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THE BERRYMAN PATENT FEED WATER HEATER.

It is commonly supposed by engineers and by users of condensing steam engines the boilers of which are fed from the hot well, that there can be no advantage gained by employing exhaust steam on its passage from the cylinder to the condenser. The manufacturer of the improved feed water heater represented in our illustration claims, however, that this device, which utilizes exhaust steam, does so with notable economy, and he presents the following facts, which he informs us he is prepared fully to substantiate. It is hardly necessary to point out that the savings indicated are large, and that any auxiliary apparatus capable of securing them may be commended to the especial attention of steam users.

The saving over feeding the boiler direct from the hot well is stated to be, in fuel, from 6½ to 8 per cent, and as compared with the conditions when cold water is delivered to the boiler, the economy is said to be from 10 to 13 per cent.

The heater does not interfere with the vacuum and requires no care. While it does not, in connection with a condensing engine, act so well as a purifier as it does in connection with the high pressure engine, yet, we are informed, it removes the greater part of the impurities contained in the feed water. The reason the purifying results are not the same as when connected to a high pressure engine is that perfect separation of impurities does not take place till the water in the heater is raised to 186° Fah. Exhaust steam from an engine working high pressure is 212° Fah., and this, passing through the heater, raises the water in it to 210°. The same exhaust steam from an engine working low pressure (or condensing) is (on its way to the condenser) reduced to 163⅓ Fah., and passing through it does not raise the water in the heater above 85° Fah. It is claimed that the water and the steam passing through the Berryman heater are raised to 150° Fah., equal to 6½ per cent in fuel consumption (10° in feed water being equal to 1 per cent saving in fuel consumed).

The manufacturer further states that if the condensing water be salt, so that it cannot be used to feed the boilers, and the latter are hence necessarily fed with cold water at 40° Fah., the heater will then raise the feed to 150°, equal to 11 per cent saving.

The Berryman heater is manufactured in the United States only by I. B. Davis, Hartford, Conn., to whom all communications should be addressed.

A Hot Water Fountain.

The city of Pesth has almost accomplished the task of obtaining an unlimited supply of nearly boiling water, which will be available for public and private use. The ready heated fluid is obtained from a deep artesian well, from which, when completed, the water will issue in a mighty fountain, to the height of nearly fifty feet. The deepest artesian well in the world has hitherto been that at Paris, which measures 1,794 feet in depth. The Pesth well has already attained a depth of 3,120 feet, and will, when bored the required depth, more than double the depth of its Paris rival. The water now issuing from the bowels of the earth, three fifths of a mile below the surface, has a temperature of 161° Fah., and the work will be prosecuted until a warmth of 178° Fah. is obtained. The meaning of these figures will be better understood when it is remembered that the temperature of a hot bath is 98°, while that of boiling water is 212°. The daily supply is already 175,000 gallons, a quantity which will be greatly increased at the enhanced depth. The work progresses at the rate of 50 feet a month, and recent improvements in the mechanical appliances render possible a still more rapid rate of working. This remarkable undertaking is being carried on partly at the expense of the city and partly at the expense of the engineers, Messrs. Zsigmondy.—*Building News.*

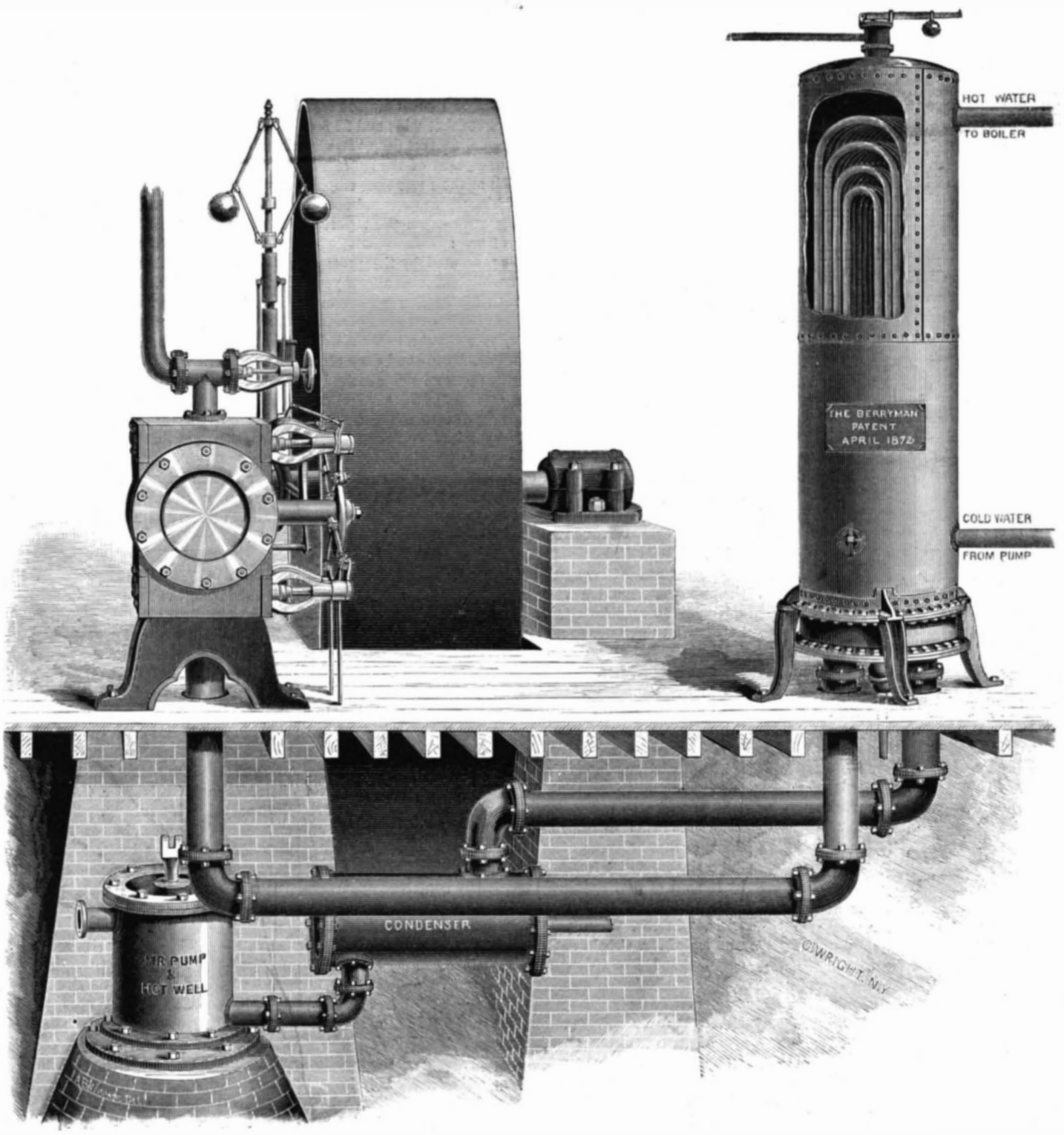
Flooding the Desert of Sahara.

Mr. Donald Mackenzie, at a recent meeting at Bradford, described his scheme for forming a canal across the Great Desert. Of the vast plain or hollow in the desert, known as El Juf, the greatest length of the depression is about 500 miles, the breadth about 120, and the area about 80,000 square miles. This vast area is depressed about 200 feet below sea level. This depression was formerly connected with the Atlantic Ocean by the channel Sakiet El Hamra, or Red Channel, which had in process of time been blocked up with sand. It was proposed to reopen this channel and let in the sea, which would cover the great area above described and enable commerce to be carried on with places in the interior, rich in produce of various kinds. The submerging of the basin of El Juf would open up a navigable highway for the commerce of the world to the heart of Africa, and present an extensive field for the influence of civilization.

Artificial Rubies.

The production of crystallized alumina in the form of corundum, which is the substance of a number of oriental gems, and especially of rubies and sapphires, has engaged the thoughts of several experimenters, but hitherto only microscopical crystals have been produced.

Two Frenchmen, MM. Fremy and Feil, have lately succeeded in obtaining specimens which may be used in watch-making, and may be cut by the lapidary. Their method consists in heating for a long time at a red heat a mixture of aluminate of lead and silica. Thirty kilogrammes of the mixture were thus treated for twenty days. The alumina is gradually liberated, and crystallizes. It thus gives colorless corundum, but if two or three hundredths of bichromate of potash be introduced into the mixture, this acquires the color of rubies. With a little oxide of cobalt the sapphire is obtained. The reproduction is exact as regards density, hardness, brilliancy, color, and even, as M. Jannettaz has observed, crystallographic and optical properties.



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SUCCESSFUL PROGRESS OF THE GREAT JETTIES.

Captain Eads' improvements at the mouth of the Mississippi river having successfully progressed to a point at which, under the act of Congress relating to the subject, a second installment of half a million dollars falls due to him, Generals Barnard and Wright, of the United States Engineers, recently made a thorough examination of the new channel. The substance of their report is given below.

It is safe to say that no engineering work of similar magnitude has ever been maintained and conducted with such splendid success, under so many unfavorable conditions. From the very outset Captain Eads has met with opposition none the less bitter because it came from official sources. He was confronted by adversaries who would neither support his plan nor agree among themselves upon the feasibility of any other project, and the prospect was that the Mississippi would remain unopened to commerce indefinitely into the future. With a boldness born of perfect faith in his scheme, Captain Eads broke through the deadlock of conflicting opinions by himself assuming the entire expenses of putting the same into practice, and asking no reimbursement or pay until the officers of the United States should themselves testify to the successful attainment of various points in the progress of operations. Congress at length passed the requisite act, and Captain Eads began the apparently unpromising work of building his great jetties out into the open sea.

Certainly no engineer has ever before undertaken such a task under such auspices. Executing a great enterprise of the first national importance, he has been entirely without Government aid; on the contrary, at the outset, officers of the Government, if not active opponents, did not in many cases hesitate to predict the failure of the scheme. Still Captain Eads has labored on, always successfully, until now large ocean vessels may safely pass through the channel he has made, and his title to the gratitude of the people rests on an unassailable foundation.

We have published, both in these columns and with much detail in those of the SUPPLEMENT, information concerning the steadily successful progress of the work; and from the beginning the SCIENTIFIC AMERICAN has been among the few steadfast supporters of the correctness of Captain Eads' theories and plans. It is therefore with no small gratification that we now congratulate Captain Eads on his triumph. Generals Barnard and Wright in their report state that there is now a channel nowhere less than 200 feet wide and 22 feet deep from the South Pass between the jetties to the deep water of the Gulf of Mexico. The width between the 22 feet curves varies from 200 feet to more than 500 feet. At the head of the Pass a channel 264 feet wide and 22 feet deep exists, and a practicable channel 23 feet deep was also found. No more complete announcement of the success of Captain Eads' work, or one which at the same time emphasizes more strongly the error of his opponents, can be made than is embodied in the following words from the report of the above named distinguished officers:

"If we look at the actual facts presented by the prosecution of this work, we find that while two and a half years ago there was a bar at the mouth of the South Pass, over two miles in extent, measured from twenty-two feet of water inside to the same depth outside, over about a half a mile of which there was eight feet of water, a wide and deep channel exists; and a result inferior in physical magnitude, but of no less importance, has been attained at the head of the Pass. This result is so exclusively due to the jetties and auxiliary works, that the auxiliary aid of appliances, if in such we include dredging machines, is utterly insignificant. About 2,500,000 cubic feet of material were excavated by the current, against 200,000 by dredging."

UNSCIENTIFIC SCIENTISTS.

Mr. William Crookes, F.R.S., is an English scientist of reputation and of no small ability. He is the inventor of the radiometer, and a very close investigator of so-called spiritualistic manifestations. We mention these two peculiarities in preference to many other very excellent and useful rôles which Mr. Crookes has assumed, because, on account of them, he is at present involved in controversies which are remarkable in their way, for bitterness on one hand and absence of production of definitely settled fact or theory on the other.

We suppose that as an originator of experiments for testing spiritual mediums in such a way that the latter always come out apparently triumphant, Mr. Crookes is unrivaled. Not that we mean to assert for a moment that the gentleman allows his belief in things supernatural to influence his actions, or that he approaches his investigation with anything but a sincere desire for simple truth, but it so happens that, by the aid of Mr. Crookes' ingeniously contrived apparatus for crucially testing them, mediums withstand remarkable trials, whereas, when people with not half the scientific acumen of Mr. Crookes apply their tests, the same mediums egregiously fail or are exposed in their fraud.

Mr. Crookes' arch enemy just at present seems to be Dr. Carpenter, another English scientist of high standing. Others have entered the arena, but the battle of the giants is waged between these two. In the *Nineteenth Century* a while ago, Dr. Carpenter attacked Mr. Crookes for jumping at the conclusion that the radiometer is actuated by impact of light, while commending the series of investigations which led to the discovery of the instrument, and then, in order to exhibit the "duality" of Mr. Crookes' mental constitution, he shows up his unscientific course with relation to the spiritualistic Home and the phenomena, supposed to be the work of the latter, which culminated in Crookes' hypothesis of Psychic Force. In a later number of the same periodical, Mr. Crookes defends himself, charges Dr. Carpenter with misconception in the matter of the radiometer, insists that he did not attribute the movement of that apparatus to light, and answers the strictures with reference to Home by explaining his precautions, etc., to eliminate chances of fraud in the experiments, and virtually demands any reasonable explanation for the phenomena observed other than that which he has adduced, and which involves the existence of an unknown and apparently supernatural force.

The drift of Mr. Crookes' line of argument seems to be summed up in some such demand as "either explain my conclusions in a way that will convince me that they are wrong, or else accept them and don't criticise," which, after all, is nothing but the song which the perpetual motionists, circle squarers, spiritualists, and their kind have sung from time immemorial. It so happens, however, that neither of the subjects in controversy are in that condition which admits of the proposing of definite explanation, and there is thus a species of false analogy between them which is apt to lead to their consideration as of like nature; whereas, while the one is a legitimate object for scientific investigation, which will in the end, if properly pursued, conduct to absolute truth, the other is simply an illusion which, when investigated, can terminate in the exposure of nothing but untruth. Theories as to the radiometer are numerous, and although it is now reasonably well settled that heat is the motive power, yet there are abundant conflicting hypotheses as to how the actuating force is exerted. No new phenomenon was ever discovered that did not undergo like stages, and the fact of theories conflicting at any period of its existence is no proof but rather assurance that in the light of constant progress they will react one upon the other, eliminate one another, and ultimately a hypothesis on which there will be agreement will be reached. On the other hand, nothing of this kind can be predicated as to so-called scientific investigations of spiritualistic manifestation. Such investigations are eminently unscientific because they aim to disprove that for which not even a shadow of foundation is assumable. A scientific investigation is simply a questioning of nature, and its object is to find the hidden laws which connect or underlie certain definite results. The fabric of truth reared, that of untruth falls by contrast—not by direct assault—just as popular errors are eliminated, not by diatribes and denunciation, but by the unswerving progress of knowledge among the people.

It goes, therefore, without saying that Mr. Crookes' line of defense is illogical. It is not for his defenders to say, "Here is an effect; we assume it to be due to a miracle; prove that it is not;" but, on the contrary, it is for them to show conclusively that it is utterly unaccountable under every known natural law; and this they have never done. Mr. Crookes' argument becomes still further weakened when those who have withstood his tests are exposed or their tricks repeated by easily explicable means, as has been frequently the case. Mr. Robert Heller, the conjuror, is exhibiting "manifestations" in this city, which are more mystifying than any we ever saw a spiritual medium execute. The cabinet business and other performances are done under the full glare of the gas, and submitted to the closest examination, and with a celerity that is astonishing. He says that spiritualists have insisted that he is an extraordinarily powerful medium, which fact they accuse him of concealing for sordid ends. He says further that he only produces effects—it is for the audience to find out how—and the name of his mysterious power is Hellerism. There is a curious analogy between his argument and that of Mr. Crookes; and we are not quite certain but that Hellerism is not as good a name as Psychic Force.

A NEW SYSTEM OF ARMOR PLATING NEEDED.

The trials of the 100 ton gun at Spezia, Italy, demonstrated quite conclusively, and to the no small astonishment of the adherents of heavy wrought iron armor for vessels of war, that iron plates were inferior to steel as a means of stopping shot. Prior experiments on steel plates were not wanting, and their results showed that steel had a tendency to split under the impact of shot. Curiously enough, with the enormous bolt of the 100 ton gun the conditions seem to have been entirely altered, and the conclusion was apparently reached that iron plates had had their day, that the contemplated 40 inch iron armor would never be rolled, and that the ironclad of the future would be encased in steel. The prematurity of this view, however, was soon after proved by the fact that steel plates broke and split up under the shot of smaller guns which produced little effect on the iron plates. The advocates of armor plating are therefore at the present time in rather an anomalous position. If vessels must be protected against the heaviest guns, then steel is required, but this can be shattered by light guns; if protection against the latter is deemed preferable, then it is certain that the armor will be riddled by the more massive projectiles. What is wanted, consequently, is some new kind of armor capable of resisting projectiles from both large and small guns, and the search for this bids fair to be as protracted and expensive as the long continued experiments during which wrought iron armor plating gradually grew in thickness from 4 to 24 inches.

Two plans are now before the English Government for so-called compound armor plates, by means of which it is hoped that all the advantages in both steel and iron may be secured

without the corresponding disadvantage of either. Mr. Wilson's system consists in a plate made of layers of steel and iron united by fusion. The plate is 9 inches thick, having steel on the outer face to the depth of 5 inches, the remainder being wrought iron. Tests made of this armor have shown that it breaks the shot of 7 inch guns while splitting and starring through its steel portion, but that the latter is held together by the iron.

Sir Joseph Whitworth has invented a new plate constructed on a different principle, which consists of a solid shield of comparatively soft steel, in drilled holes in which plugs of harder steel of high quality are inserted. These plugs are very closely distributed over the plate, and their object is to break the projectile and to prevent the extension of star cracks. This plate has also been fired at and has stood well. A competitive trial of the two systems has recently been made in England, which has led to no very definite results owing to the inferior manufacture of some of the competing plates, but the general indications go to show advantages in the compound steel and iron shield.

CONFIDENTIALLY, WITH OUR READERS.

At this season of the year very many of our subscribers in renewing their subscriptions take occasion to express their opinion of our journals. We are always glad to receive these comments—in fact, it invariably affords us gratification to hear from any of our subscribers on any subject within the scope of our field which interests them; but we take, perhaps, more especial pleasure in noting the criticisms or praises which those to whom our work is addressed bestow upon it. Whether the opinions be adverse or otherwise, they indicate something more than a mere passing interest, and evidence a degree of appreciation which goes to prove that our efforts are regarded, at least, as intended to be beneficial far beyond the affording of temporary entertainment through the presentation of merely what is new in the great world of science and mechanical industry. It so happens, however, that adverse criticism rarely—very rarely—finds place in the letters we receive. Once in a while we receive a "hauling over the coals," but we can see the good nature under it all, although occasionally we are tempted to point out that a paper run to suit each individual preference would probably satisfy nobody, not to mention the fact that it would have to be a colossal publication to contain all we are asked to insert. Besides, and although we are quite willing to admit that many of our excellent readers who send us their strictures are much more capable to conduct the SCIENTIFIC AMERICAN than we are, still, while that task is left in our hands, a conscientious sense of duty impels us to continue our possibly mistaken course by the light of the thirty odd years' experience we have had in doing so.

As for commendatory letters, which are brimful of kindness and good wishes, and which abound in such praises that really our innate modesty sternly prohibits our publishing them, their number is legion. They come in the plain words of men who know far better how to produce marvels with the hammer and chisel than with the pen, and in the earnest language of workers in science who stand foremost among intellectual minds. Inventors, mechanics, men of business, and professional men—in a word, the true brain and muscle of the country unite in these encomiums, and afford us encouragement such as would spur even the least appreciative to constantly improving efforts.

