY AND VENT FOR TRAPS.

John H. Morrell, New York city.—This inventor has recently devised several useful devices of similar nature to the present one, many of which have been illustrated in late issues of this journal. He now suggests certain new improvements in conducting water from the roof of a building to the water closet, or other traps connected with the building, by leading a pipe from the roof, and connecting it at a point below the drop cup or pan of the water closet, either to the bowl or pipe leading therefrom to the trap. The object is to prevent the escape of sewer gas into the house.

IMPROVED MACHINE FOR BORING BLIND-STILES.

Freeland H. Dam, St. Cloud, Minn.—This is a machine for boring blind stiles, fence rails, and other articles with holes of uniform depth at equal space from each other, and for carrying on the boring operation continuously. By suitable mechanism the exact feed of the boring tools, in either direction, is easily and quickly produced; and by the alternate action of the same one stile is bored while the other stile is fed forward, so that a continuous work of the machine is obtained.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED COMBINED CANE AND WHIP.

Oliver H. Saxton, Washington Court House, O.—This inventor has devised an ingenious combination of a cane and a carriage whip. The whip portion proper is flexible and made solid, and is attached to tubular sections, which are telescopic, so that, to extend the whip, they may be drawn out and secured by their screw joints.

IMPROVED BOTTLE STOPPER.

Adolph Luthy, New York city.—In this a curved-wire spring lever, that carries the stopper, is secured on the bottle by a bail pivoted to the neck band of the same, binding on a recessed top rest of the stopper plate. The lever is first pressed tightly on the stopper, and the bail then slid up over the same, holding both stopper and lever firmly in position by the spring action of the stopper and lever. The device is cheap and easily operated.

IMPROVED SCHOOL DESK.

Thomas Redmayne, Sheffield, England, assignor to William Redmayne.—This inventor proposes to make the plane surface which forms the desk capable of being adjusted and fixed either in a horizontal position, to serve as a table, in a slightly inclined position, to serve as a desk, or in a nearly vertical position, to serve as a back to the seat, which is ordinarily arranged in connection with such desks. The invention consists in mechanism for adjusting and altering the angle of the desk, and also of mechanism for locking or fixing the board or desk when it has been adjusted in the required position, so that it cannot be altered, except by releasing the locking mechanism.

IMPROVED TAILOR'S APPARATUS FOR DRAFTING PATTERNS

John Bellamy, New York city.—This inventor has devised an ingenious chart, which represents, in miniature, the forms of the different parts of the shirt. The points to draw and cut to are numbered on all the parts to correspond with the actual measures on a scale of proper size for laying off the true measures on the cloth to be cut. A different scale is used for each different size or number of shirt.

IMPROVED BELL METAL TOY BALL.

Jonathan C. Clark, Middle Haddam, Conn.—This is a hollow ball, which is made of bell metal, and in one side of which is formed a slot to allow the metal to vibrate, and thus give a sound. In the ball are formed a number of holes to allow the sound to escape freely, and within the cavity of the bell is placed a small ball, to act as a hammer to cause a sound as the said ball is rolled or shaken.

IMPROVED CIGAR PIPE.

Robert L. Weed, New York city.—This inventor proposes to overcome the prejudices of people who object to pipes by a little device which enables a smoker to enjoy his favorite tobacco, and at the same time to appear as if inhaling the fragrance of a cigar. It consists in a hollow sectional tube, resembling a cigar, made of wood or other suitable material. The tobacco may be readily compressed by the finger into both sections, so as to form a filling corresponding to that of a cigar, while the smoker can always secure and know the kind and quality of tobacco which he is about to use.

IMPROVED YARN-PRINTING MACHINE.

James Short, New Brunswick, N. J.—This is a very ingenious machine, devised for printing the yarn used in carpet manufacture. Its mechanism it would be impossible to explain without the aid of detached drawings; but the essential portion consists of new operative mechanism for a thread printing drum, by which the latter is greatly simplified.

IMPROVED GLOBE ATTACHMENT TO CLOCKS.

Henry Fick, New York city.—In order to show the position of the earth at any hour, this inventor arranges a globe so attached to a clock that it turns in unison therewith, and, at the same time, is free to be turned forward or backward by hand at any time in case it may be required to do so. When let go by the hand, the globe will automatically return to its true position, relatively, to the clock.

Business and Personal.

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

Notes & Queries

D. L. M. (steam pressure in caldron), does does not send sufficient data.—J. S. F. and others are informed that there is no such instrument as a rod that will indicate the locality of coal in the earth.—H. M. T will find a recipe for cement for leather on p. 119, vol. 28.—A. will find directions for pickling cucumbers on p. 155, vol. 31.—C. A. B. will find a recipe for a white metal on p. 393, vol. 31.—J. W. H. will find a recipe for cement for china and glass on p. 379, vol. 32.—M. will find full descriptions of friction gears on pp. 227, etc., vol. 26.—J. S. S. can polish his gun barrel by following the directions on p. 11, vol. 32.—W. W. S. will find directions for cementing leather to iron on p. 347, vol. 30.—J. C. P. will find directions for calculating the teeth of compound gears on p. 187, vol. 29.—E. H. can fasten emery to a belt with good glue.—G. B. S will find full directions for constructing friction gears on p. 227, etc., vol. 26.—J. C. W. can calculate the amount of friction of water in a pipe by the formula given on p. 48, vol. 29.—M. G. will find that a treatment of catarrh was described on p. 85, vol. 32.—J. S. W. can cement cloth to wood with marine glue. See p. 43, vol. 32.—J. S. S. can waterproof leather by the method described on p. 155, vol. 26, and paper by that detailed on p. 146, vol. 31.—E. W. C. can put a black enamel on his iron castings by following the directions given on p. 208, vol. 26.—T. D. B. can fasten emery to wood by the method described on p. 203, vol. 32.—G. B. M. can clean fly specks off gilt moldings by the process detailed on p. 27, vol. 31.—J. V. R. will find full directions for making induction coils on p. 219, vol. 32.—J. E. S. can copper cast iron by following the directions on p. 90, vol. 31.—A. McK. will find a description of meerschaum on p. 11, vol. 32.—G. C. U. and others will find an explanation of an iceboat sailing faster than the wind on p. 331, vol. 33.—S. B. will find full directions for polishing magnifying glasses on p. 363, vol. 31.—F. C. will find answers to all his questions on electroplating in No. 34, p. 284, vol. 33.—J. V. B. P. will find directions for hardening files on p. 212, vol. 26.—W. E. and G. W. McB. will find a recipe for liquid glue on p. 90, vol. 32.—J. F. C. and others are informed that the force of a falling blow is discussed on p. 90, vol. 32.—H. G. B. will find a recipe for bronzing on iron on p. 283, vol. 31.—W. W. S. can cut glass bottles by following the directions on p. 399, vol. 24.—H. J. B. can remove fruit stains by the method described on p. 283, vol. 31.—E. J. C. will find a description of a straw-burning engine on p. 214, vol. 30.—W. H. C. will find a detailed account of the sand blast on p. 296, vol. 25.—N. T. H. will find directions for etching on glass on p. 409, vol. 31.—N. will find directions for gilding picture frames on p. 347, vol. 31.—C. W. S. can preserve his skates from rust by the method detailed on p. 283, vol. 31.—E. J. O. will find directions for making artificial stone on p. 350, vol. 25.—H. B. B. will find directions for making rubber printing stamps on p. 156, vol. 31.—W. E. will find directions for crystalizing the surface of tin on p. 304, vol. 31.—P. H. H. will find a good recipe for shoe blacking on p. 283, vol. 31.—J. L. K. can galvanize iron articles by the process described on p. 59, vol. 24.

(1) F. F. asks: Is there any way to prevent lamp chimneys from breaking by heat, or by cold in daytime, when the lamp is not burning? A. If the chimneys be properly annealed, they will not easily break, if ordinary care be taken not to spatter them with cold water when very hot.

(2) S. T. R. asks: Will you please state what is the simplest test for the presence of free carbonic oxide in the atmosphere of rooms in a dwelling? A. There is no simple method of doing this satisfactorily, owing to the solubility of all the combinations into which it enters. A solution of the bichloride of copper in hydrochloric acid, or of a salt of the dioxide of copper in ammonia, gradually absorbs carbonic oxide if agitated with it.

(3) J. A. R. asks: How can I make liquid gold and silver, to be used for writing on paper? A. Procure a book of leaf gold, take out the leaves gently and grind them in a mortar with a piece of honey about the size of a hazel nut, until it is thoroughly intermixed with the gold; then add a little water and rework it; put the whole into a phial and shake well. Let it remain an hour or two, and the gold will deposit at the bottom of the phial. Pour off the liquor, and add weak prepared gum in its stead, sufficiently to make it flow freely from the pen. When required for use, shake it occasionally.