We shall make an extract from but one of these letters—and it may stand as a type of all—and this because it expresses the unsought opinion of an engineer whose achievements are so well known that every body will respect his judgment. After renewing his double subscription to both of our journals, Captain Eads says:

"I heard one of the most eminent engineers of the United States Army declare in the presence of several other highly intelligent gentlemen, a few months ago, that he considered the SCIENTIFIC AMERICAN to be the best scientific journal published in America. To this there was no dissent among those who heard him. It is my own opinion; and wishing you continued success, I remain,

Very sincerely yours.

JAS. B. EADS."

GOVERNMENT TESTS OF MAGAZINE GUNS.

A board of army officers, under the presidency of Lieut. Colonel J. G. Benton, is to convene at the Armory, in Springfield, Mass., on the 3d of April next, for the purpose of testing magazine guns. Inventors will soon be requested by the Secretary of War to provide sample arms for trial, all guns to be of caliber 45, the same as that of the Springfield rifle now in use, and to carry the United States service cartridge. It is stated that the Secretary is authorized to spend $20,000 in the conducting of these tests. The board will probably be in session until midsummer. No special rules governing the trials have yet been decided upon, and Lieut. Colonel Benton informs us that probably none will be made until the board convenes.

The terrible execution done by the magazine gun during the present Russo-Turkish war has shown the superiority of that weapon over the single fire breech-loader, and indicated the prominent part which it is destined to take in future conflicts. The main requirement is now to simplify the gun, to reduce the number of parts, and render their interconnection so plain that the soldier can easily take the weapon apart or put it together, and make his own repairs on the field. We shall probably publish full descriptions of the competing weapons when the test begins.

A REMARKABLE AND DISASTROUS EXPLOSION.

At about 5 P.M. on December 20th last, the throngs of people who were passing through Barclay street, in this city, near Broadway, on their way to and from the New Jersey ferry, were horror-stricken to behold the entire front of a large five story building fall into the street. The dull sound of an explosion was simultaneously heard, portions of the ruined edifice were hurled against buildings many feet distant, and almost instantly a fire broke out which speedily consumed a large part of the block. Twelve persons were killed, others are still reported missing, and many were wounded. The structure was used by the Messrs. Greenfield as a candy manufactory, and work was in full progress, owing to the holiday season, when the disaster occurred.

The prevailing impression at first was that a boiler explosion had taken place, but examination of the generators proved this not to be true. Numerous other theories have since been suggested, including illuminating gas explosion, formation of an explosive mixture of carbonic oxide and air in the flues from the boiler, explosion of chemicals, and others. A correspondent sends us the following interesting letter on the subject, which suggests a very plausible and probably the true cause of the casualty. The fire authorities and other official investigators have thus far failed to reach any definite conclusion on the subject. Our correspondent says:

The cause of the Barclay street fire still remains a mystery, and it having been proved beyond reasonable doubt that neither steam, gas, nor kerosene caused the catastrophe, the experts appear to have lost the scent, and are now following the hunt with blind uncertainty as to the direction they should next follow.

It may therefore be convenient at this moment to mention certain conditions that may result in explosions among substances usually regarded as perfectly harmless.

It is perhaps not generally known that many substances when reduced to a very fine powder, and thus diffused in the air of a room, will under certain conditions explode with terrific force. Among other substances may be mentioned cork. This material, which burns in bulk with a very slow combustion, becomes highly explosive when reduced to an impalpable powder and in this state distributed in an atmosphere.

The Linoleum Company of Staten Island have had unpleasant proof of this fact. In the manufacture of linoleum, cork in a very fine powder is employed to a large extent, and in its manipulation becomes dispersed about the room, causing the air to become highly charged with it.

Not very long since, the cork in one of their rooms exploded with great force, blowing off the roof of the building. On this occasion the ceiling in the room where the explosion took place remained intact, the whole force of the explosion passing through an opening in the ceiling to the room above, the roof of which chamber was carried away.

It should be noticed in this instance that the explosion traveled to the spot which presented the least resistance, and that the damage occurred in a room that was not the scene of the original explosion.

This experience may be useful in directing attention to new channels of inquiry in regard to the Barclay street fire; it certainly offers two links that may be followed with advantage, for it teaches us in the first instance, that the cause of an explosion may be remote from the spot where its effects were most apparent, and secondly that explosions may result from substances which are not within the category of explosive compounds. The subject might be carried one step further by making the inquiry whether any substances used in the candy manufactory could explode under the same conditions as the cork, but that is a matter to be handled by those making the investigation.

There is also another point that has passed unnoticed. Candy manufacturers at Christmas time make a large number of pull-crackers, folded in fancy papers with candy. What quantity of detonating powder was held at the time of the explosion?

These remarks are merely suggestive, and as such may be valuable in giving a wider range to the present inquiry, there appearing a desire to force the conclusion that the building must have fallen down if not blown up by steam, gas, or kerosene. J. M.

THE AMERICAN EXHIBIT AT THE PARIS EXPOSITION.

Commissioner General McCormick, on January 10th, stopped the reception of applications for space at the Paris Exposition, and none further are to be entertained. It is stated that 625 applications have been made, the majority coming from Pennsylvania and from this State. Fully five times the amount of space allotted to the United States has been asked for by exhibitors, so that it is therefore a certainty that disappointed applicants will be in the majority. The Commissioner General has full control in the matter of selection, and his decision is final. He is proceeding rapidly with the consideration of applications, and his selections will shortly be made known.

New Fast War Steamer.

The Iris has been constructed as a twin-screw dispatch steamer for the English Government. At a recent trial trip of six hours' full power run, which extended to about 120 knots, 96 were completed during the official six hours. The mean pressure of steam in the boilers was 62 lbs. The starboard engine made 91 and the port engine 89½ revolutions per minute. The mean total horse power developed was 7088·52, the contract being for 7000. Sixteen knots per hour was the speed attained; consumption of coal was 2·7 lbs. per indicated horse power per hour. The following are the principal dimensions of the Iris: Length between perpendiculars, 300 feet; over all, 333 feet; extreme length, 46 feet 1 inch; depth in hold, 16 feet 3 inches. The armament is to consist of ten 64-pounders. She is bark-rigged with wooden masts, and is steered by hand gear. The ship is propelled by direct-acting, horizontal, compound four-cylinder engines, designed to turn twin screws. There are four high pressure cylinders, having a diameter of 41 inches, and four low pressure cylinders, with a diameter of 75 inches, the stroke being 3 feet. Steam is furnished by twelve boilers of slightly different dimensions. The total weight of the machinery, with water in the boilers and condensers, is about 1,000 tons. The contract price is £93,000. The engines have been manufactured by Messrs. Maudslay, Sons & Field. At the trial trip the mean draught of the vessel was 15 feet 8 inches forward and 20 feet 7 inches aft.

Keely or a Rival.

The "Bradley Promethor," says a Baltimore contemporary, is a vessel propelled by "a certain kind of gas, which is evolved by mechanical disintegration, the water being forced through solid silver by hydrostatic pressure, which is automatic and is operated by the engine. This product is introduced into small cells of one inch internal diameter, made of the best decarbonized steel, and there quickened into gas by heat, which does not need to be over the ordinary temperature to produce steam. There is no water introduced as water into the generators.

"The apparatus, he claims, contains nothing but pure gas, without any likeness to a steam boiler. Three hundred pounds pressure can be had from a thimbleful of water, and the pressure can be raised any degree to thousands of pounds to the square inch by regulating the supply of water. The gas frequently reaches so intense a state as to show great signs of electrical action, but before being admitted to the cylinder of the engine it is oxidized, which fully prepares it to act with all the smoothness of steam on the piston."

We are not sure but that this is a bare-faced infringement on Keely's great conception, though the remarkable discoveries which the inventor (or the writer of this description) appears to have made incline us to the belief that the Keely brain has here also been at work. No one else is so competent as he to wrench from unwilling Nature the great truths of the aqua-disintegrating properties of solid silver, the smooth behavior of oxidized gas, or to accomplish the wholly unparalleled feat of producing "pure gas without any likeness to a steam boiler."

Water Supply of New York City.

From the report of the Department of Public Works of this city, Mr. Allan Campbell, C. E., Commissioner, it appears that the total amount expended for works, structures, aqueducts, pipes, etc., connected with the water supply for the city, including maintenance and repairs, from the period of its inception in 1842 to October 1, 1877, has been $34,692,103.73; the total revenue, $30,105,338.80. Cost over revenue, $4,586,764.93. The growth of the city has rendered an increase in the size and arrangement of the distributing mains necessary. Under a recent contract, straight pipe of the very best quality has been procured at $22.75 per ton of 2,240 lbs., probably the lowest price at which such pipe was ever brought to this city. This unexampled low price of iron pipe makes it very desirable that the necessary additions and alterations should be made at the present time. Small mains of former years will in course of time be replaced by large ones on the principal streets and avenues, and in connection therewith a sufficient number of fire hydrants will be added. The report maintains that the supply from the Croton river system, including the Housatonic river, is the proper mode to be pursued. This plan contemplates an additional aqueduct, when increasing population shall have taxed the present one to its fullest capacity.

A "Momentum" Torpedo.

Commodore John A. Howell, U.S.N., has invented a new movable torpedo, which is driven by the energy stored up in a heavy rotating wheel in its interior. The apparatus is a cylinder with two conical ends, and at each extremity is a two-bladed screw. Inside beside the fly wheel is the explosive charge. By an outside gear wheel on the screw shaft, which connects with a motor on board ship, the fly wheel is set rotating; then the contrivance is slid down a boom and into the water, it being supposed that the momentum of the fly wheel will keep the screws rotating long enough to drive the machine ahead for 300 feet or so, in a straight line. Recent trials at Newport were unsuccessful, the rudder not acting well and the torpedo going in every direction but the right one.

TO OUR SUBSCRIBERS.

We find ourselves obliged to ask the indulgence of those of our readers who have lately failed to receive their numbers of the SCIENTIFIC AMERICAN with usual promptness. This is the season of the year when most new subscribers remit and old ones by the thousand renew, and the demand for papers is always excessive. Of late, however, the inflow of subscriptions has been even greater than usual, and our regular editions have been quickly exhausted. We are rapidly reprinting recent issues, so that our patrons may rely on receiving their numbers at the earliest possible moment.

UTILIZATIONS OF THE GOOSE QUILL.

Metal pens came into general use in about the year 1840, supplanting, as is well known, the time honored goose quill. For the latter it therefore became necessary to discover some other utilization, and efforts in this direction have led in France to the establishment of a new industry, the manufacture of the so-called "feather articles" (*articles de plume*), the creators of which, and the inventors of the ingenious

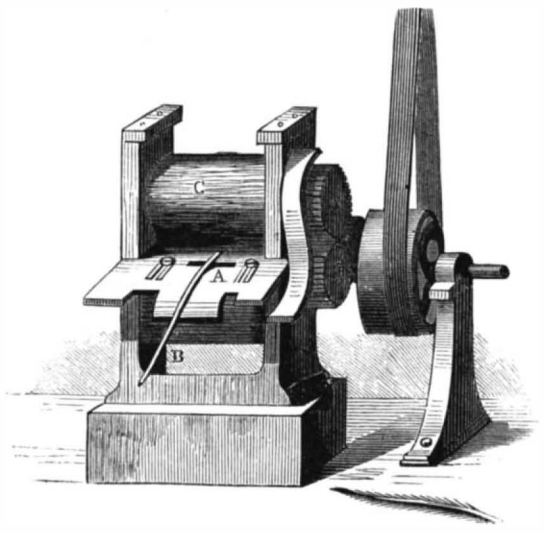


Fig 2.—CUTTING FEATHER SHAVINGS.

machinery by which it is practiced, are MM. Bardin and Soyez. At present there are not enough geese raised in France to supply its needs, and hence large quantities of the feathers are imported into that country from Siberia and Russia.

The feathers of the goose wing, which are the only ones used, are classed by numbers, according to their position in the wing. Each package in commerce is composed of plumes of the same number, because each variety has a special application. In order to exhibit the process of manufacture it is necessary first to dissect one of the principal feathers employed, namely, the *bouts d'aile*, or exterior feathers of the wing. These consist of a strong stem or quill bent, and having on one side short and on the other long barbs, as shown in Fig. 1. The feather was useless for pen making, as, owing to the difference in weight of its vanes, it did not balance in the hand. This defect, however, now becomes the chief merit of the feather, as the short barbs or *biots*, 2 in our engraving, are especially useful. The first operation is to soak the feathers thoroughly in water. Then the lower portions of the quill are cut off by a special machine, and the plume is ready for the removal of the brillantine, 1. This is the thin horny layer which covers the outside of the shaft. It is removed by hand with a penknife in fine strips, and is sent in large quantities to dyers, who dye it in various bright colors. It then is used for the manufacture of light tufts or plumes for bonnet trimming. The wide barb, 3, is also removed by hand. The feather thus denuded is placed, little end first, under a roller, B C in Fig. 2, which carries it against a cutting edge which slices off the upper shaving, 4, a horny layer between the vanes on the back of the feather and under the brillantine. The remaining portion is again put through a similar machine and a second slice is taken off, called the lower shaving, 5. These shavings next go to the apparatus represented in Fig. 3, which has cylinders on which are cutting screw-threads, by which the shavings are split up into numerous fine filaments. With these, known as feather bristles, excellent brushes are made, and the waste and short scraps are employed for stamens, etc., of artificial flowers. The interior of the figure 6, Fig. 1, is a soft, white, elastic pith. This is ground up into a fine flock, and is used for the manufacture of flock wall paper. The material is suitably colored, and is sifted upon the paper while the coloring matter on the latter is yet wet. It adheres and produces a cloth-like surface, and is said to take dye better and to form a much more beautiful surface than the wool flock commonly employed.

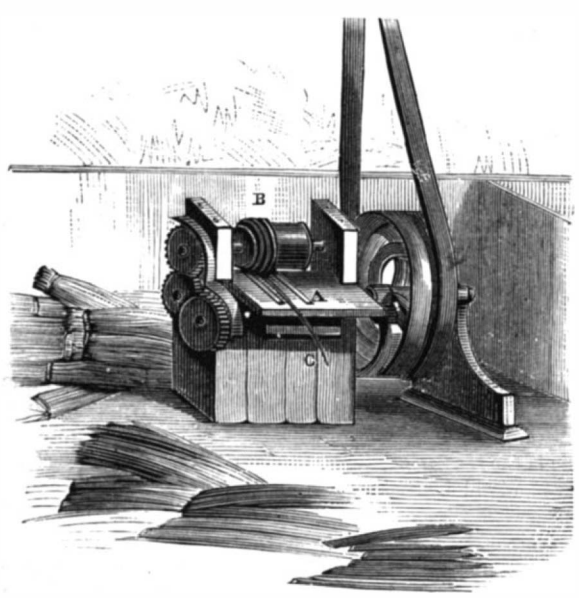


Fig. 3.—SPLITTING FEATHER SHAVINGS.

The barbs of the feather are dyed and worked in between the threads of a woven backing, with which they form a kind of felt, their barbules tightly interlocking. So firm and close is the fabric thus produced, that several hours' rubbing by coarse feather bristle brushes worked by steam power is necessary to raise the nap sufficiently to give the material the desired appearance of a thick rich plush.

We have now traced the manufacture of all the different parts of the feather except the barrel or quill which was cut off. This is converted into toothpicks by the stamp or press exhibited in Fig. 4. The details of the cutting dies are shown in Fig. 5, at A, B, and C. At the factory of the above named manufacturers some 250,000 quill toothpicks are thus daily made.

There is much to do to the quill, however, after the above described cutting before it becomes a finished toothpick. The opaque covering skin must be taken off and the interior pith removed. The first is usually done before the toothpicks are cut, and is accomplished by throwing the quills into a large vat, where they are violently agitated with water simply. After the cutting, the quills are placed in a wire basket and moved to and fro in the water until the light pith within is washed out. The picks are then dried in a centrifugal apparatus and by heat, and are next made into bundles by means of the apparatus represented in Fig. 6. The toothpicks are simply inserted in a receiver, A, their ends, B, gathered in the hand and a copper ring slipped over them. Then while they are held in the ring they are bound by red string into a tight bundle.

Toothpicks are often met with in this country with names of popular restaurants or with fancy designs stamped upon them. Quill pens are also similarly ornamented. This is done by inserting the quills into a receptacle, A, Fig. 7, which contains ashes heated by a lamp beneath. When they

Fig. 1.—THE GOOSE QUILL DISSECTED.

have arrived at a proper heat the quills are removed and laid upon a band of iron, B, on which are raised characters or figures. Upon this they are pressed by the lever, C. The difference in temperature suffices to produce transparent letters, etc., on the dead white body of the quill.

Quills are also used for paint brush handles, in connection with cork for floats for fishermen, as a cover for cigarettes, and to form the stems of fuses for cannon. The ordinary percussion fuse has a quill stem filled with fine powder and a fulminating capsule above. The quill is inserted in the vent of the gun, and the capsule comes beneath the hammer when the lock string is pulled.

New Inventions.

A novel Sad Iron patented by W. B. Dolsen and J. B. Sherwood, of Moberly, Mo., has a hollow cylindrical handle filled with oil; from this runs a wick, which extends into a chamber in the iron and is there ignited, thus keeping the iron hot. The oil reservoir and lamp portion can be readily removed.

Royal W. Barnard, of Fayette, Iowa, has patented a Process for Purifying Rancid Butter. It neutralizes and removes the developed acids which are formed upon the butter globules by the fermentation of the milky film, and consists in working the butter through a solution of brine containing an alkaline carbonate mixed with a solution of tartaric acid or its equivalent. The alkaline carbonate neutralizes the rancid acid, while the effervescence, caused by the decom-

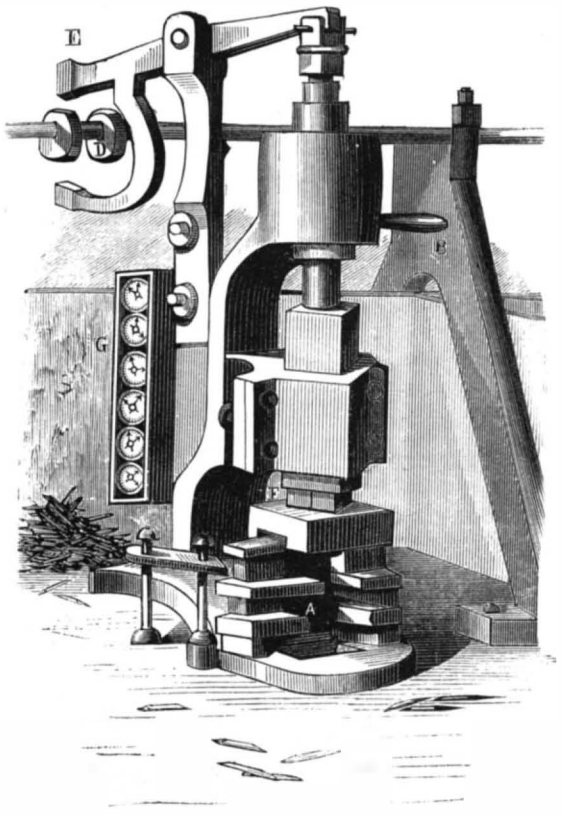


Fig. 4.—STAMP FOR TOOTHPICKS.

position of the alkaline carbonate by the tartaric acid, loosens and removes the neutralized impurities.

Philip Pointan, of Baltimore, Md., has patented a Roofing Tile. It has upon one side an overhanging lip and upon the other two parallel projecting ribs between which the overhanging lip of the next adjacent tile fits and is secured. A ridge is formed near the end of its upper face, a corresponding groove upon its lower face at the opposite end, and also a raised and hollowed out cap piece at the said lower end of its upper face which covers and holds the adjacent lip and ribs of the two next lower tiles, said cap piece being raised to double the height of the marginal side ribs and lip, so that, when the tiles are laid face to face in piles for baking, the cap pieces abut against the lower plain surface of the tile to form a support for it at the ends, the ribs and lip resting upon each other at the edges, and a central projection resting upon a similar projection in the center; the whole to form a reciprocal support for each and every tile at the ends, side, and center, which holds them straight during the baking operation and prevents warping.

Byron E. Chollar, of Chicago, Ill., has patented an Automatic Feed Regulator for Carburetters. It is designed more particularly for regulating the feed of the hydrocarbon in carburetting ordinary city illuminating gas in large public buildings, in order to enrich the quality of the gas just before it is consumed, and thus to secure a more economical consumption as well as a better light, by making a smaller amount of gas supply the requisite light by reason of its increased illuminating power resulting from the absorption of the rich hydrocarbon. It consist in connecting the valve of any of the ordinary forms of automatic gas governors directly with the valve or cock controlling the supply of hydrocarbon so as to cause them to act in constant unison together, whereby the sensitiveness of both valves is always the same, and the flow of the gas and hydrocarbon always bears a constant and uniform relation to each other independently of the carburetting apparatus.

In a Coffin patented by Lewis W. Drake, of Hazleton, Pa., the ends and sides are connected by intermediate corner pieces, placed at obtuse angles thereto. The corner pieces are made with semi-circular side beads, and the joint with

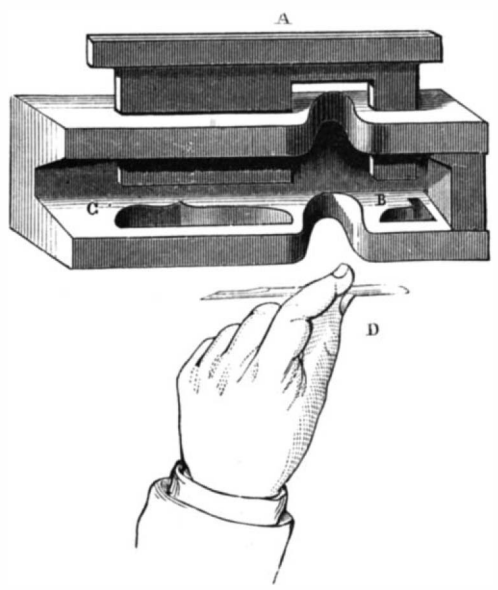


Fig. 5.—TOOTHPICK CUTTING DIES.

the ends and sides obtained by interlocking tongues and grooves of a suitable form.

Salomon Pischlowitz, of New York city, has invented a method of Turning Angular Bodies having Convex Surfaces. It consists of wooden boxes having an oblong groove of twice the size of the body to be turned, and socket holes for inserting the tenoned ends of the blocks. The boxes are secured to the lathe center and turned by the spindle, so as to cut, first, the outer sides. The blocks are then changed in the boxes, and the second side cut, and so on until the sides are turned off forming angular bodies with arc-shaped sides.

A Folding Chair patented by Zenophon Earle, of Appleton, Wis., consists of the following connected pieces: A back, a swinging seat with locking side pieces, hinged front legs, and rounds connecting center bar or side bars. It is easily folded up. The side pieces and center bar of the rounds make the chair strong and durable.

Fig. 6.—BUNCHING TOOTHPICKS.

An Orthographic and Numerical Frame for the use of schools patented by Henry O. Harden, of Stoutsville, O., consists of a rectangular frame. Parallel cross slats are framed into one side bar of the frame, but the other side bar is made into two parts securely attached together, with a space between. The cross bars are grooved to receive letter or numeral blocks inserted through the opening of the side bar. It will prove a great help to teachers.

A Spring Air Gun patented by Michael Weber of Zurich, Switzerland, consists of an air cylinder and sliding spring-piston arranged in the stock, and connected with the barrel by a sliding air tube, which is carried back to set the spring piston to the trigger catch by a swinging lever and trigger guard, that engages, by a toothed front segment, a bottom rack of the connecting air tube. As soon as the air tube is carried back, a hinged guard shield is dropped below the breech of the barrel, and admits the insertion of a ball. The return of the lever carries the air tube back to connect with the barrel, and raises the guard shield, the gun being then ready to be discharged by pulling the trigger, which releases the spring piston, and throws the ball by the compression of the air in the air cylinder and tube.

John P. Dorr of Oconto, Wis., has patented a Steering Apparatus, of the kind used to move rudders by steam pressure. His improvements consist of a chain sheave over which the tiller rope runs. The slide valve of the valve chest of the cylinder is connected with a sliding bar which is operated by a lever fulcrumed above the deck. By it the motion of the rudder is controlled by shifting the valve, so as to admit steam to the cylinder as circumstances may require.

A Hat Box patented by Frederic Jinkins of Orange, N. J., has its body extended above the base of the rim and formed with a lip which is adapted to engage with a flange on the rim portion. The hat is thus held securely in place and is prevented from turning or shaking around, and from rubbing the binding.

A Ship's Log invented by David Carroll, of Spring Creek, Pa., consists of a tube passing down through the bottom of the vessel and forming a well hole below, in which two revolving screws are arranged, of which the upper is placed parallel to the longitudinal axis of the vessel, the lower at right angles to the same. The revolutions of the screw are indicated by suitable transmitting gearing and registering apparatus inside of the vessel. Below the screws is arranged a longitudinally and laterally swinging speed indicator that works a pointer along a graduated plate.

A Roller Skating Surface, the invention of George M. Rollins, of Brooklyn, N. Y., consists of a floor composed of rock-asphalt, bitumen, and resinous oil, which are mixed together and applied in a warm and plastic state. It is manipulated by means of floats until the surface becomes entirely cold and level.

An Invalid Bed Attachment patented by B. D. Brown, of Shamrock, Mo., can be worked by one nurse, and enables the patient to be easily moved. Canvas is attached by side pieces stretched by end cross pieces and raised by a portable hoisting apparatus attached by hooks to cords of the side piece. A second canvas is hinged to the main canvas and raised in the same manner.

A Car Axle Box has been patented by Trenton W. Lillard, of Luray, Va. In the bearing of the upper part is placed a lining of anti-friction metal to receive the wear, and in the face are formed grooves to receive the surplus oil from the journal and carry it down into the grooves in the surface of the lower part to a wick, which by an arrangement of endless bands catches any grit or surplus oil and carries it down into a tank.

Messrs. W. H. Haylock and Alonzo Benedict, of Jonesville, N. Y., have patented new Wagon Springs. The invention consists in making the side bars each of two parts, joined together at the middle of the vehicle by a flexible steel plate, which is secured by a slip or otherwise to the center of a side spring. The ends of the latter are attached one to each of the two parts of the side bar.

A new Level has been devised by Mr. Oliver Pickering, of Needham, Mass. Movable sights are combined with a common level so that they may be thrown out into position for use, or retracted, in order that the level may be used in the ordinary way.

Caleb W. Durham, of Chicago, Ill., has patented a Hot Air Furnace which is composed of two parts: First, a rectangular, oblong combustion chamber, from which projects a series of radial, inclined, continuous flanges; second, a case enclosing the aforesaid parts, The air circulates in passages formed between the combustion chamber, outer case, and the parallel flanges, and becomes highly heated before escaping at the top of the furnace into the conducting flue. The flanges have a lengthwise inclination on the sides of the combustion chamber, but are horizontal at the corners thereof, which construction causes the air currents to change at each corner in such a manner that at each angle or corner the colder portion takes the place of the warmer, so that the whole is uniformly heated. The furnace is said to be an effective one.

A new Basket has been invented by Mr. Abraham Fox of Stittville, N. Y. It embodies a new mode of combining the splints together and with strengthening splints so as to increase the strength and durability of the bottom.

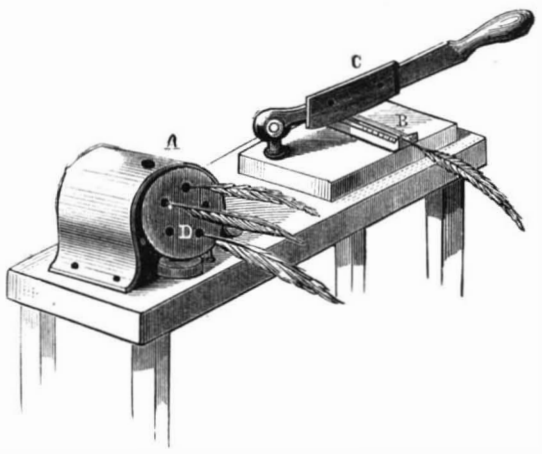


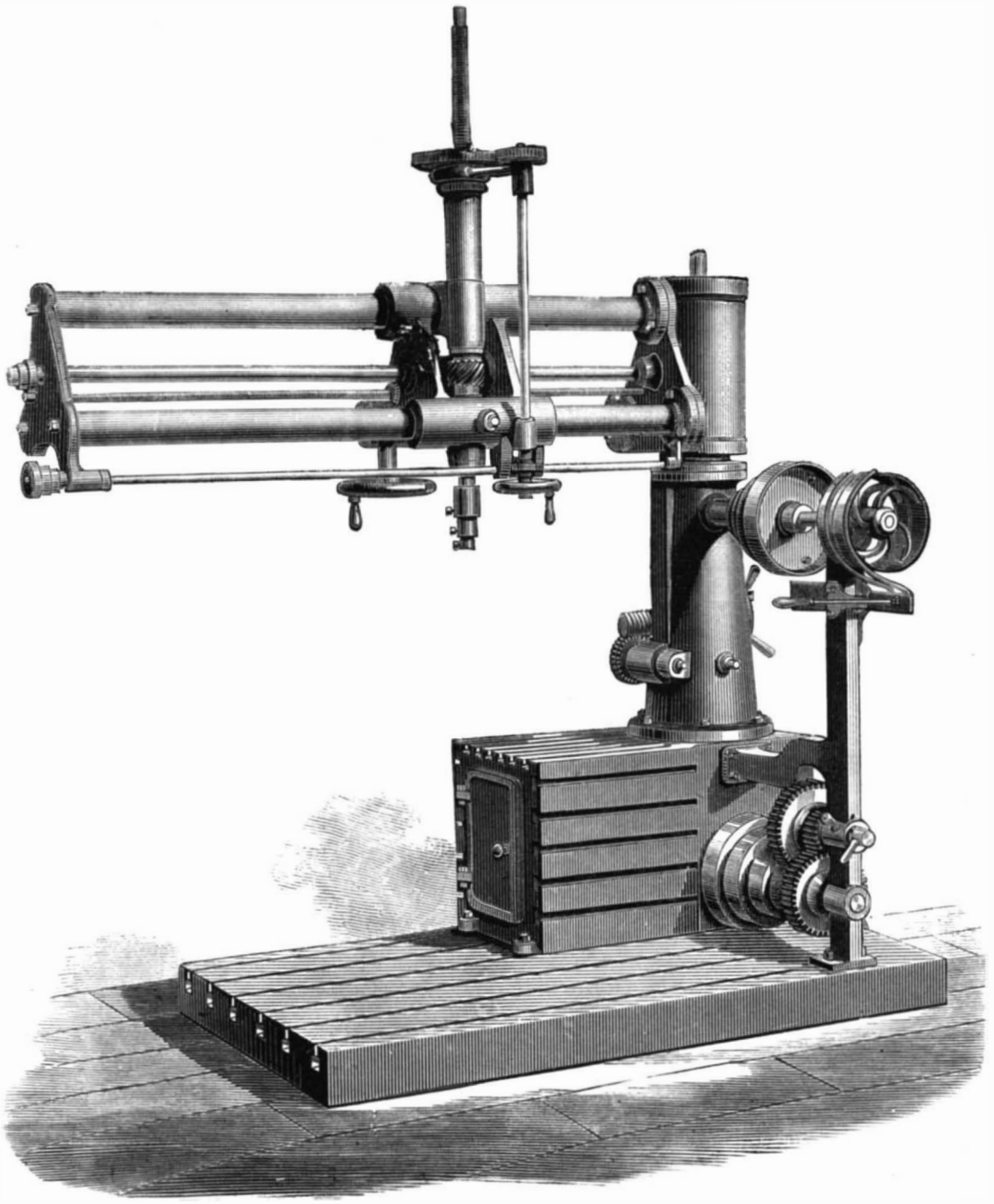
Fig. 7.—CUTTING QUILLS.

A new Ironing Board invented by Mr. Andrew Aitken of Well's River, Vt., is so constructed that it may be readily attached to or detached from the table without marring the latter. When attached it is firmly and securely held.

Mr. Jeremiah E. Walton has patented a new Thill Coupling in which the rubber blocks or packing which render it noiseless and which take up the wear may be removed without taking out the thills and without the aid of a wrench.

RADIAL DRILLING MACHINE.

We copy from *Iron* an illustration of a new English radial drilling machine. It is made on a very different system from that of the older radial, and is not nearly so heavy, nor does it so much obstruct the light. The expense is considerably diminished, owing to the reduction in weight and number of parts, and in the cost of fitting. The driving head and spindle in this machine slides upon an arm composed of three bars placed parallel and in a triangle with each other. With the arm constructed in this manner the side twist commonly found in the working of radial drills does not appear. This machine has an all-round sweep, and can be set to bore at any position in the circle—an arrangement which is convenient for drilling the ends of long articles, which can be placed in a pit sunk beside the table. The hand wheels for working the spindle and horizontal slides are quite close to the spindle, so as to be always within reach of the workman, wherever he may be operating.



RADIAL DRILLING MACHINE.

In a modification of this machine the three bars slide through a bracket supported on the main pillar of the machine. The spindle is placed at the end of the arm and exactly in the center of the bars.

Owing to the simplicity and lightness of the working parts of these machines, they can be adjusted with great facility, vertically, radially, and horizontally, and thus a great amount of work can be obtained from them. Their general arrangement is good and compact, the construction is strong and durable, and the various movements are within reach of the workman.

Communications.

Our Washington Correspondence.

To the Editor of the Scientific American:

Notwithstanding the amount of business done by the Patent Office during the last two months, there is a considerable falling off in the number of patents issued last year as compared with those issued in 1876, as will be seen on inspecting the following figures:

	Patents.	Reissues.	Designs.	Trademarks.	Labels.
1876....	14,172	621	802	959	472
1877....	12,920	568	679	1,216	392
Decrease	1,252	53	123	Incr. 257	Dec. 80

The work of cleaning the models damaged by the late fire has commenced, and the office is overrun with applicants for employment in consequence. About fifty hands are employed, who are at present mostly engaged on the sewing machines, which, although they were not directly exposed to the fire, received considerable damage by water and steam.

THE NAVY.

The Secretary of the Navy has organized a commission of bureau officers consisting of Rear Admirals Howell and Ammen, Commodore Shufeldt, Engineer-in-Chief Shock, Captain Jeffers, and Constructor Easby, to investigate and report upon the class of vessels best adapted for service in the United States Navy; the dimensions, tonnage, and battery of each particular class; the number of each class required, and the material of which they are to be built. The commission will examine and discuss the qualification of ships of other navies, their batteries, steam power, etc., and the subject of torpedoes and rams will be thoroughly investigated.

The subject of educating boys in practical seamanship so as to fit them for service in the navy having been tested and found to work satisfactorily, is to be presented to Congress with the view of making such changes in the law as will result, it is hoped, in having our navy manned entirely by seamen educated to the business. Commodore Shufeldt, who has given much attention to the perfection of the system, will explain the advantages thereof to the House and Senate Navy Committees, and will recommend the passage of a law authorizing the enlistment of 750 boys annually, or ten per cent of the seamen now allowed to the navy. Congress, a year ago, reduced the number of seamen from 8,500 to 7,500, and the boys now enlisted and undergoing instruction, numbering about 470, are included in the 7,500 seamen authorized by law. It is proposed to retain the full number of seamen if Congress will consent, and in addition thereto enlist 750 boys annually, who, after serving on the school ships one year, will be distributed to the ships already in commission, by which means it is hoped that in the course of ten years our whole naval force will consist of thoroughly trained seamen, all of which will have been ed-educated in the service.

CONGRESSIONAL MATTERS.

The Sub-Committees on Ways and Means are diligently engaged upon the proposed revision of the tariff, which is to be reported to the House after the recess of Congress. The changes of the rates of duty have not yet been determined upon, but there is little doubt that a great number of articles which now produce little or no revenue will be placed upon the free list, and that the duties on others will be greatly reduced and simplified. It will matter but little, however, in what shape the Committee reports its bill, for when it comes into the House it will be greatly changed by the log rolling of members representing different interests, each one of whom will endeavor to shape legislation to favor the local interests of his own district. Tariff legislation in general, instead of proceeding on any fixed principles, has been a scramble of different interests for the highest protection, and those branches of industry that could bring the strongest influences to bear upon individual members have had their wishes most respected, while weak and struggling interests not wealthy enough to subsidize a powerful lobby have had to suffer.

Admiral Rodgers, the Superintendent of the Observatory, has a project that he wishes to bring before Congress, to which he has been devoting considerable attention, intended to do away with the inconveniences which arise from the difference in local and railroad time. His idea is to have Congress pass a resolution which will require all railroads to have the clocks in their depots constructed with a double pair of hands—one pair to mark the local time and the other pair, of different color, to give railroad time, which shall be Washington time throughout the United States; so that at a glance one can tell the different times without confusion. If this is done, and the public have their clocks and watches fitted with hands on the same principle, the Admiral thinks the great trouble now existing in some localities from the difference in local and railroad time would be fully overcome.

FORESTRY.

The Commissioner of Agriculture has addressed a letter to the President recommending an appropriation of $8,000 to prosecute during the next year the inquiries into the subject of forestry which were begun last year under the auspices of the department by Dr. Hough of New York, who was selected by the Commissioner of Agriculture for the purpose, under authority granted by Congress in 1876. Dr. Hough has diligently prosecuted the inquiry, not only in the United States, but has corresponded with the officers of foreign governments connected with the forest management and forest schools which abound in Europe, where the vital importance of taking care of this great interest is well understood, and where for a long time an intelligent and settled policy has prevailed, looking to the increase of the woods, the equal seasonable distribution of the rainfall, the maintenance of forests upon the higher lands, and the subsequent preservation of the regular supply of water for the springs, rivulets, and rivers, and the prevention of those terrible floods which wash bare the unclothed mountain slopes, and by sudden overflows destroy the agriculture and manufactures of the valleys in those regions where proper care is not taken to avert these troubles. In the report which Dr. Hough will make to Congress he will recommend that in any legislation which may be enacted on the subject it shall be prescribed that a certain amount of land must be planted with trees by the settlers before any title be given; that instead of selling timber lands, only the privilege of cutting timber shall be sold; that foresters shall be regularly trained and appointed by Government. He also thinks that the different State Governments could promote the growth of forests by offering premiums, exempting forests from taxation, dispensing with needless fences, preventing forest fires by law, levying a tree tax similar to the road tax, planting edges for wind and snow breaks, aiding educational institutions to give instruction in silviculture, and by conferring upon municipal authorities power to lay out parks for the growth and improvement of trees. A bill drafted by Mr. Andrews, ex-United States Minister to Sweden, will accompany the report, which requires that in all future clearing of public pine lands trees be left for seeds at intervals of 70 feet in each direction.

FISH CULTURE.

From a recent report on the above subject it appears that there are now twenty-seven States who have fishery commissioners that receive and hatch the eggs of fishes furnished by the United States Fish Commission, and distribute the young fish in the proper localities. About 4,000,000 California salmon were thus distributed in October. The Wisconsin Fish Commissioners report a large amount of work, having hatched and distributed 1,736,000 lake trout, 6,295,000 white fish, and smaller amounts of brook trout and California salmon. The question whether our lakes are fitted for the last-named fish will soon be determined. The hatching has been successful with about 90 per cent of the eggs. The Maine Commissioners report an unusually large quantity of salmon, principally due, it is believed, to the efforts at fish culture in most of the rivers of the State. Several ponds have been stocked with black bass as an antidote to the pickerel. In the Mattawaukeag river 80,000 shad fry have been placed.

According to a late letter received here the

SUTRO TUNNEL

has attained a length of 18,400 feet, and is now within fifty feet of the great combination mining shaft at the Comstock lode, where its usefulness and value will be tested. The sounds of the blasts can be heard in the Comstock workings, complete connection with which it is thought will be made about April next. Thus far the expenditure has been $2,830,597; about $250,000 will be required to complete the work, and $500,000 more to equip it. When completed the tunnel will form a natural outlet for the waters of the bonanza mines, now pumped up from the depth of 2,300 feet, at an annual cost of nearly $3,000,000; with the tunnel it will be only necessary to raise it to the 1,800 feet level. In addition to this saving it is said that the cost of moving the ore from the bottom of the shafts to the open air by means of the tunnel will only be $150 a day as against $4,500 by the present system of hoisting. Besides this great economic advantage the tunnel will afford such a good ventilator that the mining can be carried on to much better advantage, for under the present system the miners have frequently to labor in an atmosphere heated to 120°, and cannot work more than a few minutes at a time without resorting to the cooling chambers.