(4) G. H. asks: Is there any marking ink sold which does not contain silver salts? The laundry washing removes all marking by $AgNO_3$ ink, probably using KCN. Some kinds of indelible printing ink are not affected. Can you give the ingredients for any such ink, to be used with a pen? A. Make a solution of genuine asphalt in alcohol. This is one of the best indelible inks known. You may find it, already prepared for sale, under the name of indelible carbon ink. Aniline black also gives very good results.

(5) W. F. W. says: 1. We have at our works three steam boilers, 26 feet long by 36 inches diameter, with 2 flues in each of 14 inches diameter. Furnace is 11 feet wide and grate bars 4 feet long. Boilers are set 15 inches from surface of bars; smoke stack is 42 inches in diameter. We require 80 lbs. of steam to do the work, and it requires skillful firing and constant hard work to make the steam. By this forcing of fires, a waste of fuel occurs. We use river water, and wash out the boilers once a week, and we find a deposit of scale in each, about two quarts in quantity, collected in a circle 8 or 10 inches in diameter, 40 inches from front of boiler. It is in the same place every week. Would the use of grate bars 12 or 15 inches longer overcome the necessity of forcing the fires, and give more heat? A. It is probable that your best plan would be to put in another boiler. Before doing this, however, we advise you to have your boilers tested, so as to ascertain whether they are as efficient as they should be. 2. Is it the intense heat on the front sheets that causes the scale to collect in a circle in the same place? A. The reason suggested for the formation of scale in particular spots is very plausible.

(6) J. S. E. says: We tried preserving eggs by coating them with paraffin, but the warm paraffin was chilled the instant it touched the egg, and it seems impossible to apply it. How can it be done? A. Send us a copy of the directions that you made use of.

(7) J. N. P. says: On a three story house was suspended a scaffold, the weight of which was not over 150 lbs.; the rigging of the scaffold was made of ⅜ inch rods, and chains, the links of which were also made from ⅜ rods. An accident occurred when there were two men on the scaffold, weighing probably 150 lbs. each. The scaffold was one of a pair which were swung together, with a bridge between. At the time of the accident one man was near one end of the bridge, and the other about the middle of the bridge, which was about 12 or 15 feet long. All at once, without any warning, one of the rods pulled in two, and the scaffold fell; the strain was from end to end (tensile); the end of the broken rod showed no fracture, and it was not splintered, but had more of the appearance of coarse cast iron; the crystals were very distinct. The iron was bought for the best Swedish wrought iron. 1. Do you think the rods were overloaded? The rigging has been in use about four years, and has been used in all kinds of weather. A. From your account, we infer that the accident was caused by a defect in the iron. 2. What do you think would be a safe load for a scaffold fitted with such rods? The total weight of the bridge was not over 75 lbs. A. Each rod, if made of good material, should be capable of sustaining with safety about 1,000 lbs.

(8) C. D. asks: Please give the formula for producing the white finish upon thermometer and barometer tubes. A. The white enamel sometimes seen is made by fusing together hard flint glass and white arsenic, in the proportion of 10 parts of the former to 1 part of the latter. In some cases, calcined bone or ivory is used in place of the arsenic. The proportions in this case are the same as in the former.

(9) T. D. H. asks: How can I make a good barometer? A. Obtain a good strong glass tube, about 34 inches long and having as smooth and even a bore as possible. Close one end by means of a spirit lamp and blowpipe, or Bunsen burner, and fill the tube with pure clean dry mercury, being careful to exclude all bubbles of air. Then place your finger over the open end of the tube and carefully invert it into a small vessel, partially filled with mercury. Be careful not to remove your finger until the end of the tube which it covers is safely below the surface of the mercury in the reservoir. When the tube is thus inverted the contents will fall until the hight of the column is about 30 inches above the level of the mercury in the little reservoir below. In the barometer the mercury never rises above 31 inches, and rarely falls below 27. The scale is therefore applied only to that part of the tube which lies between these limits. This scale may be adjusted properly by comparison with some standard instrument.

(10) M. O. asks: Of what metal shall I make an inkstand which will not corrode or spoil the ink? A. You fail to state what kind of ink. Ink varies greatly in composition. As a general rule, the metals (gold, platinum, etc., excepted) could not well be employed for this purpose, as in many cases they would contaminate the ink. Try bone, ivory, horn, or some kind of close-grained, hard wood.