OIL PIPE LINE.

A company is said to be in process of formation to lay a pipe line from the oil-producing region to our neighboring city of Baltimore. The starting point, it is believed, will be in some prominent place in Butler county, Pa. It is estimated that by the proposed line oil can be transported to the seaboard for six cents per barrel, but the company proposes to charge forty cents, which is considerably below the present railroad charges of from $1.20 to $1.45 per barrel. The transportation of oil is now, to a considerable extent, a monopoly in the hands of the Standard Oil Company, and it is the object of the company now organizing, and those who are backing it (the Oil Producers' Association), to break up this monopoly. As by the proposed line oil can be taken to the seaboard much cheaper than by rail, the Standard Company it is thought will be compelled to build an opposing line, which will make full and open competition and destroy the present monopoly.

A NEW STORM SIGNAL.

General Myers, the Chief Signal Officer, has issued a notice that there will be used hereafter an additional cautionary signal, to be known as "The Cautionary Off-Shore Signal." This signal, when shown, will indicate that while the storm disturbance is considered by the Signal Service as not yet passed for the place where the signal is displayed, and the winds may yet be high and there may be danger, the winds are expected to blow from a northern or western direction, or "off-shore," at or near the port or place where the signal may be. The cautionary off-shore signal, that is, a white flag with black square in the center, shown above a red flag with a black square in the center by day, or a white light shown above a red light by night, therefore is "cautionary" with reference to winds expected to blow from a northern or western direction or "off-shore" at or near the place at which it may be. The use of the regular cautionary signal will be continued as heretofore, retaining its former significance.

A NEW PLANET?

Professor Henry, of the Smithsonian Institute, reports that Professor Foersten of Berlin telegraphs that Palissa discovered on the 29th ult. a planet of the eleventh magnitude, in seven hours eight minutes, right ascension, thirty-nine degrees thirty-seven minutes, north declination. Professor Henry, however, thinks this may possibly be the one discovered in 1876, and named Eva.

Washington, D. C. OCCASIONAL.

Practical Utilization of Natural Gas.

To the Editor of the Scientific American:

For the past five years I have used natural gas exclusively for heating, lighting, and cooking purposes. The gas is supplied from a well 700 feet deep, located not far from the house. I estimate the quantity furnished at from four to five thousand feet every twenty-four hours.

For heating and cooking purposes gas stoves are used, the air supply being adjusted so as to secure perfect combustion. For these stoves no chimney is required, so that all the heat is utilized, without odor or other bad effects. Seven fires are used in the winter time night and day, and the house never gets cold.

The heat is pleasant, and, being moist, does not shrink the woodwork. For lighting purposes the gas is used as it comes from the well, with the ordinary lava tip or argand burner. The light produced is very uniform and steady. No gas receiver or water is used, the excess of gas being allowed to escape when a certain pressure is reached. The water pipes never freeze. Our carpets last much longer than before, as there are no ashes or dirt. Miner's strikes, the prices of gas, oil, and coal, the rates of transportation, etc., do not disturb us. We have no reason to be dissatisfied with the investment.

East Rockport, Ohio. E. NICHOLSON.

[What becomes of the thousand or more feet of carbonic acid daily produced in the rooms by the combustion of the gas?—"no chimney being required." We have the impression that an atmosphere thus constantly vitiated cannot prove very conducive to the health of people subject to its influence.—EDS.]

The Bellophone.

To the Editor of the Scientific American:

Bell is everywhere fully credited with the telephone's origination. Let your paper, then, be the first to start his name down the stream of time with his great invention. Let us all call it the "Bellophone."

Philadelphia, Pa. J. C. H.

Carbon in Chemistry.

The elements carbon, hydrogen, oxygen, and nitrogen have been called *organogens*—that is, organ producers—from the important part they play in the organic world. They make up the great bulk of the vegetable and animal creation, the other elements that enter into the composition of organic substances forming comparatively an insignificant part of their structure. But among these four organogens carbon holds a peculiar and prominent place, as the one element that seems indispensable to the existence of an organic compound. It is preëminently the organic element, not merely because it is always present in animal and vegetable substances, but because they appear to owe their existence to its remarkable properties. These compounds, although they contain but a few elements, are numberless and of almost infinite diversity of constitution and properties; and this is due, not to the so-called "vital force," but to the singular capacity of the carbon atoms to bind together a great number of other atoms into a complex molecule. This makes a great variety of molecular structure possible with a limited number of elementary atoms. The materials are few and simple; the forms into which they are arranged by the cunning hand of the master-builder, Carbon, are of inconceivable diversity. In fact, as Professor Cooke has said in his "Chemical Philosophy," organic chemistry "is simply the chemistry of the compounds of carbon, and has no distinctive character except that which the peculiar qualities of this singular element give."

In the department of inorganic chemistry we often find two elements uniting in several different proportions to form compounds whose properties are very dissimilar; but here the limit of possible changes is soon reached. An atom of one element combines with one, two, or three, or at most five or seven, of another, and there is an end of it; while the carbon compounds run on in long series, adding atoms to atoms, until the numbers that represent their chemical constitution are high among the tens and even into the hundreds. The formulæ of many of these series are tabulated in manuals of chemistry. The law of their formation is as clear as that of an arithmetical progression. In some of them most of the compounds forming the regular succession of terms are already known, while in others many remain to be discovered by chemists. There is a series of organic acids, for

example, of which formic acid, or CH_2O_2, is the first, and the successive members of which add an atom of carbon and two atoms of hydrogen to the formula of the next preceding in the list: as $C_2H_4O_2$ (acetic acid), $C_3H_6O_2$ (propionic acid), $C_4H_8O_2$ (butyric acid), $C_5H_{10}O_2$ (valerianic acid), and so on until we get up to $C_{30}H_{60}O_2$ (melissic acid), and we know not how many beyond.

Among familiar compounds we may find some of the most unlike thus built up of atoms of the same elements, but differing slightly in their atomic proportions. For instance, sugar, starch, alcohol, and vinegar are as different in their properties as four substances well could be; yet all four are composed of carbon, hydrogen, and oxygen in slightly varying proportions. The formula for sugar (our common cane sugar) is $C_{12}H_{22}O_{11}$; that of starch is $C_6H_{10}O_5$; that of ordinary alcohol is C_2H_6O; and that of acetic acid (which when diluted with water constitutes vinegar) is $C_2H_4O_2$. We need not wonder, then, at such chemical magic as the transmutation of starch into sugar, of sugar into alcohol, and of alcohol into vinegar. These are only examples of the sleight-of-hand at which this prestidigitateur among the elements is an expert. It is but dropping an atom or two of oxygen, and picking up an atom or two of hydrogen, or some such dexterous manipulation, and presto! the compound undergoes a sudden and mysterious metamorphosis. A little water, or the hydrogen and oxygen thereof, is added to the starch, and we have sugar—that is, grape sugar—and dextrine, the gum used on the back of postage stamps. Dissolve the sugar, cause it to undergo fermentation, and straightway alcohol and carbonic acid are the results. Dilute the alcohol, let it ferment again, and acetic acid and water make their appearance.

RAG SUGAR.

One of our subscribers in a distant part of the country has just written to us, stating that he has heard of "old rags being changed into sugar," and wanting "to know if it can be done." He is evidently incredulous as to the possibility of such an operation, but we can assure him that there is no doubt of it. The process is not at all a new one, having been described in an article on the "Chemistry of Sugar," which appeared in the *Journal* some ten years ago. This transformation, which appears so miraculous to one unfamiliar with chemical reaction, is akin to those we have just mentioned. Linen and cotton rags are simply forms of woody fiber, which has the same chemical constitution as starch, and like starch may be easily converted into glucose, or grape sugar. Paper, sawdust, or any form of woody fiber will answer the purpose equally well. Of course woolen rags will not do, though the first edition of a certain popular text-book of chemistry contained the rather startling statement that sugar had been made out of an old flannel shirt.

But the most wonderful metamorphosis of these carbon compounds takes place in the cells and tissues of plants and animals. In these microscopic laboratories what marvels of chemical manufacture are perpetually being effected! What myriads of curious and complicated products are here concocted! Every vegetable and animal substance that serves our use or our pleasure is thus prepared for us. It is interesting to visit a manufactory where the brilliant aniline dyes now so extensively used for coloring textile fabrics are made from the filthy coal tar, which is a waste product of the gas works; but a far more wonderful transmutation is continually going on in the rose in your garden or the violet by the wayside. The flower derives the materials of its beauty and its fragrance from the air and the earth, and elaborates these into the exquisite products that so delight our senses. The delicious juices of the grape and the peach are distilled in the alembic of the vine or the tree by a like subtle alchemy. The rich spices of "Araby the blest" have the same origin; hence, too, come the healing balms and balsams, the potent alkaloids of the medical art, and whatever else we draw from the vegetable kingdom to supply our needs or gratify our tastes.

All the processes of animal life are likewise illustrations of this chemistry of the carbon compounds. Our bodies are built up of these compounds, fabricated in the minute cells of the system from materials already prepared by the plant, which is the pioneer of the animal in the great march of organic life. Even the subtle processes of thought are dependent on the transformation of carbon compounds. The fires of feeling are fed with fuel which does not really differ from that burnt on the household hearth.

It may be added, in conclusion, that the allotropic forms in which carbon exists as an element are suggestive of the protean aspects under which it appears in its compounds. Carbon is found in nature as the diamond, as graphite or plumbago, and as coal. The diamond is the purest and most transparent of crystals, the hardest of known substances, unaffected by the atmosphere and all ordinary chemical agents, the type of permanency and indestructibility. Graphite we might at first take to be a metal, from its texture and lustre; it differs from the diamond in all respects except that it is practically indestructible. It is at once very soft and very hard and refractory. We make from it our lead pencils, which are worn away by the slightest friction on paper; and we shape it into crucibles which endure the fiercest heats of our furnaces. Coal, whether charcoal or cannel or anthracite, resembles neither the diamond nor graphite. It is indeed black like the latter, but without its peculiar metallic lustre; and whereas neither graphite nor the diamond can be ignited in any ordinary way, the most marked characteristic of coal is its ready combustibility. Its obvious end and purpose is to be burned, and it keeps up the fires, domestic and industrial, of almost the entire world. There are other elements—like sulphur and phosphorus, for example—which are remarkable for the allotropic forms they assume, but carbon must be regarded as surpassing them all in this respect, and the peculiarity seems typical of the imperial place it was destined to hold in the realm of organic nature.—*Boston Journal of Chemistry.*

Astronomical Notes.

BY BERLIN H. WRIGHT.

PENN YAN, N. Y., Saturday, January 26, 1878.

The following calculations are adapted to the latitude of New York city, and are expressed in true or clock time, being for the date given in the caption when not otherwise stated.

PLANETS.

	H.M.		H.M.
Mercury rises	5 48 mo.	Jupiter rises	6 26 mo.
Venus sets	8 03 eve.	Saturn sets	8 31 eve.
Mars in meridian	5 17 eve.	Uranus rises	6 52 eve.
Mars sets	11 56 eve.	Neptune in meridian	5 48 eve.

FIRST MAGNITUDE STARS.

	H.M.		H.M.
Sirius rises	5 15 eve.	Altair sets	5 50 eve.
Antares rises	3 40 mo.	Fomalhaut sets	6 26 eve.
Regulus rises	6 53 eve.	Algol (2d 4th mg.) in merid.	6 36 eve.
Spica rises	11 30 eve.	Capella in meridian	8 43 eve.
Procyon in meridian	11 08 eve.	7 stars (cluster) in meridian	7 16 eve.
Arcturus rises	10 33 eve.	Betelgeuse in meridian	9 24 eve.
Aldebaran in meridian	8 04 eve.	Rigel in meridian	8 44 eve.
Vega sets	7 02 eve.		

REMARKS.

There will be an annular eclipse of the sun February 2, visible only in Australia and vicinity, and there as a partial eclipse on the southern limb, the visible portion of the sun appearing as a large crescent with the horns down. The eclipse begins at Adelaide 5 h. 39 m. P.M., size 10 digits; Melbourne, 6 h. 1 m. P.M., size 11 digits; Sydney, 6 h. 34 m. P.M., size 4½ digits. At all the above places the sun sets eclipsed. Mercury rises 1 h. 28 m. before the sun, and 2° 50′ 30″ south of the sunrise point, being 27° 45′ 20″ south of the east point. Venus commences to retrograde January 29, being at that time apparently stationary. Jupiter rises 50 m. before the sun, and 1° 28′ south of the sunrise point, being 26° 23′ south of the east point.

Cost of a Pennsylvania Railroad Passenger Car.

Engineering gives in detail the cost of constructing one first class standard passenger car, at the Altoona shops of the Pennsylvania Railroad, the total cost being $4,423.75. The principal items are as follows:

Labor	$1263 94
Proportion of Fuel and Stores	28 61
2480 feet poplar	86 80
3434 feet ash	127 08
1100 feet pine	20 90
2350 feet yellow pine	70 50
500 feet oak	10 00
450 feet hickory	13 50
700 feet Michigan pine	49 00
400 feet cherry	16 00
439 feet maple veneer	24 14
4 pairs wheels and axles	332 85
2 pairs passenger car trucks, complete	533 62
13 gallons varnish	52 34
45 lbs. glue	14 33
2925 lbs. iron	87 75
792 lbs. castings	16 99
Screws	51 88
Gas regulator and gauge	25 25
2 Two-light chandeliers	50 72
2 Gas tanks	84 00
1 Air-brake, complete	131 79
57 Sash balances	44 61
61 Lights glass	65 83
2 Stoves	77 56
25 Sets seat fixtures	50 50
3 Bronze lamps	13 50
2 Bronze door locks and fittings	15 20
Butts and hinges	15 58
13 Basket racks	77 35
12 Sash levers	42 00
61 Bronze window lifts	24 40
61 Window fasteners	16 47
238 Sheets tin	41 44
273 lbs. galvanized iron	25 31
96 yards scarlet plush	228 87
44 yards green plush	109 99
61 yards sheeting	10 30
243 lbs. hair	72 95
12 Springs	22 96
12 Spiral elliptic springs	20 29
1 Head lining	80 63
2 Packets gold leaf	14 58
Various small items	261 44
	$4423 75

Postal Certificates in England.

Representations having been made to the Postmaster-General that it would be very desirable in many cases to have a certificate showing that a letter, newspaper, or book-packet had been posted without registering it or obtaining for it any special security, it has been decided by the Post-office authorities to try the experiment of issuing certificates of this description at Liverpool, Manchester, Birmingham, Bath, and some of the principal offices subordinate to those places. Forms of certificate, with an embossed half-penny stamp, will be sold to the public, on which the sender of a letter, etc., must write the address, and present it with the letter to the clerk at the counter. After examining the address, the clerk will retain the letter, newspaper, or book-packet, and return the certificate to the sender, impressed with the dated stamp of the office as evidence of posting. The subsequent treatment of the letter will be precisely the same as if posted in a letter box.

How to Make Pepsin.

Obtain, from any hog butcher, one half dozen dissected membranes of the stomach of the hog, and cut or mince them up finely; and macerate in a menstruum of 1 part muriatic acid to 32 of water, for ten or twelve hours. Decant the liquid, and re-macerate the membrane in a fresh portion of water and acid; throw the whole on a strainer; mix the filtrates together, and add to it a quantity of table salt, until a separation of pepsin ceases to take place. The pepsin impregnated with sodium chloride will float on the surface. This is collected and placed on muslin, folded several times, and submitted to pressure, to free it from adhering moisture. The strength of the moist pepsin can be readily obtained by its power of dissolving albumen; and its strength can be apportioned accordingly, by simply mixing it with sugar of milk, so that 1 grain can be made to dissolve 5, 10,15, or 20 grains of coagulated albumen.

The price asked for standard pepsin, by wholesale druggists, varies from 50 to 75 cents per ounce; at which prices a handsome margin is left for the manufacturers. I see no reason why pepsin, of the strength of those now considered standard, cannot be made for at least one half the price, and afford the druggists' apprentices some means of recreation from their otherwise monotonous duties.

The above remarks are general in their character, and are written in the hope that they will stimulate retail apothecaries to rely more on their own ability to make preparations of this kind than has heretofore been the case.—*Phila. Druggist and Chemist.*

The Satellites.

The following table presents at one view the mean distances of the satellites from their primaries, expressed in equatorial semi-diameters of the latter, and founded upon the most reliable data hitherto available:

	The Earth.	Mars.	Jupiter.	Saturn.	Uranus.	Neptune.
I.	60·27	2·72	5·70	2·98	7·71	14·55
II.	—	6·81	9·07	3·83	10·75	—
III.	—	—	14·46	4·75	17·63	—
IV.	—	—	25·44	6·08	23·57	—
V.	—	—	—	8·47	—	—
VI.	—	—	—	19·67	—	—
VII.	—	—	—	24·80	—	—
VIII.	—	—	—	57·28	—	—

It will be seen that the outer satellite of Saturn, Iapetus, is the only one revolving round its primary at a distance similar to that of our moon, with respect to the semi-diameter of the central body. The exterior satellites of Jupiter and Uranus are similarly placed in this respect, and as regards the former planet the reader will remember a suggestion of Sir John Herschel's, that a distant satellite, by which was intended one situate more nearly, as our moon or the Saturnian satellite Iapetus, might be "worth a search." At the end of the last century it was thought that if satellites of Mars existed, they might be "distant many degrees from the principal planet," upon which idea the late Professor D'Arrest argued that a search after a satellite situate many degrees from Mars would be an almost endless task; and further, that a satellite at a maximum digression of seventy minutes of arc would have a sidereal period greater than the synodical revolution of the primary. The same astronomer endeavored to ascertain, at the opposition of 1864, to what magnitude stars were visible in the vicinity of Mars with the Copenhagen refractor, which has an aperture of about 11 English inches. He considered that a satellite as bright as the twelfth magnitude could hardly have escaped him, and that objects of a fainter class were only visible in such an instrument at distances of eight or ten minutes, and in the case of Mars opportunities of viewing a satellite in such position would occur comparatively seldom. Perhaps the more prevalent idea respecting possible satellites of Mars, prior to their actual discovery, was that they would be "very small and close to the planet."—*Hind, in "Solar System,"* page 78.

A New Telegraph Company.

An organization named the "Continental Telegraph Company" has been formed in this city by parties who have been prominently connected with the Atlantic and Pacific Company. The capital has been placed at $10,000,000. Right of way through New Jersey has been obtained for the new line to Philadelphia and Washington, and work has already been commenced. The first line will run from New York to Philadelphia, and will consist of five wires, the size of the wire being No. 6, with poles 30 feet in height and 7 inches in diameter at the top, 40 poles to the mile. The second line will run from New York to Baltimore and Washington, and will also consist of five wires. Business will probably be opened about the 1st of April. One of the features to be introduced will be a combination of the Morse instrument and the telephone. Lines will be extended only to points where the amount of business will warrant, and the best of materials will be used in construction.

FISHER'S TORPEDO GUARD.

We illustrate herewith a new system of guards for protecting the hulls of vessels against torpedoes. The apparatus is especially designed for application to men-of-war as a protection against submarine attacks; but it may be applied to other vessels to increase their buoyancy and carrying capacity Horizontal pipes of suitable dimensions are curved to conform to the hull and are attached to the latter and at a short distance from the sides of the vessel. The ends of the horizontal pipes are connected together by vertical pipes, A, to one of which, on each side of the vessel, a tube, B, is attached, which leads to a pump, C, by means of which air or water may be forced into the entire system. The inventor claims that when a submarine torpedo comes in contact with this protecting piping it will be caused to explode at such a distance from the vessel as not to injure the hull. By filling the pipes with air it is claimed that the carrying capacity of the vessel will be increased; or by allowing water to enter them, the ship will have greater draught and less of her surface will be exposed.

Patented through the Scientific American Patent Agency November 20, 1877. For further particulars address the inventor, Mr. J. Harmanus Fisher, P.O. Box 69, Baltimore, Md.

IMPROVED ORE CRUSHER AND PULVERIZER.

We recently witnessed some interesting operations in the reduction of ore by the Alden ore crusher and pulverizer, an engraving of which is presented herewith.

In order to exhibit the construction, part of the frame side of the machine in the illustration is removed. The dies and die faces and their mode of suspension, as well as of travel and action, are clearly shown. The dies are hung upon shafts, the ends of which project through the sides of the frame. On these ends are the connecting links, each secured by bolt and washer. At the lower ends of these links a rectangular yoke is attached in a similar manner. This yoke, one side of which only is shown, surrounds the free hanging ends of the dies and moves on a nearly horizontal plane, alternately pushing and pulling the dies within it the full distance of the stroke and imparting a rubbing effect, which is a peculiarity and one of the best features in the machine. The regulation of the set of the dies to different grades of production is effected by means of adjustable steel keys. The connection between the yoke and the crank is direct by means of a connecting rod or pitman. In the attainment of the required motion the usual appliances of crank shaft, flywheels, and pulleys are employed.

From the engraving the general construction and operation of the machine will be clearly comprehended, and no further description is required.

At the time of our examination galena and zinc ores were being crushed. The following results were obtained: Through No. 15 mesh, 12½ tons in 24 hours; No. 30 mesh, 10 tons in 24 hours; No. 60 mesh, 6 tons in 24 hours.

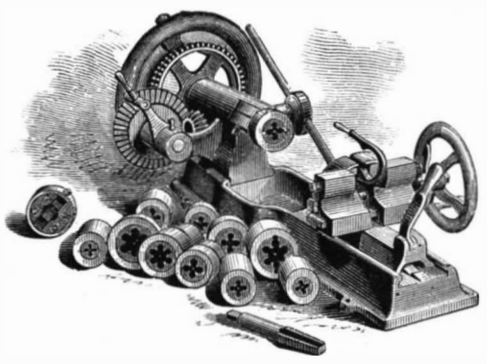
In the process of reducing ore this machine does the work of the preparatory breaker, and obviates the need of the intermediate machinery ordinarily employed between the preparatory and the final treatment. It works upon the principle of abrasion instead of direct compression. It breaks, crushes, and pulverizes by rasping and rubbing fragment upon fragment between the horizontally corrugated steel faces of the jaws. The motion of the rubbing surfaces is obtained by the oscillation of the dies, which both swing at the same time, in one and the same direction, and to an equal extent.

The following is a summary of the advantages claimed: It takes ore from the dump and breaks, crushes, and pulverizes it at one operation to any desired degree of fineness, ready for smelting, concentrating, or amalgamating; it is adjustable, and can be instantly regulated to yield coarse, broken, egg, nut, pea, powder, or dust; the heaviest piece of the largest machine (receiver, 14 inches by 7 inches) weighs 2,400 lbs; that of the smallest machine (receiver, 10 inches by 3 inches) weighs 587 lbs.

The machine is built in three sizes, and is adapted for crushing and pulverizing gold, silver, copper, zinc, and other ores; also for crushing quartz, flint, emery, corundum, felspar, manganese, phosphate rock, plaster, soapstone, firebrick, slag, etc. For further information address the manufacturers, Messrs. Copeland, Dodge & Co., 206 Broadway, New York city.

THE NO. 10 BOLT CUTTER AND NUT TAPPER.

The patent adjustable die, in the new machine herewith illustrated, is the same which has already been described in these



columns. To the apparatus is also added a variety of hand and power bolt cutters and nut tappers well known to the public. Threads are made by this machine in once going over, and crooked work is threaded without being straightened. The engraving shows a staple held in the chuck or vise ready to be operated upon. For large work the gearing provided multiplies the direct force of the crank seven-fold, and the arrangement is such that the die being run sufficiently far on the work the gears may be instantly thrown out, and the die whirled swiftly back off the thread by means of the balance wheel. Extra dogs are attached to the chuck to hold large smooth pipe which may slip in the vise.

Small work is rapidly done with the gears out, by handle on the balance wheel. The work represented in the illustration is half inch, and the gearing for large work need hardly be applied for any nuts or bolts under ¾ inch.

It will be observed that the merit of this machine is largely in the great range of sizes and variety of shapes that may be conveniently done on it. Its capacity for bolts and nuts ranges from three sixteenths to one and a half inch; for pipe from one eighth inch to two inches. It is especially useful for repair shops of mills and mines, wagon shops, boat builders, etc.

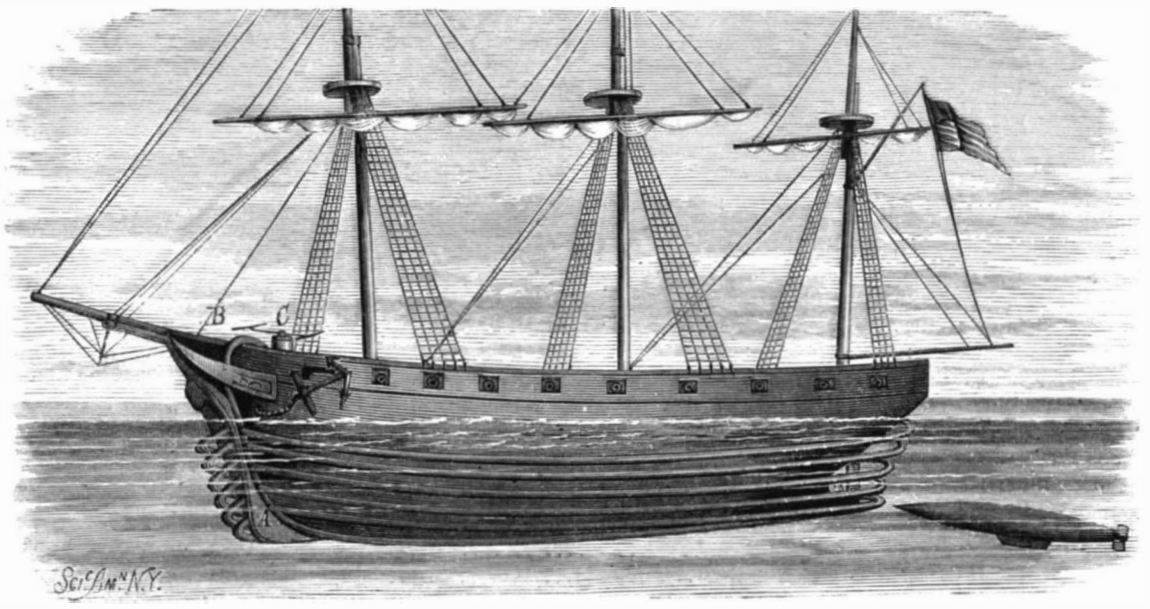
For further information address the manufacturers, the Wiley & Russell Manufacturing Company, Greenfield, Mass.

Craniology and Crime.

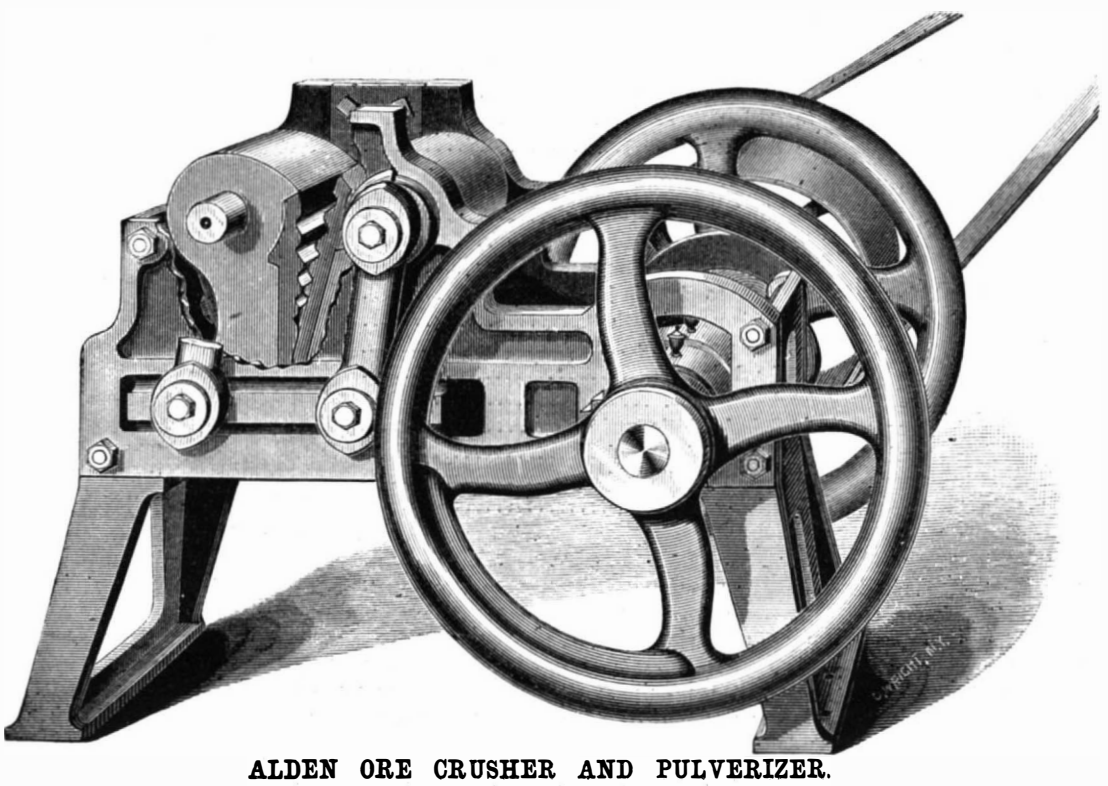
The British Medical Journal presents, at some length, the results arrived at by Professor Benedict, in his examination of the brains of sixteen criminals. These, on comparison with the healthy brain, proved to be abnormal. Not only, too, has he found that these brains deviate from the normal type, and approach that of lower animals, but he has been able to classify them in three categories. First, absence of symmetry in the two halves of the brain; second, an obliquity of the interior part of the brain or skull; third, a distinct lessening of the posterior cerebral lobes.

Rubber Bottoms for War Ships.

It has been found necessary to protect the submerged portions of war vessels against the results of plunging fire, more especially as, even in our armor-clad frigates and corvettes, few of them possess armored decks. An experiment in this direction is about to be tried at Portsmouth, England. It has been thought that if the bottom of a man-of-war were faced with India rubber of considerable thickness, the pressure of the water outside would effectually close the hole made in the hull by a plunging projectile which had forced its way through the decks. The suggestion is to be submitted to a practical test on board the Skylark, under the superintendence of Lieut. R. N. Custance, senior gunnery lieutenant of the Excellent. The head of an iron tube will be closed with rubber eight inches in thickness, and so made perfectly water-tight. The sealed end will be sunk in the water until the rubber occupies a position analogous to that which it would occupy if attached to the hull of a ship below the load-line. The bow gun of the Skylark will then be depressed until the rubber can be sighted down the tube, and a 64-pounder shot will be fired through it. Should the water fail to enter the tube, the rubber will be known to have performed its work by closing up the shot hole. The conditions, however, are only approximate, as the iron skin of a ship would, on penetration, be probably so jagged as to keep the aperture open for the inward rush of water.



FISHER'S TORPEDO GUARD.



ALDEN ORE CRUSHER AND PULVERIZER.

Fruit Cellars.

The importance to every fruit cultivator of a suitable place in which to store the products of his orchards late in the autumn and during the winter is strangely overlooked. No farmer's establishment can be satisfactory without a fruit cellar, and this is specially the case if large quantities of apples, pears, or grapes are among the products of the farm. The ordinary cellars under dwellings do not meet the want, as they are usually not adapted to preserve fruit, except for a month or two after harvest. They often do not protect from frost, or they are damp and without means of ventilation, and fruit soon decays. To keep fruit several conditions are important. First, the atmosphere of a fruit room should be dry; there should be no more dampness than ordinarily exists in the cold outside air. The room should be susceptible of ventilation in proper weather, not by direct currents of air, but by air modified before it reaches the fruit. A fruit room must be frost-proof; it must be cleanly and accessible. As regards location, it may be placed on a side hill, the excavation opening to the south; or it may be placed under a barn or stable, or other convenient outbuilding. It is not well to store large quantities of fruit in rooms under dwellings, even if they are adapted to the keeping of the fruit. The hygiene of families must not be jeopardized by the possibility of evil results arising from the decay or fermentation of vegetables in rooms under family apartments.

Ten years ago we constructed

a fruit cellar under our stable, and it has proved so satisfactory that we venture to give a brief description of it. The division walls are constructed of brick, and the apartments are two in number, an outer and an inner room. The outer room is but partly underground, and is ten by twelve feet in area and eight feet high. The inner room is wholly underground, and frost-proof; it has four brick walls and a cemented floor. In this room the fruit is stored early in December, when the weather becomes cold. The outer room holds the fruit during the autumn months after it is gathered, and it is cool, well lighted, and dry. The windows are left open and a free circulation of air allowed so long as no danger from frost exists. When the fruit is taken to the inner room, the door is closed and no light admitted. Ventilation is secured in moderate weather by opening the inner door and throwing down a window in the outer room. In this cellar we kept apples of last season's growth until the present winter in perfect condition. Some of these apples, exhibited at the autumn agricultural fairs, were pronounced as fresh as those of the past season's growth.

Apples stored in this cellar which would bring only one dollar a barrel at the time of gathering we sold last spring and summer at three dollars, without picking over. The profits of a good fruit cellar are greater than anything connected with farm arrangements.—*Boston Journal of Chemistry.*

A CELEBRATED SHORT-HORNED COW.

We copy from the London *Graphic* a fine portrait of a celebrated shorthorn cow, Tenth Duchess of Geneva, whose personal and family history is somewhat remarkable. Tradition ascribes the origin of the family to a breed of cattle possessed for centuries by the family of the Duke of Northumberland, but the actual records commence in the last century, when an ancestress of this cow passed into the possession of Mr. C. Colling, of Ketton, Durham, who was one of the founders of the shorthorn as a distinct and highly improved breed. In 1804 Mr. T. Bates, of Kirklevington, Yorkshire, purchased one of the Duchess cows, and recognizing in her excellence and that of her male offspring the superiority of the family over the shorthorns he had previously owned, he determined to secure more of the sort; and at Mr. Colling's great sale, in 1810, when forty-seven animals of both sexes and all ages, from eleven years downward, made the then unprecedented average of $732.84, he gave $929.64 for the two year old heifer Young Duchess, afterward called First Duchess, a daughter of Comet (sold on the same occasion for $5,080), and granddaughter of the cow he had first purchased. From that heifer, in the female line direct, sprang those Duchesses which have at different periods won the chief honors of the Royal Agricultural Society of England, and for many years past have commanded the highest prices at public and private sales. Mr. Bates, while practicing to a considerable extent the system of in-and-in-breeding, crossed his Duchesses at different times with other approved shorthorn families, notably with those of Mr. Colling's Red Rose and Princess, thus combining what he considered three of the oldest and best shorthorn families in the kingdom. In 1853, at the Tortworth sale (after the death of Earl Ducie), Sixty-sixth Duchess was bought by Messrs. Becar and Morris, of New York, for $3,557.40.

Her descendants, having changed owners in America, were finally dispersed by auction in 1873, when Tenth Duchess of Geneva was bought by Mr. Berwick for the Earl of Bective at $35,000. She had bred in America the bulls Third Duke of Oneida, Sixth Duke of Oneida, and the heifer Eighth Duchess of Oneida, bought also for Lord Bective, at the same sale, for $15,000. In this country she has produced the bull Duke of Underley and the heifers Duchess of Underley and Duchess of Lancaster, all of which, with Eighth Duchess of Oneida, are now in the herd at Underley Hall, Westmoreland. The Tenth Duchess of Geneva died in January last, and in the same month the Earl of Bective had the misfortune to lose his old bull Second Duke of Tregunter.

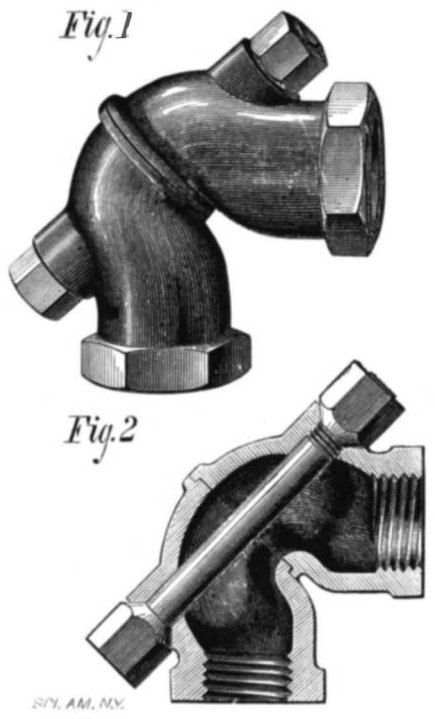
THE SHORT-HORNED COW TENTH DUCHESS OF GENEVA.

Two Flowers from One Stalk.

Mrs. Lucy A. Millington, of South Haven, Mich., writing to the *Gardener's Monthly*, says:—"Perhaps some of the many lady readers of your *Monthly* would like to know how to get two flowers instead of one from every flowering sheath of their Calla lilies. As soon as the joint flower is cut, or begins to wither, pull the stalk down through the open sheath clear to the bottom. At the bottom will be found standing, close to the stalk, another bud, inclosed in a delicate covering. Cut the old stalk away as close as possible without injuring the bud, and if it has not been kept back too long it will grow up very quick. I have never failed to get both buds to flower. I never tie up the leaves close, but leave them free."

CHAPELL'S PIPE COUPLING.

In the annexed engraving is illustrated a new and improved pipe coupling which is claimed by its inventor to obviate the difficulty in starting union joints which have become rusted fast, in hunting out the left hand thread where right-and-left elbows are used, also in bending pipes for steam and gas fitting to the exact angle required. It consists of two parts, both of the same pattern and threaded with right hand threads, but faced on a diagonal line to fit each other, and secured together by a bolt passing through both parts, having a conical head and a conical nut covering the point of the bolt, both fitting into conical seats in each part. The two parts are curved in such a way that when one part is turned around the bolt one half a revolution it will assume positions equivalent to those of a union joint. In the position shown it is equivalent to an elbow and union joint, and it may also be secured in any intermediate position. If this fitting was in general use, the inventor claims, there would be no need of left hand threads, taps, and dies, thereby avoiding a large outlay of capital.



Patented April 17, 1877. For further information address the inventor, E. S. Chapell, Pembroke, Maine.

New Agricultural Inventions.

A Collar Pad has been invented by Martin F. Sauer of Somonauk, Ill. Two elliptical pads fit on the upper part of the horse's neck, while a strap rises slightly above the neck, leaving the upper portion unpressed and out of contact. The neck is thus prevented from being made sore by the collar.

In a Windmill invented by William A. Guzeman of Washington, Iowa, the face side of the wheel is nearest the vertical axis of the mill, the wind striking it on that side when in operation. It is provided with a rigid vane shaft placed parallel with and in front of the wheel. It combines many other useful improvements and will at once commend itself to the favorable attention of millers.

A Churn invented by Eliza Brough of Greenville, Mich., is kept erect by spring rods and elastic springs and is oscillated on gudgeons at the sides. A tube runs down through the center through which water can be poured to temper the milk. The machine can also be used as a clothes washer. The butter comes quickly.

In a Churn patented by George H. Bradshaw of Fayetteville, Tenn., the dasher is formed of a hollow truncated cone, provided with flanges and connected with the shaft by rods. A band fitted into the interior of the cup is provided with flanges. Great agitation is secured with little heat.

Between the lugs of a Thill Coupling invented by Carlton E. Pickering of Hornellsville, N. Y., is pivoted a block, the upper part rounded off and notched forward. A double hook thill iron fits over this and is secured by a spring catch. At the bases of the lugs is placed rubber packing. It is noiseless in use and easily detached and attached.