(11) C. W. H. says: Herewith is a rubber band which has the appearance of having been subject to heat sufficient to destroy its elasticity, and almost to char it. In 1870, I placed this band around a bundle of letters, and put the bundle away. From that time it has not been disturbed. I find this band in its present condition, while the letters on the outside of the bundle next to the band, as well as all papers lying next to it, are discolored and have the appearance of being scorched. There was nothing else in the drawer in all that time, except clean bundles of letters. Can you account for it? A. The specimens forwarded prove to have undergone oxidation, but it would be surprising if the results noted could be traced to this. The degree of heat necessary to have scorched the paper, as stated, would have caused a partial decomposition of the rubber, leaving it in a viscous condition, which is not the case.

(12) J. B. asks: How can I carbonize, decarbonize, and extract phosphorus from iron, when melting it on a small scale? A. Fuse with a small quantity of cubic niter and calcium chloride.

(13) J. S. B. asks: Can you inform me of the process for a detonating compound composed of chlorate of potash and amorphous phosphorus, and the nature of the explosive conditions under which it explodes, etc.? A. Glue, or gum, or any similar substance is first dissolved in a small quantity of water to the consistence of a thin sirup, with which, having been heated to 122° Fah., the phosphorus (amorphous in powder) is incorporated, by gradually adding it and keeping the mixture stirred so as to form an emulsion, to which is next added the chlorate of potassa, having been previously well pulverized. The amount of phosphorus should be in the proportion of $\frac{1}{10}$ or $\frac{1}{12}$. A drop of this mixture, if allowed to dry, detonates violently on the slightest friction as well as by contact with flame.

(14) A. B. B. asks: How can I remove grease spots from paper? A. Warm the paper and cover it on both sides with dry, finely ground pipe clay, and place it under a slight pressure for a few hours. Then dust off the clay, and remove the fine dust that still adheres by means of a good piece of india rubber.

Can carbonic acid gas be collected and liquefied from tubs of fermenting grain, as in distilleries? A. Yes, but we do not think it would repay you for your trouble.

(15) H. & W. ask: We wish to dissolve some bleached shellac, and have tried alcohol, spirits of turpentine, and potash, but all have failed. Can you tell us what will do it? A. If the substance in question is really shellac, alcohol will dissolve it readily. Shellac is also soluble in a hot solution of borax in water.

(16) E. S. C. says: I am building a side wheel boat, 18 feet long and of 5 feet beam. The engine cylinder is 3 inches by 6 inches. Please give proper dimensions for paddle wheels to run at the rate of 7 miles per hour. How fast should they revolve? Is it best to speed back with cog gear or belt? A. It is not probable that you can realize the speed you mention. We would recommend wheels about 3 feet in diameter, making 30 to 35 revolutions a minute. You can use friction gearing to advantage.

(17) P. asks: What buoyancy in sea water will a globe of glass containing 100 lbs. weight of atmospheric air have when immersed to a given depth? In other words, if a utensil containing 100 lbs. of air is submerged in water, how much weight will it carry or hold up without sinking? How many cubic inches of space contains 100 lbs. of air? What is the weight of air by the gallon? A. You do not send sufficient data; but we will give you what you need to work out the example. The weight of one cubic foot of air, at ordinary temperature and pressure, is 0·076391 lbs.

(18) W. T. A. says: I am using two return flue boilers 28 feet long and 3 feet 4 inches in diameter, and a new high pressure Corliss engine. I burn wood and have plenty of draft. The water is full of lime, which stops my gages up and precipitates in large quantities throughout the boilers and engine. If I use a heater, exhausting from the engine into it and then allowing the steam to escape at the other end of the heater, would it purify the water at all, and help me out of my trouble? A. The use of a good heater would probably prove of advantage in your case. It would be well for you to blow off some of the water in the boiler once or twice a day.

(19) W. B. asks: What sized wheel is proper for a side wheel steamboat 80 feet long, of 15 feet beam, and 4 feet deep? Should the whole house be perfectly round, or does it want to slant out at the bottom? A. Make the wheel as large as convenient. It will answer very well to use a round wheel house, leaving some clear space below.

(20) W. B. G. says: I am using several water wheels, which I think will be sufficiently described by calling them center vent turbine wheels. If I gear them so that, to do the same work as now, they would have to make more revolutions, do I thereby increase their power? I also use more water. In other words, does the amount of water vented bear any relation to the speed of the wheel, and can a small wheel be made to do the duty of a larger one by simply increasing its speed relative to the work to be done? A. Generally, any particular wheel has a certain velocity at which it gives the greatest efficiency.

(21) C. J. H. asks: How can I insulate copper wire for an induction coil? A. Cover the wire with silk. The longer the wire, the greater the shock. One thousand feet will give a good shock.

(22) N. B. A. asks: Please give me a recipe for an ink which, although it is of a reddish color when first applied to the paper, in a few moments turns black or purplish black. I think it is called chromium ink. A. Dissolve 3 ozs. solid extract of logwood in 3 gallons hot water; to this add ½ oz. bichromate of potassa, also dissolved in a little hot water. The ink, when cool, is ready for use.

(23) F. O. asks: 1. With what can I fasten leather to wood? The cement must not be soluble. A. Melt together equal parts of pitch and gutta percha. Apply hot. 2. Will kid leather submerged in kerosene be destroyed? A. We think not. 3. Will felt withstand the action of kerosene? A. It will.

(24) J. A. C. asks: Does the electric current used in sending a message to Europe or elsewhere return again to the instrument from which it emanated, either by a wire or by the ground? If the wire is dispensed with, does the current return by way of the earth in a direct line, and, having an affinity for the place from which it came, pass by all other attractions in its passage to that? A. The current does not return through the earth, but is absorbed by it at each end, thus causing a movement in the wire the same as if the ends were joined. It was formerly supposed that the current returned through the wire, but this has been proved to be incorrect.

(25) M. M. M. asks: By what method and under what conditions can the power of a permanent steel magnet be kept exactly the same for any length of time? A. The most effective way is to place a bar of iron across the poles.

(26) W. M. J. asks: 1. Would good varnish or paraffin make a good insulator for wire intended to be used in the helices of a relay? A. Silk or cotton would be better. 2. In what way does insulation act upon the condition of a magnet other than to separate one wire from another in the coils? A. Insulation of the wires is only inteaded to separate them, and prevent any conduction between the layers.

(27) E. C. G. says: 1. I am about to make an electro-motor. What metal must I use on which to wind the magnetic coils? A. Iron. 2. What kind and size of wire must I use? A. No. 14 copper wire.

(28) N. W. L. says: You state that grease or paint applied to the cells of a telegraph battery will prevent creeping. Having been annoyed by the creeping of our battery, and acting on the hint, we applied butter to it, that being the only grease at hand at the time. Since the application the battery does not creep, but the current is a great deal weaker. Is the butter the cause? A. No. Probably the battery needs fresh water.

(29) W. L. asks: 1. What bright large star is in the northeast, not very high, at about 6 P.M.? A. It is Capella, the principal star in the constellation *Auriga*. 2. What bright bluish star is high overhead to the westward? A. It is Vega, but more frequently called Lyra. It is the principal star in the Harp. 3. What large star is near *Orion* on the west side? A. It is Aldebaran, the largest star in the constellation *Taurus*.

(30) W. P. H. says: 1. I have in my possession two glass disks 2 inches in diameter, made by Chance & Co., of Birmingham, England. One consists of hard crown glass and one of dense flint. With these I wish to make a plano-convex achromatic objective: what should be the radii of curvature for the surfaces of the disks in order to have a focus of 10 inches? A. If the flint is of medium density, the curves of the crown may be 3·4 inches radius. The flint glass should be double concave, one side to fit the crown, the other side of 25 inches radius. If the flint is very dense, the curves may be of 3·5 inches radius for each side of the crown, and 26 inches for the long side of the flint. 2 What would be the negative and positive foci of the disks? A. The focus of the crown will be the radius, that of the flint ⅔ its radius.

(31) C. M. B. says: I have a soapstone griddle which, by accident, was thoroughly greased. How can I extract the grease? A. Wash it carefully with hot potash lye, and rinse with clean cold water until all trace of the alkali has been removed.

(32) R. F. S. asks: 1. What are the diameter, focus, and shape (plano convex or double convex) of the eye lens for a good microscope, and is it achromatic? A. The lenses of the eyepiece of a microscope are both plano-convex, made of single pieces of glass. The field lens is usually larger and of longer focus than the eye lens. 2. What is the diameter, focus, and shape of the field lens, and is it achromatic, and what is the proper distance between the eye lens and field lens? A. For medium powers, the field lens may be of 2 inches focus and the eye lens of 1 inch focus, set 1½ inches apart, with the convex sides toward the object. As they correct each other, the combination is achromatic. 3. What is the proper shape of an achromatic objective, plano-convex or double convex? A. The best objectives for high powers are made of three separate lenses, each lens of two kinds of glass. The best form for a single lens of one piece of glass is a double convex, whose radii are as one to six.

(33) I. J. asks: How shall I clean the lenses of optical instruments? A. Breathe on the glass, and wipe with chamois skin or the nap side of cotton flannel. Paper of any kind would be very likely to scratch the glass. This also answers A. F. O.