Senator T. F. Randolph, of Morristown, N.J., has patented a Ditching Machine, which is an improvement upon his previous invention, which has obtained a considerable reputation. The previous machine could cut a ditch when running in one direction only. The present or improved machine is so constructed as to work equally well in either direction, so that the cutting wheel and lifting spade do not require to be raised out of the ditch and the entire machine turned about and reset for the return cut, at end of the ditch. The saving of time effected by this improvement is above 50 per cent, so that the cost and labor of cutting a ditch is reduced more than half.

John P. Moore, of DeMossville, Ky., has patented a Millstone Balancing Device, which provides an improved means of balancing millstones to make them run true and grind uniformly, and which permits an easy and accurate adjustment, and dispenses with weights. The improvements consist, first, in using in the place of the block a headed bolt whose head carries the weight of the millstone by resting against the under surface of the opening in the balancerynd and is itself supported upon the spindle; and employing in connection with the threaded end of said bolt a nut and washer which not only holds the bolt firmly in the balance rynd, but also rests against the flattened heads of the horizontal adjusting screws and acts as a nut lock to the same. The invention also consists in forming such nut directly upon the bottom part of the distributing cup.

A Grain Toller, patented by Adolphus H. Vitt, of Union, Mo., consists of a stationary conductor tube, that conveys the grain from the hopper or elevator to a revolving and vertically movable spring disk. The disk is lowered by the pressure of the grain, and the grain allowed to escape over the edge of the disk into an encircling casing with two exit spouts. Vertical partitions of the encircling casing, of which one is stationary, the other adjustable, conduct a certain proportion of grain to the toll spout, while the remaining grain is conducted to the grindstones of the mill.

A Ventilator patented by R.S. Grigsby, of Fayetteville,

Tenn., consists of a right-angled tube having slotted sides, and provided with sliding doors for closing its outer ends. The device may be applied to a fruit house, and is effective in ventilating the interior of fruit piled up around it.

In an Airtight Paint-Mixing Can invented by Isaac Banister, of Newark, N. J., a shaft running through the center is fitted with a crank on the outside. Radial knives and a spiral knife are arranged on three sides of the shaft, leaving the fourth side free. By turning the crank the radial knives cut the sediment to pieces, and the spiral knife scrapes the sides. When not in use, the paint is situated in the free side of the can, leaving the knives clean outside.

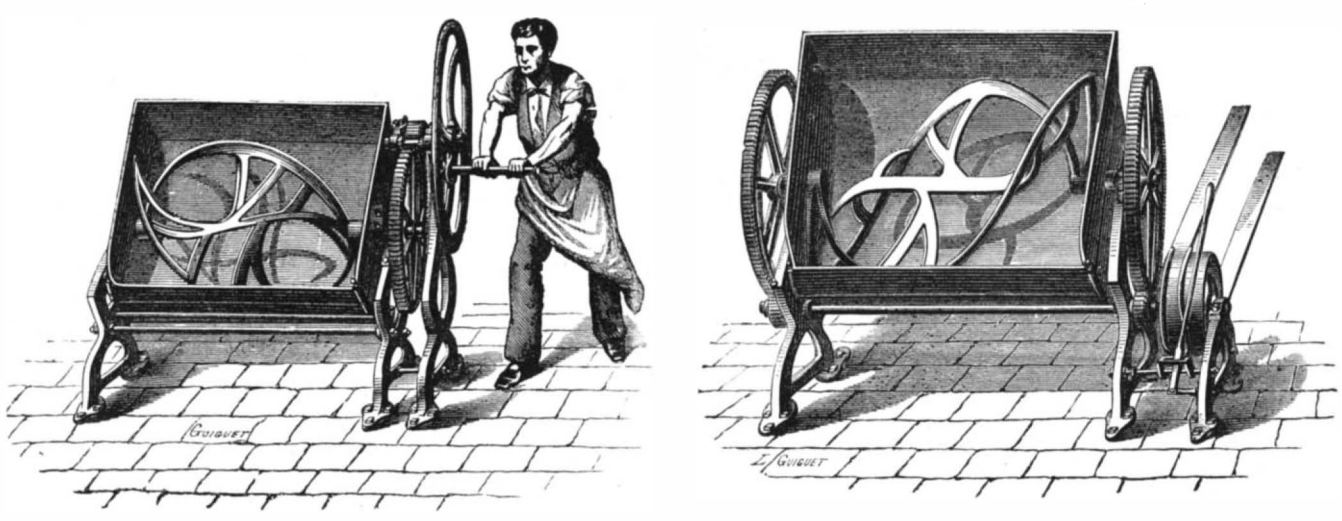
Messrs. John M. Ludlow and Sanford C. Pruitt, of Hall, Ind., have devised a new Circular Toothed Pulverizer and Cultivator, which destroys weeds, cuts cornstalks and rubbish in pieces, ridges the soil, and may also be used for marking the ground.

A new Platform Wagon patented by Mr. E. H. Booth, of West Colesville, N. Y., is so constructed that the draft may be applied directly to the axle, while the rolling of the latter is prevented. A reach may be used, and the horses may be hitched much nearer to the load than is usually the case.

Mr. Alvin T. Dora, of Chariton, Iowa, has devised an improved Hay Rake and Loader, which may be attached to the rear end of a hay rack, or to the rear axle of a wagon, and which is so constructed as to collect the hay and deposit it upon the hay rack without allowing it to be scattered by the wind. The hay is collected by a rake and carried up by and between bands and an endless apron.

BOLAND'S IMPROVED KNEADING MACHINE.

The annexed engravings represent an improved kneading machine largely used by bakers throughout France and Belgium. It is adapted for any employment where soft masses are required to be thoroughly mixed. The new feature is the mixer or kneader, which is formed of three arms or blades, the central one of which is S-shaped, straight in the middle, and in line with the axis of the shafts, while the ends are curved spirally to the extremities of radial arms that extend one from each shaft but in relatively opposite directions. The other two blades extend from the extremities of the arms to the inner but opposite ends of the shafts. Their middle curved parts run along the inner surface of the receptacle, while the outer ends are curved spirally but in opposite directions to their respective terminal points. Suitable braces are provided, and the kneader may be operated by either hand or power, as indicated in our engravings.



BOLAND'S IMPROVED KNEADING MACHINE.

It is claimed that this machine thoroughly mixes the dough, without cutting it, saves labor, and produces better bread. It is used in all the Government bakeries in France, in the Paris hospitals, and in Philadelphia, New Orleans, and other localities in this country.

Patented through the Scientific American Patent Agency November 27, 1877, by Mr. O. Boland, of Paris, France. For further information address E. L. Touret, agent for the United States, 226 West 22d street, New York city.

Mineral Negatives.

BY PROFESSOR J. S. ST. JOHN.

On account of the expense of grinding thin sections of fossils and the difficulty of duplicating many varieties, I was led to try photography as a means to copy these sections on glass for use in projection, and with your permission I will present my results for consideration.

I found that in photographing with a camera by transmitted light the sections were too opaque to produce an image on the ground glass of sufficient intensity to tell when the fine lines were in focus, and that with such fossils as sponges and corals much of the detail was lost. In attempts at projection by using the section in the lantern I met with the same difficulty. By using a microscopic objective, not enough of the fossil could be brought in the field.

For some time I have been preparing transparencies for class work by using dry plates and printing from negatives by contact, and have obtained good results; consequently I resolved to try photographing sections with dry plates, using the section as a negative.

The trial was made, and to me the result is very satisfactory. We shall soon see some of these photographs projected on the screen.

I will now give a description of how the dry plates may be prepared and of the process of photographing the sections.

TO PREPARE THE PLATES.

In selecting the glass, only those pieces should be used that are free from blisters and other defects. It may be cut in pieces $3\frac{1}{4}$x$4\frac{1}{4}$ inches, which is a convenient size for the lantern. After washing the glass it is albumenized. The albumen may be prepared by taking the white of one egg, 300 c. c. of water and 12 drops of carbolic acid. Shake thoroughly and filter through a sponge.

For the silver bath, use 30 grammes of nitrate of silver for every 300 c. c. of pure water. The bath should be acid, and in the best condition. If the dry plates are to be used for negatives, use any good collodion, as Anthony's. If for positives, it should be made thin by adding equal quantities of ether and alcohol. Kelsey's Banner collodion works well by using three quarters of the iodizer that comes with each bottle. Flow the plate with the collodion and place it in the silver bath, as in the wet process. When it comes from the bath it is held under the tap and washed thoroughly on both sides until all signs of greasiness disappear, when the plate is flowed not less than three times with a preservative, allowing it to flow from the plate into the sink each time. I have tried many of the preservatives that are used with dry plates, and have found none so simple as what is called the coffee preservative, which may be prepared as follows: H_2O, 300 cub. cen.; Java coffee, 30 grammes; rock candy (white), 18 grammes. Boil the whole 15 minutes and filter.

After the plate has been flowed with the preservative, it is placed in a rack to drain. When the desired number have been prepared, they are placed in a dark box to dry. I have found that when the plates are allowed to dry slowly, in this way, they are much better than when dried quickly. Plates made in the afternoon are ready for use the next morning. If a large number of plates are to be dried, it would be well to place them in different boxes, so that if the door of one was left open through carelessness only the plates in that box would be spoiled. I have kept plates a year before using. If tannin instead of coffee is used, they will keep for years. I made some of Newton's emulsion and tried it with the coffee preservative with good results. If a person could buy this emulsion prepared it would save one half of the work in preparing the dry plates, and would secure more uniform results; for, by using it, the silver bath is dispensed with, as the silver is placed in the collodion. But perhaps for beginners the emulsion process would be too difficult. We will now consider how these dry plates are used in photographing the rock section.

The section, with the dry plate in contact, is placed in a photographic printing frame and exposed to diffused light from four to forty seconds, according to its intensity, the kind of dry plates used, and the character of the section. A coffee plate is more sensitive than a beer plate, and the Newton emulsion more sensitive than either. The exposure may be made at night, to gas or lamp light. Many of my best prints have been made in this way. There are important advantages gained by working by artificial light; for e. g.—the intensity of the light is nearly constant, while the intensity of sunlight varies every hour of the day, making it more difficult to determine the proper length of time necessary for exposure. If we find that 40 seconds is the time required for an exposure by lamp light, we know that all prints from that negative, or others of like intensity, will require the same time.

After the plate is exposed, it is taken to the dark room and developed. This is accomplished by taking the plate as it comes from the printing frame and holding it under the tap for a short time, until the film is thoroughly wet, and then flowing it with the following developer: Pyrogallic acid, 2·5 grammes; citric acid, 3·5 grammes; Pure H_2O, 284 cub. cen.

For a $4\frac{1}{4}$x$3\frac{1}{4}$ inch plate pour into a small graduate or beaker about 10 c. c. of the developer and add two drops of $AgNO_3$, the same as that used in the bath.

As the developer is poured on the plate it is allowed to flow back into the beaker again, and this is repeated until the picture is distinctly seen on the surface of the glass by reflected light, when it is washed and fixed as in the wet process. Cyanide of potassium or the hyposulphite of soda may be used. The hypo. is best.

It will now be found that the picture is not so distinctly seen, and a beginner would be tempted to throw it aside as worthless; but, on application of a fresh quantity of the developer, the picture soon grows to the desired intensity, when the plate is washed and placed in the rack to drain. If the tone of the print is too brown, which is often the case when the coffee preservative is used, a weak solution of potassic sulphide may be poured over the surface of the plate, which will not only change the tone but will clear the picture. In using this pyro. developer, it will be found to turn to a wine color after it has been flowed over the plate a few times; just as long as it remains this color it will not fog the plate, but if it begins to turn black or muddy, it should be thrown out and a fresh supply taken. The plate that is now developed may be used in the lantern, or prints from this may be made by using it as a negative and proceeding as with the rock section. To protect the photograph from injury, it should be varnished and covered with a thin piece of glass.

I think many minerals could be photographed in this way; of course only those presenting detail could be worked. Many of the agates would work well; if they were colored, the prints on the glass could be tinted to imitate them.—*Anthony's Photographic Bulletin.*

Recent American Earthquakes.

Professor C. G. Rockwood, Jr., contributes to the American *Journal of Science and Arts* a record of the earthquakes which have occurred on the American continents from May 10, 1876, to November 18, 1877. These aggregate about 65 distinct shocks, the distribution of which is approximately as follows: California, 13; Territories, 9; Canada and Eastern States, 9; Southern States, 8; Western States, 7; Middle States, 4; Central America, 3; South America, 7; West Indies, 3, and Sandwich Islands, 2.

The severest earthquakes reported are those which occurred on May 19 and November 4, 1877. The first was a series of severe shocks lasting four or five minutes and followed by a destructive tidal wave along the coast of Peru and Chili. On the Peruvian coast the wave was from 20 to 60 feet high, and caused immense destruction in the harbors. It is supposed to have originated near Iquique, and its average rate of progress was to Callao 228 miles per hour, to San Francisco 348 miles, to Honolulu 408 miles, and to Australia 378 miles.

The earthquake which occurred on November 4 was felt throughout a large part of Canada, New York, and New England. In some places it lasted for 20 seconds; reports from others fix its duration at four or five minutes. In the valley of the St. Lawrence river the vibration was sufficient to overturn crockery, crack ceilings, and in a few cases to throw down chimneys.

New Method for Mapping.

A new method of orography, or mountain representation, whereby the outline of a horizon is given by an automatic operation, has lately been brought to notice by M. Schrader. Considering the horizon as a cylinder, in whose axis the observer is placed, this cylinder is transformed into a circular plane. A telescope attached to a sleeve on a vertical support rising from the middle of a circular disk covered with paper is directed to follow the outlines of the hills, etc., and the movements of a lever connected with it are transmitted by means of an arc and a horizontal rack to a pencil or style, which transforms them into out and in movements on the paper. If the telescope describes a circle round the horizon the style gives a corresponding circle on the paper, and if it rises or descends the trace of the pencil is further from or nearer to the central axis. The telescope being brought to a horizontal position by means of a spirit level, a circle is described round the central axis, and this affords a means of measuring the profiles of the hills. It is easy to transform such orographic circles into a map, and M. Schrader showed the French Academy a geographical map of Mont Perdu, obtained with his instrument.

Tanning Woods.

In general it may be said that plants whose wood endures in wet soils, experiencing only a slow alteration, contain, in the wood itself, tannin, whether associated with resinous matters or otherwise. Among such woods may be noticed the Quebracho, a tree belonging to the family of the Apocineæ, specimens of which were displayed by various South American States at the Vienna Exhibition. In Paraguay the wood of the tree has long been in use for dyeing brown shades, though the employment of the wood as a tanning and dyeing agent is of more recent date. It contains a colorable compound, which, under the influence of light and air, is transformed into an orange yellow dye, and it is also possible to obtain from the same wood a very beautiful yellow coloring compound.—*M. J. Arnaudon.*

The Story of an Invention.

It may not be generally known that an important invention in connection with the manufacture of carpets originated as follows: An operative weaver, in one of the largest establishments in this country, was engaged in weaving a carpet that in its finished stage would appear as a velvet pile. At that period this description of carpet was woven much in the manner of Brussels, the loops being afterward cut by hand —a slow and costly process. These loops are formed by the insertion of wires of the requisite thickness to form the loop; they are then withdrawn. This weaver—whether by cogitation or as the result of a bright thought—came to the conclusion that if these wires were so constructed as, on being withdrawn, to cut the loops, thus instantly completing the formation of the pile, it would be a great saving of labor and time, and a great economy. Taking one of the rods, he changed its form to the required shape, ground a knife edge upon it, took it to his looms, and inserted it into the web—all the while maintaining strict secrecy—and with some degree of excitement watched its weaving down until the moment for its withdrawal. This came, the rod was drawn out, the loops were cut, and the experiment was a perfect success, the pile being cut with great evenness.

The weaver, with a shrewdness often wanting in inventors, doubled up the rod and hid it away, wove down the line of cut loops upon the roll, then "knocked off," or stopped his loom, and proceeded to the office of the mill, where he demanded to see the principal. The clerk demurred to this, asking if he himself could not do all that was required; but no, the weaver persisted. Then the manager tried, but with the same result; only the principal would suit the weaver. The employer was informed of the operative's persistence in determining to see him; so he at once ordered him to be admitted. This was done, and the weaver stepped into the well furnished and handsomely carpeted office of the manufacturer. His employer addressed him: "Well, John" (for so we will call him), "what is it you want?" "Well, maister, I've getten summut yo mun hev," replied John. "Wodn't yo like a way ut makkin t' loom cut th' velvet piles?" continued the weaver. "Yes! that I would!" replied the employer; "and I will reward any man handsomely who brings me a plan of doing it," added he. "Awm yore mon, then," said the operative. "Wod'll yo gi' me?" he further asked. After some further conversation a bargain was struck, and a sum agreed upon, which the weaver should be entitled to claim in the event of his plan for automatically cutting the pile of the carpet being a success. Arrangements were made for its trial; the weaver made his preparations; the master, the manager, and one or two confidential employés gathered around the loom upon which the experiment had to be made, all others being sent outside the range of observation. The new form of wires were inserted, woven down, and withdrawn, leaving a well cut pile upon the face of the carpet. The weaver had won his reward, for it was honorably paid. An annuity of £100 was settled upon him, which he continued to enjoy until within a recent date, and for anything we know to the contrary may be enjoying yet. He retired from the weaving shed, determined to spend the rest of his days in ease and comfort. His employer secured by patent the benefits of his invention, it being one, among several others, which contributed to place that manufacturing establishment in the foremost rank in the trade, while its owners attained wealth and social eminence as the reward of their prudent enterprise.—*Textile Manufacturer.*

Engineering Progress.

In a recent address on the "Status and Prospects of Engineers," delivered before the Liverpool Engineering Society, the President, Wm. Graham Smith, said that the scientific progression of the profession had been gradual and ceaseless, though the ancients had executed works of greater magnitude than those undertaken at the present day. Among the familiar examples of ancient prowess are Lake Moeris, an irrigation reservoir 150 square miles in extent; the pyramids of Gizeh, constructed 5,000 years ago. Tubal Cain was a worker in metals, and to show the ancient lineage of the profession, George Smith has ascertained from an ancient tablet that the title "Master of Works" existed in Assyria 700 B. C. The remains of works are to be found in Egypt, China, and indeed all over the world, clearly denoting that the ancients possessed great engineers. Among the ancient titles known are those of "Lord of Canals" and "Establisher of Irrigation Works." Vast as are the works of the ancients, they by no means exhibit skill equal to that shown at the present day. The Suez Canal and Mt. Cenis Tunnel, through nature's barriers to national intercommunication, have been opened by the skill of men now living. The blowing up of the mass of rocks in the Hell Gate, the deepening of the Mississippi river, the construction of the East River Bridge, New York, and the great underground railways of London, are all instances of the scientific progress of engineering, and will long remain to immortalize the names of their builders.

THE "Illustrated Annual of Rural Affairs," for 1878. Luther Tucker & Sons, publishers. Albany, N. Y. Price 30 cents. A valuable little work.

THE REPRODUCTION OF MUSICAL TONES BY ELECTRO-MAGNETISM.

The following observations on the subject of the reproduction of musical tones through the agency of electro-magnetism have recently been presented by Philip Reis, at the Free Institute at Frankfort-on-the-Main, and we find them translated into the *Journal of the Telegraph:* The problem is to produce by the action of the voltaic current audible signals or tones instead of visible signs. In the process of reproducing tones by electro-magnetism an artificial imitation of the mechanism of the human ear is employed, consisting of a stretched membrane corresponding to the tympanum,

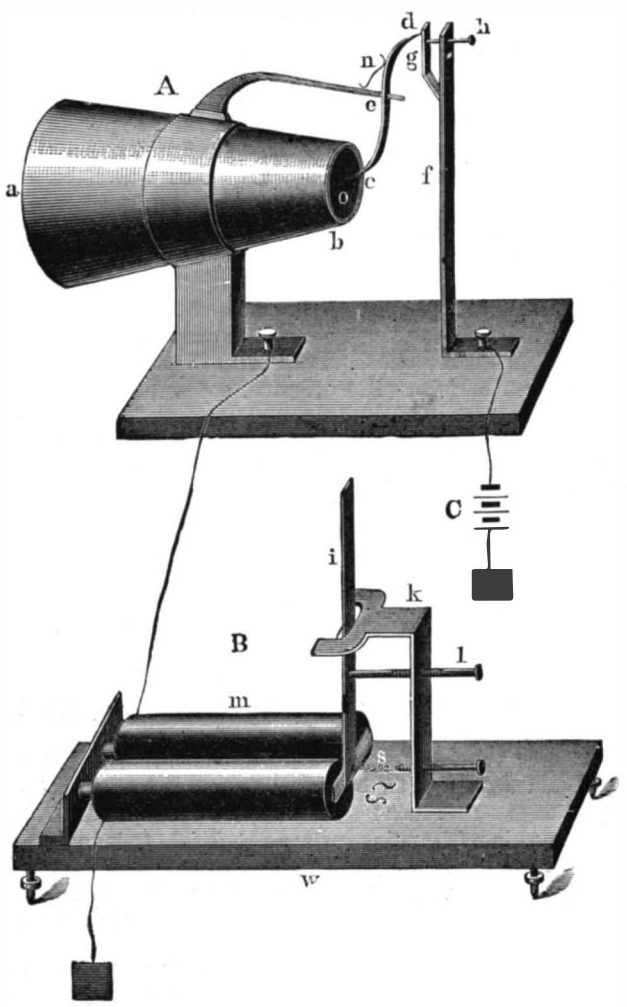
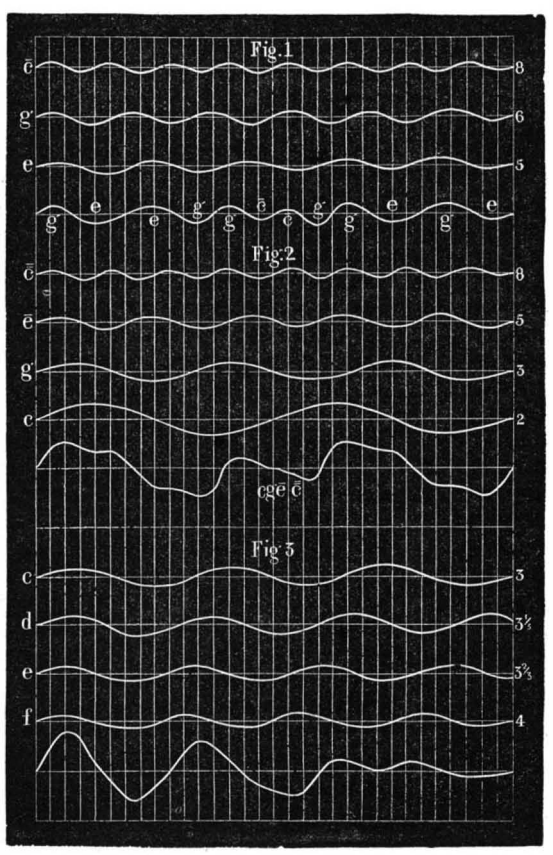


Fig. 4.—REIS' MUSICAL TELEPHONE.

which by its vibrations opens and closes an electric circuit extended to a distant station by a metallic conductor.

If we analyze the process by which the ear distinguishes a simple sound, we find that a tone results from the alternate expansion and condensation of an elastic medium. If this process takes place in the medium in which the ear is situated, namely, the atmosphere, then at each recurring condensation the elastic membrane or tympanum will be pressed inward, and these vibrations will be transmitted, by the



TONE CURVES.

mechanism above referred to, to the auricular nerves. The greater the degree of condensation of the elastic medium in a given time, the greater is the amplitude of the movement of the tympanum, and consequently of the mechanism which acts upon the nerves. A series of vibrations, a definite number of which are produced in a given time, and of which we thus become cognizant, is called a tone. If several simple tones are produced simultaneously, the sound conducting medium is subjected to a force which is the resultant of several simultaneously existing forces acting upon each other according to the ordinary laws of mechanics. In accordance with this principle we may construct from the condensation curves representing several simultaneous tones a single resultant curve which will correctly represent the effect produced upon the ear,

Fig. 1 shows a curve representing a composite tone formed by the combination of three simple tones, in which all the relations of the components return successively.

Fig. 2 represents such a curve formed of more than three tones, in which the relations do not appear so distinctly, but a musical expert will readily recognize them, even when it would be difficult in practice for him to distinguish the simple tones in such a chord. We can understand by reference to Fig. 3 why it is that the ear is so disagreeably affected by a discord.

The apparatus of Professor Reis is so constructed as to respond to these sonorous vibrations, however complex, while the application of the electric current thereto renders it possible to reproduce similar vibrations at any required distance. In this manner musical tones may be telegraphically transmitted from one point to another.

Referring to Fig. 4, A is the transmitting and B the receiving apparatus, which are supposed to be situated at different stations. For the sake of clearness, the appliances by which the apparatus is arranged for reciprocal transmission in one direction or the other have been omitted. The tone-transmitter, A, Fig. 4, is on the one hand connected by a metallic conductor with the tone receiver, B, at the distant station, and on the other with the battery, C, and the earth, or the return conductor. It consists of a conical tube, *a b*, about 6 inches in length, and having a diameter of 4 inches at the larger and 1½ inch at the smaller end. It has been found by experiment that the material of which the tube is constructed has no influence upon the action of the apparatus, and the same is true as to its length. An increase in the diameter of the tube is found to impair the effect. The inner surface of the tube should be made as smooth as possible. The smaller or rear end of the tube is closed.

In order to prevent the interference occasioned by the action of the sonorous vibrations of the atmosphere upon the back side of the membrane, when making use of the apparatus, it is advisable to place a disk about 20 inches in diameter upon the tube, *a b*, in the form of a collar or flange, at right angles to its longitudinal axis.

The tone receiver, B, Fig. 4, consists of an electro-magnet, *m*, mounted upon a sounding box or resonator, *w*, and included in the circuit of the electrical conductor from the transmitting station. Facing the poles of the electro-magnet is an armature which is attached to a broad but thin and light plate, *i*, which should be made as long as possible. The lever and armature are suspended from the upright support, *k*, in the manner of a pendulum, its motion being regulated by the adjusting screw, *l*, and the spring, *s*.

In order to increase the volume of sound, the tone receiver may be placed at one of the focal points of an elliptical chamber of suitable size, while the ear of the listener is placed at the other focal point.

The operation of the apparatus is as follows: When the different parts are in a state of rest, the electric circuit is closed. If an alternate condensation and rarefaction of the air in the tube, *a b*, is produced, by speaking, singing, or playing upon a musical instrument, a corresponding motion is communicated to the membrane, and from thence to the lever, *c d*, by which means the electric circuit is alternately opened and closed at *d g*, each condensation of the air in the tube causing the circuit to be broken, and each rarefaction in like manner causing it to be closed. Thus the electro-magnet, *m m*, of the apparatus at B becomes demagnetized or magnetized, according to the alternate condensations and rarefactions of the body of air contained in the tube, *a b*, and consequently the armature of the electro-magnet is thrown into vibrations corresponding to those of the membrane in the transmitting apparatus. The plate, *i*, to which the armature is attached, transmits the vibrations of the latter to the surrounding atmosphere, which in turn conveys them to the ear of the listener.

It will be seen, therefore, that the result produced by this apparatus is not the veritable transmission of sound by means of the electric current, but is simply a reproduction of the tones at some other point, by setting in action at this point a similar cause, and thereby producing a similar effect. It must, however, be admitted, that while the apparatus which has been described reproduces the original vibrations with perfect fidelity so far as their number and interval are concerned, their intensity or amplitude cannot as yet be transmitted. The accomplishment of this latter result, therefore, must await the further development of the invention.

It is in consequence of this defect in the apparatus that the more inconsiderable differences of the original vibrations are distinguished with great difficulty, that is to say, the vowel sounds are heard with more or less indistinctness, for the reason that the character of each tone depends not merely

upon the number of the sonorous vibrations, but upon their intensity or amplitude also. This also accounts for the observed fact that while chords and melodies are transmitted and reproduced with a surprising degree of accuracy, single words as pronounced in reading or speaking were but indistinctly heard, although in this case also the inflections of the voice, interrogative, exclamatory, etc., could be distinguished without difficulty.

Nitro-Glycerin Explosives—Their Storage and Transportation.

The use of high explosives is constantly on the increase, and the problems of safe manufacture, handling, and transportation of such substances have become matters of very great importance. Gunpowder and gun cotton have been entirely superseded for blasting and mining purposes by nitro-glycerin, dynamite, and dualin; and nitro-glycerin has now given place to the explosive powders formed from it. These are, in brief, a mixture of nitro-glycerin with any non-fusible (sometimes fusible) powder, the proportion of the admixture being the gauge of the explosive force. By the use of these explosive powders or pastes many undertakings become possible which otherwise would not have been attempted; much time is saved, and fully one third of the former cost. The great silver mines of Nevada are blasted exclusively by dynamite and similar compounds; they are in general use in the mines of California, Utah, Colorado, Arizona, Missouri, Michigan, Pennsylvania, New Jersey, and New York, and very extensively throughout the United States, for all work requiring explosive force.

NITRO-GLYCERIN.

Nitro-glycerin, which may be called the base of all modern explosive powders, is a light colored, oily liquid, about 50 per cent heavier than water, which gravity causes it when poured into a bore hole filled with water to sink and displace the latter. Its manufacture is quite simple: 2½ parts, by weight, of strong nitric acid are mixed with 5 parts of strong sulphuric acid; after this mixture has cooled, 1 part of pure glycerin is carefully added, and stirred in, care being taken to keep the temperature below 70° Fah. The nitro-glycerin, which quickly forms, is then separated and carefully washed in cold water. The explosive force of nitro-glycerin is generally computed as ten times that of gunpowder, but this is rather an overestimate; still it is undoubtedly the highest explosive force known at present.

Experiments made by military committees in Europe have further confirmed that the sensibility of nitro-glycerin to mechanical shocks is much less when frozen than when liquid. In the transition state, however, the sensibility seems to be rather increased, especially in respect to light shocks, such as those arising from packing for transport; this is confirmed by the experience of the laboratory and factory. To obviate such difficulty, such places and the sheds where cartridges are made are now heated by water, as the agent best fitted to distribute an equable temperature.

A paper recently translated by Captain Hess, for the Institution of Civil Engineers, London, gives some valuable information on the subject of freezing the nitro-glycerin. It appears that though in the purest form, as tri-nitro-glycerin (containing 18·5 per cent of nitrogen), the freezing point is from 39° to 53·6° Fah. (according to Ott), there is generally a considerable mixture of the ethers with the commercial article, causing it to bear, before congealing, sometimes a temperature as low as 17·6° Fah. According to Champion, some blasting oils would not solidify in a temperature of 5° to 10° Fah. Zero, which could easily be obtained and maintained by means of freezing mixtures or highly volatile fluids, would render the storage and transportation of this dangerous liquid comparatively safe. In change of location, however, where a much warmer temperature may be encountered, the danger would soon be as great as ever. With the explosive oils of commerce, as a rule, congelation takes place partially, and under the influence of lengthened cold the process of thawing is slow and gradual.

DYNAMITE.

Dynamite, which, as already mentioned, is, in its various forms of powder, the next in force to nitro-glycerin, was commenced as a manufacture in 1867, and the quantity now annually made in the United States and Europe reaches 15,000,000 pounds; and it must continue to increase. One remarkable fact deserves attention: that, whereas in mixtures of gunpowder and the fulminates with inert substances the explosive power is diminished in proportion to the adulteration—the direct effect being to make the combustion less rapid—on the other hand the absorbents used in the nitro-glycerin powder do not strictly retard its explosion in any degree, but they add vastly to the safety in handling and transportation. A mixture of the oil, in proper proportion, with pulverized infusorial earth, charcoal, chalk, ashes, or plaster-of-paris, makes a comparatively dry powder, but of high explosive power, with the great advantage of standing much hard usage.

How, then, is it exploded? The ordinary means is by the use of a heavy percussion cap, or "exploder," consisting of a copper shell, like a common gun cap, and containing ten grains or more of fulminate of mercury. The exploder is not fired by percussion, but by a fuse, or by electric wires inserted in contact with the fulminate. A powder made of 50 per cent of nitro-glycerin and 50 per cent of infusorial earth is very dry, and cannot be exploded except by a triple force exploder, and when the charge is strongly and tightly confined. On the other hand, a powder of 50 per cent of nitro-glycerin and 50 per cent of mica scales or fine sand is very wet and leaky, and explodes almost as easily as the liquid oil.

An explosion of dynamite occurred in San Francisco while the powder was being prepared for a large blast under water. The loose powder, in the course of being packed into cartridges, was, it is represented, set on fire from the pipe of a workman, and before it could be extinguished the fire reached exploders in other cartridges.

DUALIN.

Dualin is a diversified mixture, from the saturation of poplar pulp with nitro-glycerin, to 60 per cent of nitro-glycerin 40 per cent of sawdust, etc., etc. In the case of dualin, the lower the temperature the more sensitive it is to friction.

A bill was introduced at the late special session of Congress to amend the law in relation to the transportation of such explosives, but we have heard no further of it.

The present United States law bearing on the subject was passed July 3, 1866, before dynamite was invented, and was designed to regulate the transportation of nitro-glycerin. There is some doubt as to its application to the nitro-glycerin compounds. In a case before the United States District Court for the Northern District of New York, it was held that dynamite or "giant's powder" was not within the law; but there is no certainty of this as an established interpretation. Under the law, such compounds cannot be carried on public conveyances unless packed in metallic cases, the latter surrounded with plaster-of-paris, and outside must be placed the mark, "Nitro-glycerin—Dangerous."

There is much deception and smuggling of the various articles as other freight, and surreptitious freight may be put along with passenger trains. As almost all transportation of these compounds extends through more than one State, State laws with diverse requirements could afford no relief; but it seems just that the General Government should also recognize and enact according to the discriminations made at the present stage of experience and knowledge of the substances—not giving too much credence to claims of safety set up either by the manufacturers or users of the substances. The following are some main points for a just and fair law:

1. Great restriction or entire prohibition of transportation of liquid nitro-glycerin, or of any leaky powders, with inspection to secure such result. Frozen nitro-glycerin to be permitted in refrigerating cars, and on freight trains only.

2. Permission for dry explosive powders to be carried on freight cars only, or on trains not carrying passengers.

3. Explosive powders to be packed exclusively in regulation cases.

4. Percussion caps or exploders, or any article that might extraneously cause explosion, not to be permitted in the same car or vessel with the powders.

5. Each package should be plainly marked on the outside with the names and proportions of the various ingredients.

There is some discussion as to the comparative safety of metal, wood, and paper cases for the powders. It is a question of vibration. Some form of nitro-glycerin—possibly dualin—was in a can at the Hoosac Tunnel, in contact with a rail, and about 350 feet from a blast. The agitation of the can, caused by the vibration of the rail, produced an explosion, which, it is presumed, would not have occurred had the vessel been of wood or paper.

Herr Gossie, of Antwerp, constructs, either in a railway car or in the earth, a water-tight reservoir, divided by means of T and angle irons into compartments of equal capacity, in which the explosives (suitably packed in water-tight boxes) are placed after the reservoir is filled with water.—*American Exchange and Review.*

Origin of the Letter Stamp.

The alleged origin of the stamp had a tinge of romance in it. It was thirty-seven years ago that Rowland Hill, while crossing a district in the North of England, arrived at the door of an inn where a postman had stopped to deliver a letter. A young girl came out to receive it; she turned it over in her hand and asked the price of postage. This was a large sum, and evidently the girl was poor, for the postman demanded a shilling. She sighed sadly, and said the letter was from her brother, but she had no money; so she returned the letter to the postman. Touched with pity, Mr. Hill paid the postage and gave the letter to the girl, who seemed very much embarrassed. Scarcely had the postman turned his back when the young inn-keeper's daughter confessed that it was a trick between her and her brother. Some signs on the envelope told her all she wanted to know, but the letter contained no writing. "We are both so poor," she added, "that we invented this mode of correspondence without paying for our letters." The traveler, continuing his road, asked himself if a system giving place to such frauds was not a vicious one. Before sunset Rowland had planned to organize the postal service on a new basis—with what success is known to the world.

A New Lime Light.

At a recent meeting of the Warrington Literary and Philosophic Society (Eng.), a new lime light not requiring oxygen gas was exhibited by Mr. Fletcher. This gentleman stated that until about five years ago metallurgists and others had no practically available source of heat for experimental work giving temperatures between that of an ordinary gas or lamp blowpipe and the oxyhydrogen jet or electric arc. After the general introduction of his hot blast blowpipe, experimenters supposed that a lime light could be obtained, and the danger and cost of making oxygen gas could be dispensed with. But all experiments in this direction had proved a failure for the reason that the high temperature jet is exceedingly small, and only illuminates a tiny spot of the lime; if made larger in size the temperature falls too low to be of service for this purpose. From the outcome of some experiments in a totally different direction he obtained what is possibly the germ of a practically available light, having a distinct actinic or chemical power, and is white, showing all colors precisely as in daylight. The little furnace he exhibited, although a toy to look at, would, he stated, melt with ease one half pound or more of copper, cast iron, and steel, and he thought with a slight modification would fuse platinum. It would with a simple blowpipe soften a crucible of the most refractory clay. The *Mining Journal* gives Mr. Fletcher's relation of the discovery:

Some time ago needing a small block of caustic lime which he had not at hand, he put a bit of limestone in his furnace to burn the carbonic acid out. On looking at it in a few minutes he found the lime illuminated the workshop, and the light was painful to the eyes. This suggested the point that if an ordinary lime cylinder were protected by a non-conducting casing over all parts except when the light is required, a good light might be obtained. The casing he uses to the lime is the same as that of the furnace—that is, a mixture of one part ganister or refractory clay, and six of sawdust, rammed in a mould and fired. This makes after burning a firm cellular mass, in texture almost like pumice stone, and its power of retaining heat is such that in this casing, which is only ½ inch thick, he can melt ½ lb. of cast iron with a simple blowpipe, and can then take the furnace, crucible, and all in his hand without feeling the heat to any inconvenient extent. As a jacket for ordinary furnace work this mixture will, perhaps, prove one of the most valuable materials, in all the places except where exposed to mechanical wear. The lime light burner which he exhibited is simply a block of lime partially cased with this material, and a blowpipe of ordinary construction, except that the gas is mixed with air to a certain extent before the blower commences to act on it. Owing to this previous mixture, the blower has less air to supply, and the combustion is quicker; in fact, so rapid and perfect is the combustion of gas that this blowpipe on a larger scale may compete with the hot blast. A sheet of platinum gauze held in the hottest part of the flame is fused and perforated almost instantly, and the lime becomes sufficiently heated to give a white light, which he had tested, and found to be equal to about 95 candles. This flame is noisy and quite unfit for the magic lantern. There is, however, the possible germ of a greater future in it.

The White Incrustation on Bricks.

At a meeting of the Philadelphia County Medical Society, held December 26, this subject was reported upon by the Committee on Microscopy, Dr. Jos. G. Richardson, chairman. The committee decided the white deposit to be sulphate of magnesia, better known as epsom salts. In the deposit, the microscope revealed the presence of epithelial scales from the human skin, and the *débris* of many plants. The sulphuric acid comes from the coal gas and the coal burned in the city; the base, or magnesia, is from the bricks themselves, a large quantity being found in the clay of which they are made. It is not regarded as in any way injurious, though quite unsightly and destructive to the walls. This coating may be prevented by a thick coat of paint on the wall, or the immersion of the bricks before use in a bath of sulphuric acid, and subsequently to the action of running water.

Relative Cost of Water and Steam Powers.