(34) H. S. asks: What is the magnifying power of the home-made compound microscope, described in your issue of October 30, 1875? A. If the tube or body of the home-made compound microscope be 12 inches in length, the magnifying power would be about 100 diameters. The same eyepiece, with an objective of ⅙ inch focus, would give a power of about 200 diameters; then by lengthening the body, the power may be easily increased to 300 or more. A common and convenient way of determining the power of a microscope is to focus an object of known size, and place a rule on the stage outside, then look with one eye at the object in the microscope and with the other at the rule. It will readily be seen how large the object appears to be on the rule, and this gives the approximate magnifying power

(35) H. M. says: I am getting up a small engine and boiler to drive a yacht. If my boiler will furnish steam to fill a 3x3 cylinder, and I put in 6 cylinders each 3x3, cut off each at ⅓ stroke, and use the steam expansively the rest of the way, could you recommend such a course? A. We cannot recommend the plan.

(36) R. J. F. asks: Is it possible to improve an object glass of a telescope by change of figure, if the fringes around objects are equally colored with green and purple? Would the thickness of the glasses make much difference? A. Telescopes are usually made of a double convex crown and a concave flint. In small objectives, of less than 3 inches diameter, the flint is usually double concave, and in large glasses, concavo-convex. The following curves for a 6¼ inch objective, of 8 feet focus, answer very well: Outside curve of crown 50 inches radius, contact curves 29 4/10 inches, and the back convex side of flint 140 inches. This combination forms an achromatic lens, which will get rid of your trouble.

(37) R. M. asks: How must the lenses be set, and of what size and focus must they be for the home-made microscope, recently described by you? I want it to magnify from 1,000 to 1,500 times. A. The lenses must be set as described in the article. The focal length of the objective should be about ⅛ of an inch, and of the field lens of the eyepiece 1⅕ inches, and the eye lens ½ inch. Then, by lengthening or shortening the body, a power of 1,000 or 1,500 may be obtained.

(38) J. B. says: I am building a machine showing the earth turning on its axis at an inclination of 23½°, the moon revolving around the earth, and all around the sun. Is there such an apparatus in existence? A. There are very perfect instruments for showing the movements of the solar system. They are called planetaria. 2. Would it be best to make it vertical or horizontal? A. For the sake of convenience they are made vertical. They cannot be made correct, but only approximately so. 3. Do the planets return to the same places in a year? Will they be seen next year in the same place on the same day at the same time? A. The planets never return to the same place on the same day of the year.

(39) W. H. D. L. says: If milk is not properly cooled, or is confined in a tight can before the animal heat has passed off, it soon becomes tainted. Would bacteria or some similar organisms be present in such a case? A. Yes. 2. What must be the magnifying power of a microscope to reveal such organisms? A. A power of 200 diameters shows the animalculæ in stagnant water; and no doubt it would be all you would require. A less power, even, might answer your purpose.

(40) S. D. T.—You could not see anything in a mirror attached to a kite, because of the constant movement of the mirror and the highly magnified condition of the light coming from the mirror to the observer.

(41) E. R. asks: Does any one manufacture cast steel that can be tempered? A. All cast steel can be tempered.

(42) T. G. asks: It is asserted that water, in running out of a basin through a hole in the bottom, takes a rotary motion, and, when unmolested, the circular motion is always one way, namely, the same as the hands of a watch laid on its back. Is this true? A. We think not.

(43) F. R. B. asks: Can I arrange a small compound microscope so as to throw an enlarged image on a screen, as a stereopticon does? A. You cannot do it, on account of the high magnifying power, small field, and want of sufficient illumination.

(44) C. T. P. says: Please inform me which is the proper way to run a belt, with the grain or the flesh side next to the pulley. A. The grain side.

(45) W. H. P. says: I am running a 50 horse power tubular boiler, but have not got draft enough at times. The main flue is of iron, 2 feet in diameter, and passes up through the roof of the building about 4 feet, and then on a level 17 feet) to the chimney. Will a jet of steam help the draft? If so, how large should it be, and where should it enter the flue? A. A jet of steam in the iron flue will help your draft without damaging the chimney. The size of your jet must be determined by experiment.

(46) T. W. C. says: I have a boat, 50 feet long by 18 feet beam by 3½ feet depth. What should be the dimensions of engine, boiler, and feep pump respectively? She is to have a stern wheel, and her engine is to work at high pressure. A. You might use two engines, with cylinders 7 by 12 inches, and a vertical boiler 5 feet in diameter and 8 feet high. Feed pump should be 2½ inches in diameter and of 12 inches stroke.

(47) J. M. says: Please give us the best composition of brass to be polished, so as to give it the nearest resemblance of gold. A. Mix 10 parts copper and 1 part tin. Add 2 lbs. spelter to every 100 lbs. of the brass.

(48) S. M. C. says: Bloxam's "Chemistry" p. 203, Philadelphia edition, says: In the reduction of iron ore, a large sized blast furnace consumes *daily* 50 tuns of ore, 30 tuns of coal, 6 tuns of limestone, and 100 tuns *of air*. Is not the amount of air exaggerated? The working of a blast furnace is familiar to me; and considering the size of the blowers and number of strokes per minute, I cannot conceive of this amount of air passing through the tweers in the time given. A. The statement is correct. It falls under, rather than over, the truth.

(49) S. H. says: In regard to your article on "Flat Surfaces" (October 23, 1875) I would like to ask how the constants used in the formulæ are obtained? You say the factor of safety used is 8, but that seems to me to be indefinite unless we know what modulus of strength is used, and how it comes in. If you could give the formulæ in such a way as to bring in the ultimate tenacity or some other modulus easily determined for different qualities of metal, you would, it seems to me, make them much more useful to engineers. Perhaps you will inform us what different quantities are included in the constants of the given formulæ, that is to say, what modulus of strength, etc. A. The constants are those for tensile strength. It is assumed in the article that the ultimate strength is as follows: Cast iron, 20,000 lbs. per square inch. Wrought iron, 48,000 lbs. per square inch. Steel, 80,000 lbs. per square inch.

(50) A. J. M. says: I have an electromagnet of 1 inch iron, 1 foot long, having 100 feet of No. 16 copper wire on it. What amount of horse power will I require to make an electro-magnetic machine to cause that magnet to lift 100 lbs.? A. An eighth of a horse power would be ample.

(51) S. W. says: Salt of steel is the *sal martis* of the old chemists. It is common copperas, or green vitriol, or sulphate of iron.

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

A. G. S.—It consists of manganese, with iron, alumina, and silex.—J. M.—It is made of burnt sugar and chicory.—W. A. W.—The paper was covered mostly with a pigment having clay and lime for its basis, and no poisonous matters were detected in the small scrap forwarded.—O. P.—It is bituminous shale rock.—J. E. B.—It is sulphuret of iron.—W. L. W.—It is iron pyrites, and is worth working if the quantity is very large and the cost of mining small.—C. P. C.—It is carbonate of magnesia.—J. M. R.—It is yellow hydrated sesquioxide of iron on mica schist.—E. S. B.—It is galena, with a trace of silver.—A. M. C.—It is gold.—H. J. R.—If the specimen referred to was inclosed in a box (unlabeled) marked "Fine Steel Cutlery," it is iron pyrites.—C. F. H.—No. 1 is pyrites (no gold detected). No. 2 is an inferior kaolin. Use Dana's "Mineralogy."—J. F. F.—They are fragments of quartz and amethyst, with magnetic iron sand.—P. J. M.—We were unable to detect any foreign substance with the gelatin.—W. D. C.—It is calcspar and hornblende.—A. J. H.—Both are oxide of iron.—J. H. P.—Nos. 1 and 2 are quartz rock with small scales of mica. No. 3 is bituminous slate.—E. P. McL.—No. 1 is iron filings. No. 2 is red jasper.

A. C. S. asks: Can you give me a recipe for removing black smoke marks off a brick wall? We do not want to paint the wall.—W. A. K. asks: Can any one inform me of a good way of heating street railway cars.

On page No. 396 of this paper will be found an advertisement of a new recipe book, just published, which will be found a useful companion for reference by every one.

COMMUNICATIONS RECEIVED.

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

On a New Method of Ventilation. By L. B. G.
On Instinct. By C. T.
On the Formation of Planets. By H. L.
On Bankers' Safes. By S. M. L.
On the Wagner Free Institute. By W. H. W., and R. G.
On Explosive Oils. By J. R. C.
On Spectral Lines and Atomic Weights. By A. H. McK.