The cost of the water power equipment at Lowell was, for canals and dams, $100, and for wheels, etc., another $100, per horse power. But this, as a first experiment, was more costly than a similar equipment need be. At Saco, the expense incurred was $175 per horse power; but at a later period, for turbines with high heads, the expense would be less. A construction and equipment, solidly carried out, with the latest improvement in wheels, would not cost over $200 per horse power, and would, under favorable circumstances, cost less. An estimate at Penobscot was for $112.50 per horse power. If the construction be with wooden dams, and the equipment with lower grade wheels, then the cost would be about $50 per horse power; and although the construction would be less permanent than the more solid, it would outlast any steam apparatus. On the other hand, Fall River estimates of steam equipment, exclusive of foundations and engine houses, run from $100 to $115 per horse power. A Boston authority gives $115 per horse power for nominal 300 horse power and upward, inclusive of foundations and masonry. Similarly, a Portland authority places it at $100 per horse power. The actual cost of steam equipment in the water works of various cities of the United States varies from $150 to $300 per horse power.—*The Water Power, Maine.*

How to Destroy Lice on Cattle.

S. D. says: In answer to a question asked by one of your correspondents, relative to destroying lice on cattle, take common lamp oil, mixed with kerosene—not much kerosene—rub along backbone and around the eyes and nose, as they come there to get moisture; they will soon disappear. Too much kerosene will take the hair off.

New Mechanical Inventions.

Mr. William H. Pierce, of Tolono, Ill., has patented a new Valve Gear, in which a rod from the hub of the balance wheel of the engine connects with an upright arm having a handle, and also two pins arranged equidistant from the shaft, which are used for reversing the engine. Attached to the shaft is an arm, which receives a movable slide, to which last the cut-off connecting rod is pivoted. By adjusting this slide the strokes of the piston can be lengthened or shortened, and the steam supply to the cylinder regulated.

Mr. Paul S. Forbes, of New York city, has patented a new Rotary Condenser, made of a tube coiled into wheel form, and having its ends projecting at the centers of its opposite sides. It is placed in the well of a vessel and constantly revolved in the cold water therein, thus serving to condense the exhaust steam from an engine connected with it.

In order to avoid the work of cutting the screws in a lathe and turning the head and stand, Mr. William Guthrie, of Galva, Ill., has devised a new Jack, both the male and female screws of which are cut in ordinary bolt and nut cutting machines, and both the head of the male screw and the case or stand of the female screw are accurately cast upon the screws after the latter are cut.

Mr. Benjamin W. Hoyt, of Manchester, N. H., has invented a Lath Holder for temporarily supporting laths at any height on the wall. It is made of two hinged sections that turn on a swiveled top piece, with supporting hooks. The lower part has a cross-piece with curved or braced arms, like a basket, for holding the laths, and the middle part additional pointed arms or hooks for being supported on the studding of the wall.

An improved combined Wrench and Vise has been patented by Mr. Homer T. Gates, of Hartford, Ohio, in the jaws of which an object may be securely clamped by turning a nut. The vise may be completed by simply inserting the handle of the wrench in a socket made for the purpose. The construction of the wrench is also such that it may be used in places where wrenches ordinarily cannot be used.

In a new Machine for Cutting Wooden Cogs, invented by Mr. Warren L. Morris, of Victory, Ga., the cutting head, formed of the rotary shaft and its attached knives, has three cutting edges formed in different planes, and respectively used for cutting the working end of the cog, the tenon that fits in the mortise of the cog wheel, and the shank of a cog for receiving a key for securing the former in the wheel rim.

Mr. Ira Winn, of Falmouth, Me., has patented a machine for Removing Bark from Wood. There are a fixed and a revolving spindle for supporting and rotating the stick to be denuded, a centering device for holding the stick until it is engaged by the spindles, a yielding knife for removing the bark, and a stop for shifting the feed.

A new Bit Clamp for Boring Machines has been devised by Mr. Frederick Dezendorf, of Cornwall-on-Hudson, N. Y. It may be adjusted to different sized shanks of bits to firmly hold the same, and consists of two pins that are fulcrumed to the ends of a rigid T piece of a threaded center piece, and are adjusted by a conical nut turning on the latter.

A new Windlass Water Elevator, patented by Mr. Thurston B. Barber, of Baltic, Conn., has an improved construction of chain wheel which prevents the chain from slipping or being wound thereon, and improved devices for tilting the buckets, and a generally new arrangement of mechanism for lowering and raising the latter.

Mr. Edward G. Hall, of Healdsburg, Cal., has patented a new Ore Roasting Furnace for the reduction of cinnabar ores. The ore is placed in a hopper, whence it passes to a drying chamber, being carried along by a coned and tapered screw conveyer. During the passage it is heated sufficiently to drive off the volatile matter. It then goes to a wasting chamber in which is a conveyer which carries it ultimately to another chamber provided to receive it. The quantity of ore carried through the furnace is regulated by sliding the hopper. If the latter is placed over the smaller portion of the conveyer, a less quantity of ore is taken away by the screw than when the hopper is adjusted over the larger portion.

A new Self-Oiling Axle Box for coal cars, devised by Mr. James Dawber, of Braidwood, Ill., is so constructed that when the car is dumped a quantity of oil flows from an oil chamber to cotton waste, from which it is supplied to the axle.

Mr. Michael Waters, of New York city, has invented an exceedingly ingenious apparatus for automatically replacing a car the wheels of which have run off the track. We cannot explain the mechanism of the device without the aid of drawings. Its operation, however, is briefly as follows: As soon as the car wheels leave the track, broad flanged auxiliary wheels take their place upon it. These are rotated by the forward motion of the car. Mechanism is thus set in operation which carries these wheels outward until they are of the same gauge as the truck wheels, and the car being also raised, the truck wheels are brought over the track. It only remains to lower the car by automatically acting devices to replace it on the rails.

A new Windmill, devised by Mr. John J. Kimball, of Napierville, Ill., embodies two wheels which are geared together and so constructed and arranged that the wind which escapes through one wheel will reach on the blades of the other one. The speed of the wheels may be regulated, and they are caused to edge more or less to the wind as the force of the same increases or diminishes.

Messrs. George and Thomas Shaw, of Dukinfield, England, have patented a Machine for Polishing Vegetable Fibers, such as are used for brush making. The material is heated with a dressing of sizing mixture and then submitted to the action of brushes, whereby they are rendered lustrous and in a measure waterproof.

Mr. George J. Kautz, of Emporium, Pa., has devised a new Sawing Machine, which is an improvement on the apparatus patented by him April 17, 1877. The invention consists of feed mechanism for the lumber, constructed of a weighted top roller and lower spiked roller, in connection with an intermittently-revolving spiked feed roller. There is also a revolving circular saw, turning in a swinging frame. A lever arrangement throws the feed mechanism and saw in or out of gear by a suitable clutch device with the driving shaft, and regulates the cutting off of the lumber.

Mr. W. H. Whitely, of Joslin, Mo., has invented a new Double Acting Pump, in which there is a double valved piston with two valved suction pipes and a discharge pipe. The advantage claimed for the double suction is that twice as much water is taken up at a stroke as is the case with ordinary pumps, and that the discharge by short strokes is as great as when long ones are made.

Mr. George W. Hooper, of Greene, Me., has also devised a Double Acting Force Pump. A double valve box is located at the foot of a cylinder in which works a valveless piston. There is a water way on one side of the cylinder which communicates therewith at its upper end, and also with one of the compartments of the double valve box. A new packing is used on the piston rod.

An improved Propelling and Dry Dock Attachment for Vessels, devised by Mr. James Curtis, of Middletown, Mo., consists essentially of balanced propelling wheels at the end of a lateral revolving shaft, in connection with water induction and eduction trunks. The latter are arranged with tightly closing, hinged or sliding gates that may be closed, forming a chamber or dry dock, from which the water is pumped for repairing the wheels.

Mr. Edmund Golucke, of Crawfordsville, Ga., has devised a new Horse Power for ginning cotton, threshing grain, sawing wood, etc. The improvement consists chiefly in the construction of the gear wheels, which are made of wood with the cogs formed in the shape of tapering plugs inserted between fixed partitions and held by pins which are imbedded partly in the tapering plug and partly in the fixed partition, the plugs being held in place laterally by a removable disk or plate. The improvement also consists in the means of attaching the draft levers to the post of the king wheel, whereby they are more securely held in place.

Mr. Stephen M. Redfield, of Maryville, Mo., is the inventor of an improved Tenoning Machine, in which adjustable planes are pressed upon the board by strong band springs, so that they cut equally at both sides when reciprocated by a hand lever.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion.

Notes & Queries

(1) R. R. R. asks for a recipe for mending china? A. Make a paste of powdered quicklime and white of egg and apply it to the parts to be united.

How is the first span or wire made in building a suspension bridge, where it is impossible for a boat to cross? A. A kite can be used to carry a string across, and by means of the string a rope is pulled over.

(2) C. M. says: I have a cellar floor cemented with ordinary Newark cement. A fine dust sweeps from it every time it is swept. Is there any preparation of silicate of soda or water glass that will cover this cement so as to glaze it, and prevent the surface cement from such abrasion? A. No: none that would serve practically as a remedy. A cheap earthen or cement tile would afford the relief sought. There is a tile made of cement concrete, having a cement face hardened by a patented process, that promises to be very useful in situations like those that you refer to, but it is not yet put upon the market by a manufacture sufficient to supply the demand that will arise for it.

1. Is a wire rope of galvanized iron wire, say of the size of one's forefinger, a suitable electrical conductor? A, Yes. 2. Would such rope answer as well as an ordinary iron rod of ⅝ inch iron? A. No.

(3) F. J. T. asks: 1. What is the nature of soluble glass or silicate of soda? A. It is simply a soda glass having a large excess of soda. It is completely dissolved by continued boiling in water, forming a clear sirupy liquid, used as a varnish for making artificial stone, etc. 2. Can it be mixed with white lead without detriment? A. White lead (lead carbonate) may be mixed with it to form a brilliant white paint; but not the oil lead. 3. Can it be used as a sizing for plastered walls before painting without causing the paint to peel or crack? A. No, not very well.

(4) J. M. H. wishes a recipe for making oiled walnut for furniture? A. There are different processes; one is to partially fill the pores of the wood with a coat of shellac varnish first, and then to finish with a coat of boiled linseed oil. The finest surface is given by applying a preparation called "wood-filler," and then finishing with the oil. This preparation can be obtained ready for use from the large paint and varnish dealers in this city.

(5) M. M. G. writes: A church in this city has a motor operated by the water in the city pipes for the purpose of blowing their organ. The engine is an oscillating one. The water enters through a 2½ inch pipe under a pressure, say, of 25 lbs. After doing its work it is discharged through a 2½ inch pipe into a cistern, the outlet being submerged to save atmospheric pressure, and then into a street sewer, say 30 feet from the engine. Is this discharge pipe large enough, it being the same size as the inlet pipe, to carry away the water after it has been relieved of its pressure? The engine does not work satisfactorily. The fall in the discharge pipe to the cistern is, say, 8 to 10 feet, the fall occurring 20 feet from the engine. A. The areas of the pipes should be inversely as the square root of the head of water in feet. In this case the outlet pipe should be 3 times the diameter of the inlet pipe; the former discharging into the open air. To get the full benefit of the fall of 8 or 10 feet, the water should be discharged above the water in the cistern, and the pipe not submerged into it. You do not avoid the atmospheric pressure by submerging the pipe.

(6) W. N. B. asks for a simple formula for artificial or cement stone for paving purposes? A. Almost all the successful processes are patented. What will prove probably to be the most successful is the carbonizing process, which consists in subjecting the pure cement surface to a bath of carbonic acid gas under pressure. This gives a surface as hard as the hardest marble.

(7) B.R. writes: It is well known that much of the soap in use contains impure elements and is liable to breed disease. Cannot science give us a substitute which shall be free from these objections? A. The use of soap is simply to furnish an alkali which with water will combine with the natural oily exudation of the skin. A little ammonia or borax may be used instead.

How can a feverish condition of the eyeballs and eyelids be removed without medicine? A. Bathe the eyes in cold water freely, do not use them to read either by gas or lamplight or near a window, avoid rich and greasy food, and keep the blood cool with any mild aperient.

(8) F. J. S. wants to know if rain water will become hard in a cement cistern? A. Yes, so long as there is any lime in the cement to be absorbed by the water.

(9) T. F. F. asks how to clean carpets simply and cheaply? A. Use ox gall, 1 pint to a pailful of water, with scrubbing brush and floor cloth, after-

ward rinsing in same way. They should be perfectly free from dust by beating, and should be nailed down. Great care should be taken to rub them as dry as possible with a clean floor cloth. A small portion only should be done at a time. A carpet treated in this way will be greatly refreshed in color.

(10) R. E. B. asks for a recipe for making a shoe dressing or polish? A. Take gum arabic 4 ozs., molasses 1½ ozs., good black ink ¼ pint, strong vinegar 2 ozs., spirit of wine 1 oz., sweet oil 1 oz. Dissolve the gum in the ink, add the oil, rub them in a mortar until thoroughly united, then add the vinegar, lastly the spirit.

(11) W. G. asks: 1. Can I paint a hard finished wall with white lead thinned with linseed oil? A. Yes, if the wall has had time to season and become hard and dry. Paint should not be put upon hard finished walls before they have had two years' seasoning. They will probably require 4 or 5 coats to give them an even tint; let the color be a neutral gray approaching lavender. 2. Will it stand washing? A. It will stand a reasonable washing if you give the paint time to harden.

(12) W. S. P. asks how to re-gild an old picture frame? A. Take a sponge and some clean water and wash the frame well, then let it dry; procure some water gold size; mix some warm thin size with the gold size so as to enable you to work it with a camel-hair brush; give it two coats; when dry, rub it over with a piece of fine sandpaper; it will then be ready for gilding. When the frame is covered rest it on its edge to drain; when perfectly dry dip a brush into water and wipe the gold over with it; it will take the particles of gold off and make it appear solid. For any parts not covered, take bits of leaf with a dry brush and lay on as before; then give the whole a coat of clear parchment size, brush the back edges over with glue, and the frame is ready.

(13) G. V. B. asks: What is the size of the Corliss engine that was in the Centennial building? What sized boiler was used and what was the horse power? A. See SCIENTIFIC AMERICAN SUPPLEMENTS 19, 26, and 36.

Can I melt brass in an iron pot? A. Yes, but the pot is likely to fall to pieces, and spill the brass that is melted in it.

(14) S. T. asks: How can I purify common sperm oil so that it can be used for sewing machines? A. Agitate the oil for some time with strong (cold) aqueous solution of tannin in excess; let stand 24 hours, draw off the oil, filter through a column (about 3 feet) of coarsely granular black oxide of manganese and then through a similar one of good animal charcoal also coarsely granular. The filters should be heated by a hot water or steam jacket.

(15) F. W. M. writes: 1. Will you please inform me what kind of oil paint I can use to paint pictures on canvas? A. You can obtain colors already ground in oil. Nut oil or fine linseed oil and turpentine are used. 2. Also what to use for backgrounds? A. The canvas is prepared by treating it with a thick sizing of Paris white. 3. What kinds of varnish to use to varnish the picture after it is painted? A. Use ordinary picture varnish, mastic, dammar, or amber.

(16) In answer to C. B. S.—It is what is known as Indian fiber—not ramie. It is not as valuable as flax.

(17) H. B. C. asks: What is the estimated weight of seasoned oak and pine per cubic foot? A. A cubic foot of live oak will weigh from 57 to 79—average 68; of red oak 47 to 54, average 51; and of white oak 43 to 67, average 50. A cubic foot of Georgia pine weighs from 38 to 58, average 48; of ordinary yellow pine 27 to 39, average 33; and of white pine from 21 to 35, average 28 lbs. See Hatfield's "Transverse Strains," p. 533.

(18) L. F. asks: What does black varnish on parts of a pattern denote? A. That the parts so varnished are core prints.

(19) F. A. asks: Should lathe centers be hardened? A. Yes, the live center to a blue, the dead center to a straw color.

(20) S. P. says: I am using an auger in the lathe to bore holes in end grain wood, and cannot bore straight. Can you tell me the reason? A. The screw end follows the direction of the grain of the wood. File the thread off the screw, leaving a sharp point, and your difficulty will disappear.

(21) J. R. asks: What can be done to help the acoustics of a public building when the sound of the voice of the speaker when loud or on a high key reverberates and all runs together in a confused jumble? The building has an arch in each end, and gable ceiling. The arch in end facing the speaker forms a sort of vestibule and the sound of the voice seems to go up behind this arch to the ceiling and cause the trouble. A. The confusion of hearing is probably caused by the waves of sound being diversely reflected from the two inclined surfaces of the ceiling. Consult p. 356, of vol. 29, 1873; also p. 302, vol. 30, 1874; also p. 324, vol. 30, 1874; also p. 186, vol. 32, 1875.

(22) R. A. asks how to make an æolian harp? A. Make a rectangular box of very thin boards about 5 inches deep and 6 inches wide, and long enough to fit across the window at which it is to be placed. At the top of each end of the box glue a strip of wood about half an inch in height, to serve as a bridge for the strings, which are stretched lengthwise across the top of the box and are made of catgut or wire. The strings should be tuned in unison by means of pegs constructed to control their tension, as in the violin.

(23) In answer to S. M. B.—The chimney shaft should be carried up well above the house, and higher than any portion of it, or than any surrounding object. It has always been regarded as a good plan to make the throat of the flue a little smaller than the flue itself, and to make the sides of the fireplace diminish to the throat by convex rather than by concave lines. Moreover, no two fireplaces should discharge into the same flue, nor any aperture for ventilation be introduced into a fire flue.

(24) N. Y. asks: What kinds of knives are used to sever the paper in newspaper printing presses? A. Knives with a serrated edge.

(25) L. L. asks: How can I recover lead from dross? A. Place it in a ladle and over the fire, and melt it with grease or oil.

(26) P. S. asks: Have there been any locomotives made in which all the working parts were of steel, including connecting and other rods? A. Yes.

(27) J. K. asks: Is there any difference in the grain emery used for cutting and that used for polishing purposes? A. Yes, one is made by crushing between rollers and the other between stamps.

(28) O. F. asks: Are small emery wheels run at the same speed as large ones, and if not, why not? A. They are not, because of the extra quantity of countershafting required to increase the revolutions sufficiently to give the required speed in feet per minute.

(29) A. L. asks: If the curves of the teeth upon a wheel are struck with compasses, can those teeth be properly termed epicycloidal? A. No; but the approximation is very near.

(30) O. F. asks: Do gear wheels made of brass composition run well together? A. Yes.

(31) R. R. asks: What is the objection to heating small pieces of steel in the open fire (to harden them)? A. Decarbonization takes place, injuring the steel.

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

C. F. M.—Worth from two to three dollars per ton in New York. It is used principally for making fireproof boiler and roofing felts, paints, artificial stones, cement, etc.—N. A. R.—It is an impure kaolin containing iron sesquioxide, lime salts and silica. Calcareous clay often accompanies such deposits. Its precise value could only be determined by quantitative analysis.—T. K.—The stones supposed to be diamonds are quartz crystals (specific gravity 2·7). Diamonds may occur in such gangue. The stones are identified by their specific gravity (=3·52—3·55); by their extreme hardness, scratching corundum or sapphire; by their crystalline form (regular octohedron or cube, or some form geometrically connected with these); many exhibit a peculiar appearance arising from the faces being curved or rounded. They are unaffected by acids or alkalies.

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INDEX OF INVENTIONS

FOR WHICH

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

December 11, 1877,

AND EACH BEARING THAT DATE.

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10,346.—FANCY CASSIMERES.—F. S. Bosworth, Providence, R. I.
10,347.—CASKET MOULDINGS.—W. M. Smith, Meriden, Conn.
10,348.—CASKET SCREW.—W. M. Smith, Meriden, Conn.
10,349 to 10,351.—STEP PLATE.—M. Krickl, New York city.

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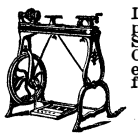
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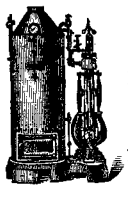
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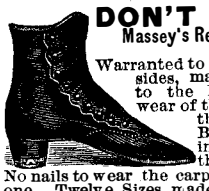
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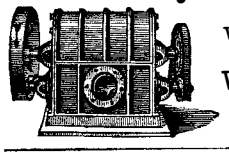
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