Also inquiries and answers from the following:

A. K.—J. R. T.—J. B. O.—S. W.—N. F. F.—R. M.—J. G.—D. A.—J. G.—G. N. T.—F. G. S.—J. D. H.

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 rubber tires for traction engines? Who sells machines for bending cold iron bars? Who sells carrier pigeons? Who makes screw-cutting dies, made to the Whitworth thread? Whose is the best engine governor?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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8,794.—BUTTONS.—J. R. Farrell, Boston, Mass.
8,795.—EMBROIDERY.—E. Crisand, New Haven, Conn.
8,796 and 8,797.—SODA WATER APPARATUS.—F. H. Shepherd, Boston, Mass.
8,798.—CARPETS.—T. J. Stearns, Boston, Mass.

SCHEDULE OF PATENT FEES.

On each Caveat..... $10
On each Trade mark..... $25
On filing each application for a Patent (17 years)..... $15
On issuing each original Patent..... $20
On appeal to Examiners-in-Chief..... $10
On appeal to Commissioner of Patents..... $20
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On filing a Disclaimer..... $10
On an application for Design (3½ years)..... $10
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On application for Design (14 years)..... $30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, November 12 to 16, 1875.

5,383.—R. C. Nugent *et al.*, Dayton, O., U. S. Machine for turning flanges on boiler heads. Nov. 12, 1875.
5,384.—A. Payette, Montreal, P. Q. Axle box. Nov. 12, 1875.
5,385.—G. W. Copeland, Malden, Mass., U. S. Boot and shoe lasting machine. Nov. 12, 1875.
5,386.—E. S. Howland, Batavia, Ill., U. S. Dress for metallic grinding rings. Nov. 12, 1875.
5,387.—F. N. Dullois, New York city. Manufacture of plumbers' traps. Nov. 12, 1875.
5,388.—W. H. Babbitt, Toronto, Ont. Cooking pot. Nov. 12, 1875.
5,389.—J. C. Blyth *et al.*, Ottawa, Ont. Milk can. Nov. 12, 1875.
5,390, 5,391.—E. W. Grant, Ypsilanti, Mich., U. S. Step ladder. Extension of No. 4,705. Nov. 12, 1875.
5,392.—A. M. Brush, Potsdam, N. Y., U. S. Organ stop action. Nov. 15, 1875.
5,393.—W. H. Johnson *et al.* Combined milk pan and water vat. Nov. 15, 1875.
5,394.—A. Button, East Saginaw, Mich., U. S. Combined tool. Nov. 15, 1875.
5,395.—A. N. Breneman, Lancaster, Pa., U. S. Boot and shoe holder. Nov. 15, 1875.
5,396.—H. Whiteside, Jr., Montreal, P. Q. Sectional mattress. Nov. 15, 1875.
5,397.—M. Glenn, Stratford, Ont. Machine for separating wheat, seeds, etc. Nov. 15, 1875.
5,398.—F. C. Crean *et al.*, Montreal, P. Q. Propeller wheel. Nov. 15, 1875.
5,399.—E. Longley, Cincinnati, Ohio, U. S. Addressing machine. Nov. 15, 1875.
5,400.—J. C. Bassett, Oshawa, Ont. Thrashing machine gearing. Nov. 15, 1875.
5,401.—C. Appleton, Whitechurch, Ont. Sleigh brake. Nov. 15, 1875.
5,402, 5,403.—W. N. Whiteley, Springfield, Ohio, U. S. Extension No. 4,863. Mower and reaper. Nov. 16, 1875.

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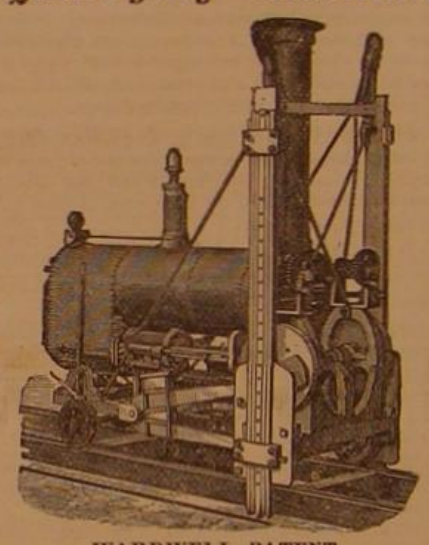

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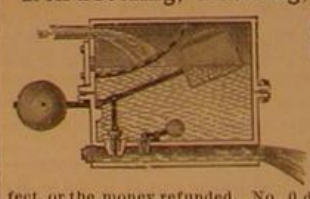

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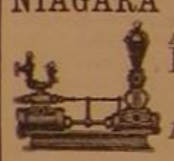

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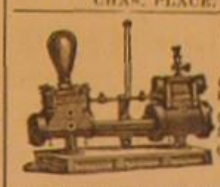

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